SCIENCE & TECHNOLOGY
*September, 1969*
*Vol. 18, No. 10*



# computers and automation

***Jobs and Careers in Data Processing: Three Men Program New Lives for Themselves***

# Sometimes our first name makes liars of us.

A lot of SDS systems aren't scienti
People keep thinking our com
good for science. But they're not l
Here's a selection of applications.
just those in your area.

**A university** in Canada uses an S
run the library circulation depar
students select books. At other sc
model computer handles student r
scheduling, grade reporting, teach
computers and runs research proj

**In industry** you'll find standard
numerical control, of course. A s
pany monitors over a hundred oil w
SDS computer, while many others
lyze seismic data and blend gasoli
the midwest are coping with the c mplex
in designing large structures with the h
computers. And there are a multitude of
tems designed for specific industries, like c
ling a rolling mill.

**Biomedical** uses include running an
tal, from preparing payrolls to monitori
ill patients. In some hospitals they're
mathematical models predicting patient
alyzing ECG's and clinical laboratory experi

**Business data processing** appl
commercial time-sharing install
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For Interdata Designate No. 40 on Reader Servic

# Letters To The Editor

**computers** and automation

**Vol. 18, No. 10 — September, 1969**

## Computer Applications for Language Teachers Sought

Compared to the wealth of computer applications available to teachers of science or math, the teaching of English literature and language is done in relative computer poverty. We are consequently engaged in a project to acquaint secondary school teachers of possible computer application in the instruction and administration of classes in English literature and composition.

We would be very grateful to any of your readers who might provide us with some practical applications that could be used as examples in a computer orientation program. Any contribution will, of course, be fully acknowledged, and the information will be shared freely.

MARTIN J. BIRNBAUM
*Teaching Research*
*Monmouth, Ore. 97361*

*(Please turn to page 7)*



| | |
|---|---|
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computers and automation

Vol. 18, No. 10 — September, 1969 *The magazine of the design, applications, and implications of information processing systems.*

## *Special Feature:*

## *Jobs and Careers in Data Processing*



## *Regular Features*

### *Editorial*



### *Ideas: Spotlight*



### *C&A Worldwide*



### *Multi-Access Forum*



*The three men on the front cover, left to right, are Maurice Roy of Watertown, Mass., and Bill Stevens and Lou Roach, both of Roxbury, Mass. After spending years in "dead-end" jobs driving trolleys and pressing pants, these men became computer programmers.*

*For their story, see page 10.*

## *Departments*

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

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

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

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

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

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

Information International, 12435 West Olympic Boulevard, Los Angeles, California 90064, (213) 478-2571; 89 Brighton Avenue, Boston, Massachusetts 02134, (617) 787-4700; 7880 Coolridge Drive, Camp Springs, Maryland 20031, (301) 449-4248.

**INFORMATION INTERNATIONAL**

**Designate No. 18 on Reader Service Card**

# Computergraphics have come a long way

## LETTERS TO THE EDITOR

*(Continued from page 4)*

### Social Consciousness

I have read with interest the "Multi-Access Forum" feature in the April, 1969 issue of *Computers and Automation.* I would like to reprint the first entry under "SICSIC of the ACM" in our magazine, *Law and Computer Technology.*

Robert P. Bigelow serves as Bibliographer of our magazine; Dr. Herbert Grosch is a member of the Steering Committee of the Section on Law and Computer Technology of the World Peace Through Law Center. I think that the readers of *Law and Computer Technology* would be most interested in the efforts of members of the Section on Law and Computer Technology to instill that social consciousness of men of the law in the information science profession.

WILLIAM S. RHYNE, *Secretary*
*The World Peace Through Law Center*
*400 Hill Bldg.*
*Washington, D.C. 20006*

Ed. Note—We are pleased at your interest in "Multi-Access Forum" and are glad to give you permission to reprint the entry under "SICSIC of the ACM" from the April 1969 issue. Please include our standard reprint clause.

### Licensing of Japanese Information Processing Engineers

The American Embassy in Tokyo has forwarded information that the Ministry of International Trade and Industry (MITI) has established regulations for the licensing of information processing engineers. The regulations were published by the Ministry's Notification No. 366, effective July 16, 1969.

These regulations give official sanction to the information processing engineering profession, which it is hoped will assist the development of the industry. According to the regulations, an information processing engineer is anyone capable of performing either system analysis, system design, program design, or programming for information adjustment, processing, filing, retrieval, or other functions of electronic computers. MITI intends to issue two classes (1st and 2nd) of licenses to qualified engineers who pass examinations which will be conducted once a year by the MITI.

We believe this information will be of interest to participants in the EDP industry.

SAUL PADWO, *Director*
*Scientific and Business Equipment Div.*
*U.S. Dept. of Commerce*
*Washington, D.C. 20230*

**c.a** EDITORIAL

# The Anti-Ballistic Missile System Called "Safeguard" and the Social Responsibilities of Computer People

By a tie vote in the Senate of the United States, broken by the vote of Vice President Agnew, the Senate has approved the proposal of President Nixon to start construction of an anti-ballistic missile system called "Safeguard". This step has been taken basically as a result of three factors:

- The continuing and vast political pressure of the military industrial complex.
- Failure by President Nixon and many Senators to understand and appreciate several extremely important facts.
- The abuse of information.

This is a sweeping assertion, and requires some careful explanation and the offering of evidence.

1. *The Military Industrial Complex.* A reasonable definition of the "military industrial complex" is that it is a segment of the United States, including industries, regions, lobbies, retired military officers employed by defense contractors, and other people (in various positions) who make a great deal of money from the $80 billion budget of the U.S. Department of Defense. (According to tables in *The Depressed Society* by Professor Seymour Melman, 73% of this budget has been paid to 100 companies.) Naturally, all these people want a continuation of the funds that have poured into their hands, and, naturally, many of them will be inclined to distort information so as to serve their own interests.

2. *Facts About "Safeguard".* Some of the most important facts about the anti-ballistic missile system called "Safeguard" are these:

- It won't work, and cannot be expected to work, and therefore is useless;
- It explodes nuclear warheads over the territory of the United States, thereby exposing Americans to nuclear death, firestorm, and radiation. For example, an American looking towards an intercepting ABM would become blind if he saw the flash;
- It decreases the security and the defense of the United States, by taking the arms race up one more spiral, by wasting billions, and by perpetuating myth.

One of the reasons why the system won't work is that the computing system which is supposed to intercept incoming missiles and ignore decoys is too complex to be constructed without testing in the real situation, and real testing is impossible. This was made abundantly clear in a brilliant paper by Dr. J. C. R. Licklider, "Underestimates and Overexpectations", reprinted in the August issue of *Computers and Automation.* Another reason why the system won't work is that as soon as the first nuclear explosion overhead has taken place, there are a number of minutes of radio blackout, so that the ABM radars cannot locate any more missiles or decoys for these minutes.

3. *The Abuse of Information.* The abuse of information consists of a number of active and passive suppressions, misrepresentations, and lies by people who do know better. For example:

- It took the U.S. Dept. of Defense about a year to admit that 6000 sheep which died in a mysterious accident in Utah, died from nerve gas that escaped from an Army testing ground in Utah. Suppressing information of this kind and similar information about the ABM system is of no value whatever to the American people, and is an act of disloyalty by the U.S. Dept. of Defense.
- To name a missile system "Safeguard" when it does not actually protect or safeguard the people of the United States, is a misrepresentation—in fact a perversion, fit for the double-think of George Orwell's *1984.*
- To present information about the anti-ballistic missile system called "Safeguard" in a newspaper advertisement saying that 84% of the American people approve of it, when the ad presents biased information and is paid for very largely by defense contractors, is a lie.

For a thorough appraisal of ABM, see *ABM: An Evaluation of the Decision to Deploy an Antiballistic Missile System* by Jerome B. Wiesner, George W. Rathjens, Abram Chayes, and 17 other authors, published by the New American Library, Inc., 1301 Ave. of the Americas, New York, N.Y. 10019, May, 1969, paperbound, 282 pages, 95 cents. Dr. Licklider's paper is in this volume.

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Computer professionals are becoming active in regard to their social responsibilities. A statement was issued in July by about 150 computer professionals organized into a group called "Computer Professionals Against ABM". This group included Daniel D. McCracken, author of ten books on computer programming, Dr. Joseph Weizenbaum, Professor of Electrical Engineering and Political Science at Mass. Inst. of Technology, and Paul Armer, director of the computer center at Stanford University and President of the American Federation of Information Processing Societies. The statement includes this assertion:

> . . . . The project is a dangerous mistake. Whatever other arguments may be brought to bear for or against Safeguard, our conviction is that on technical grounds alone, it does not deserve the support of Congress.

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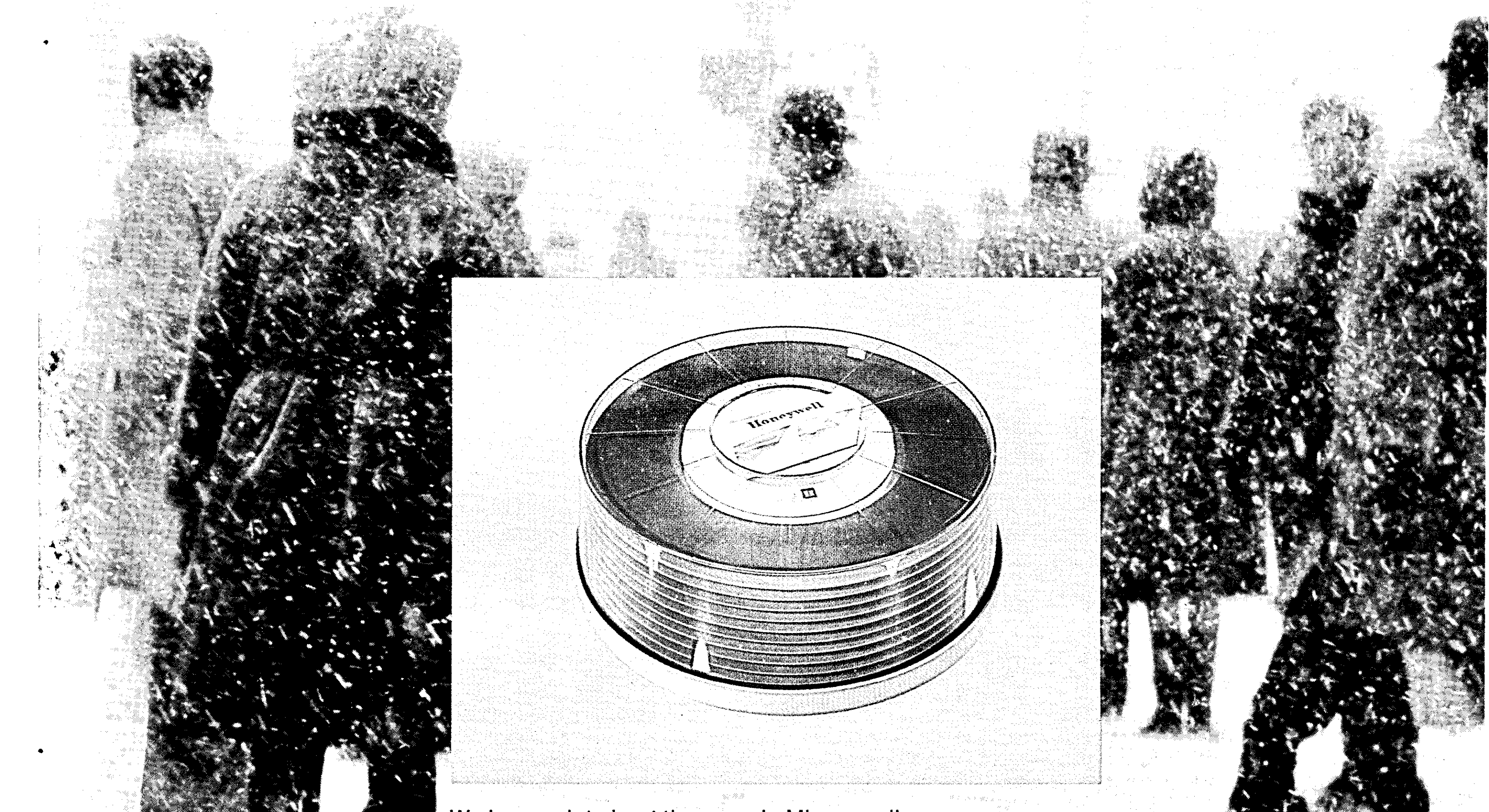
Inevitably, the technology for handling information is continually developing, and one of the associated classes of professionals is the computer professional. As our technology grows, our professional responsibility grows too. We as computer professionals must to a greater and greater extent assume the social responsibility for not telling and not participating in suppressions, misrepresentations, and lies. No computer professional should participate in the ABM system called "Safeguard".

Edmund C. Berkeley
**Editor**

# If Honeywell disk packs aren't 100% error-free, then it don't snow in Minneapolis in the winter time.




We know a lot about the snow in Minneapolis.

We know a lot about disk packs too. After all, we're the "Other Computer Company."

So it's not surprising that our disk packs are so good.

We offer the flattest surfaces in the industry.

We've eliminated flagged tracks.

And every Honeywell disk pack is 100% error-free.

Anyone can use them. Because we have a full line that's compatible with any make of computer.

And we can deliver as soon as we get your order.

If you'd like to know more, call your local Honeywell Communications and Data Processing representative. Or our home office, collect, 617-235-7450, extension 531. We'll give you a disk pack you can count on.

Sure as little green apples.

## The Other Computer Company:

**Honeywell**

Communications and Data Products Division

**Designate No. 20 on Reader Service Card**

# AS WE GO TO PRESS

THE U.S. COURT OF CUSTOMS AND PATENT APPEALS HAS RULED UNANIMOUSLY THAT COMPUTER SOFTWARE OR PROGRAMS ARE PATENTABLE. The court's decision was on the appeal of Charles D. Prater and James E. Wei from a ruling by the Patent Office Board of Appeals.

The court held software inventions patentable because a general-purpose computer is used to perform the process. "In one sense," the decision read, "a general-purpose digital computer may be regarded as but a storeroom of parts and electrical components. But once a program has been introduced the general-purpose computer becomes a special-purpose digital computer which, along with the process by which it operates, may be patented."

The Court ruled, however, in support of the Board of Appeals on far broader claims of patent protection by the appellants.

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THE FEDERAL COMMUNICATIONS COMMISSION HAS APPROVED A PROPOSAL FOR A NEW TYPE OF NON-TELEPHONE COMMON CARRIER which will offer microwave channels for interoffice and interplant communications between Chicago and St. Louis. Permission was granted to Microwave Communications Inc. (MCI) of Joliet, Ill. to set up such a system; it took the company six years of hearings and proceedings to win that approval.

MCI will rent microwave channels to organizations for their own internal use. Unlike the telephone and other existing systems, this service will be available only to send communications from one office or plant of a company to another. It will provide channels for subscribers, who will arrange their own terminal connections.

John D. Goekin, President of MCI, believes the new system will open "a vast new industry in communications." He claims the St. Louis to Chicago link will save users at least 50% and up to 90% of communications costs.

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IN THE MEANTIME, THE FEDERAL COMMUNICATIONS COMMISSION HAS SCHEDULED A SERIES OF CONFERENCES ON THE "FOREIGN ATTACHMENT" TARIFFS OF THE TELEPHONE COMPANIES. The purpose of the conferences is to assess the technical and engineering questions involved in the various objections raised to the tariffs of the telephone companies that govern interconnection of customer-owned equipment to the interstate facilities of telephone companies, and to define and resolve as many of the conflicting positions as possible.

The initial conference will be held Sept. 25. Anyone interested in participating should submit an original and 14 copies of a written statement summarizing his recommended changes in the "foreign attachment" tariff. Statements should be sent to the Chief of the Common Carrier Bureau by Sept. 10. Anyone wishing to attend the conferences as an observer should notify the Bureau Chief by the same date.

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VARIAN DATA MACHINES HAS ANNOUNCED A COMPLETE COMPUTER LEASE/RENTAL PLAN, which is believed to be the first such plan in the "small" computer industry. Until now, most small computers have been available on a "sale only" basis.

Under the Varian plan, their computers (the 520i and the 620i) and peripheral equipment can be rented for periods ranging from four months to four years. Customers have the choice of: (1) a short-term rental, (2) a full payout lease, or (3) a lease with option to purchase.

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MATHEMATICAL-COMPUTER ANALYSIS HAS CAUSED A SPECIAL THREE-JUDGE FEDERAL COURT TO INVALIDATE INDIANA'S APPORTIONMENT. The state was ordered to abandon its present multi-member electoral district system and replace it with districts of substantially equal population. (A multi-member district is one in which two or more legislators in the same house are elected on an at-large basis.) The court's requirement of uniform districts was based upon a complex mathematical analysis made by John Banzhaf, an Associate Professor of Law at George Washington University, who was called as an expert witness. Banzhaf is responsible for a decision by New York State's Supreme Court that no weighted voting reapportionment plan can be approved without being submitted to a mathematical-computer analysis. He was also the first to demonstrate mathematically that the present Electoral College system discriminates against residents of smaller states.

If upheld on direct appeal to the U.S. Supreme Court, the principle set down by the Indiana court could invalidate the apportionments of 33 states which have similar multi-member districts.

### THREE MEN PROGRAM NEW LIVES FOR THEMSELVES IN COMPUTERS

Maurice Roy, Bill Stevens, and Lou Roach (pictured on the front cover) traded in their repetitive, uncreative jobs for the challenge of careers in the computer industry. Not too long ago, Roy, 47, and Stevens, 44, were trolley drivers for a public transit authority. Their job was to pick up trains that had been serviced and drive them out to the tracks. Roach, 46, worked for 20 years in a dry cleaning shop where he pressed pants.

The three men, bored with jobs which "you didn't need a brain to do", learned about a course in computer fundamentals and programming offered (at a minimum cost) by Arthur D. Little Inc. of Cambridge, Mass. They enrolled in the course and attended class for nine months, two nights a week. When they successfully completed the course, they were tested and hired by Honeywell EDP as trainees for an additional 14 weeks of intensive study, this time full-time.

Upon completion of that course, they went to work for Honeywell EDP's Programming Systems Division in Waltham, Mass. Now they feel their future is wide open.

"The most important thing this job gives me," said Lou Roach, "is a sense of achievement — being able to look back and see a few bricks that I've laid, being part of something that's alive."

Stevens and Roach, both Negroes, feel training for the computer industry could be an important means to upgrade the skills of persons in the black community. "The people in the ghetto need only proper training," Stevens said.

Congratulations! Mr. Roy, Mr. Stevens, and Mr. Roach — and best wishes for continued success.

c.a

# MULTI-ACCESS FORUM

## "HOW MUCH SHOULD AN EDUCATED MAN — AND A TOP MANAGER — KNOW ABOUT COMPUTERS?" — DISCUSSION

### I. From Belden Menkus
**7 Blauvelt Ave.**
**Bergenfield, N.J. 07621**

Your editorial in the July, 1969 issue ("How Much Should an Educated Man—and a Top Manager—Know About Computers?") contains an excellent idea. But you have not touched on the two underlying problems:

(1) The computer professional's reluctance to communicate with management in clear and simple language.
(2) Management's reluctance to learn about the computer.

In order to close the communications gulf between systems men and management, technical specialists must be able to explain their technology in terms that management can understand. Management is not required to be technically proficient. It is required to manage. And it is the mark of the true specialist to be able to explain a highly technical question in laymen's terms.

On the other hand, it is the responsibility of management to be not only willing to learn about computers, but to actively seek opportunities to do so. Unfortunately business administration academics have tended to foster the idea that doing so is beneath the executive plateau. This idea has sometimes prevented management from acquiring the knowledge available from technical specialists.

Your suggested "summary of essentials" is a good start, but it will deal with only a part of the broader problem.

### II. From Eugene S. Stark
**Manager of Data Processing Dept.**
**Massachusetts Casualty Insurance Co.**
**50 Congress St.**
**Boston, Mass. 02109**

The title of your July editorial ("How Much Should an Educated Man—and a Top Manager—Know About Computers?") caught my attention; the content raises some questions in my mind.

Why do you limit yourself to computers? How much should an educated man know about any and all of the myriad of appliances with which he comes into daily contact? Indeed, how much should he know about the social, legal, biophysical, and psychological bases of our civilization?

I am an avid reader of anything having to do with Data Processing. I believe that I keep in touch with current advances and happenings in this field. I am unhappy with most of it.

The Data Processing population seems to be busy playing games with this toy. No one seems to realize that the computer, per se, is a very unimportant part of Data Processing even if it is "the most remarkable machine" (sic).

Can you name just one process that has been created by the computer? Except for its speed, what is the computer doing that has not been done before?

From its inception the computer has been surrounded by myths and fables. For example, why is the study of mathematics still stressed in Data Processing courses? I have done both business and scientific programming and have never had to use anything higher than Algebra. In business I have not had to use even that much. Why is there such a stress on the workings of the computer? Unless you are going into programming or systems, where is the need to know?

The main contribution of the computer has been to show how little business management knows about business!

The Data Processing manager who has worked his way up from Tab Operator does not necessarily know much about Data Processing. There is confusion between being able to type and knowing how to write a letter properly. Being able to operate Data Processing equipment does not confer the capability of being able to apply the equipment properly.

The speed and power of our computers has made it possible to enlarge operations. This enlargement also applies to the small wastes and inefficiencies which most business tolerates.

Management must learn its own business. Management must also learn to utilize the abilities of consultants and technicians wisely and within the limits set by Management.

Of course an educated man should know about computers and all other things you mentioned and I mentioned. The prime necessity for the business world, however, is an understanding of its own business. This understanding is still mainly lacking.

### III. From the Editor

More discussion is invited from all interested readers on:

How much should an educated man—and a top manager—know about computers?

It is a large subject in which there are many diverse views, and little that can be demonstrated as certain. It is nonetheless important.

In regard to Mr. Stark's comments, there are of course many "processes that have been created by the computer": to name just one, space travel to the moon and back—which would have been literally impossible without the computer. And there is no doubt that the wise use of computers will improve management's understanding and operation of businesses. ☐

# TIME SHARING VS. INSTANT BATCH PROCESSING — A CLARIFICATION OF SOME TERMS

**Arch C. Davis**
**Dept. of Electrical Engineering**
**Princeton University**
**Princeton, N.J. 08540**

I wish to help clarify the terms used in NCAR's case study of time sharing vs. instant batch processing in the article by Jeanne Adams and Leonard Cohen in the March, 1969 issue (as discussed in Nathan Relles' "Letter to the Editor" in your June, 1969 issue). The three terms Mr. Relles questions are: the Heisenberg uncertainty principle, the Hawthorne effect, and the novelty effect.

The Heisenberg uncertainty principle simply states that we cannot, as in classical physics, have an "observer" who does in no way affect the process which he is observing. As a physical limit, this principle has importance at sub-atomic dimensions. Otherwise, we can approximate such an "observer".

The "Hawthorne effect", on the other hand, refers to sociological phenomena, far more complex than the phenomena of our physical "observer". In this instance, the presence of observers and the unnatural conditions surrounding a controlled experiment are likely to have significant effects on the outcome.

Suppose I were to sit down with pencil and paper and record as a child built castles in a sandbox. Don't you suppose my presence would change his motivation for, or design of the castles? Indeed, the results might be radically different than if he had built them alone.

Finally, the "novelty effect" is intimately connected with the "Hawthorne effect", and incidentally with many other sociological phenomena, including hope, the law of rising expectations, etc. To state it simply: There is a component of interest in an object or situation due to its newness alone. Take a housecat and place him in a strange room. He will explore curiously for a while, and thereafter will not show as keen an interest in his surroundings.

When we are studying time-sharing vs. instant batch, if we assume that the students are unfamiliar with either, then the "novelty effect" might have a differential effect if one system proves more interesting at the outset. The "Hawthorne effect" could hold if, for instance, those conducting the experiment had subtle prejudices for one system or the other. These feelings might rub off on the students.

Aside from the above semantics, my experience with a number of installations, both commercial and scientific, convinces me that the results of NCAR's study are valid. The most important thing to realize is that when batch isn't instant, (for programmers' tests, not production) valuable man-hours are wasted (time is money). Perhaps even more important to our industry: a scarce resource is being misused and squandered—the time and talents of highly-trained personnel. ☐

# NUMBLES — SOME COMMENTS FROM "DOWN UNDER"

## I. From Kerry G. Fields

**15 Jesmond Rd., Broydon**
**Victoria, 3136, Australia**

After reading some of the letters (and your replies) on Numbles in "Multi-Access Forum" in your April, 1969 issue, I was prompted to write. I have three main reasons for writing, one of which is slightly ulterior.

First, has a letter from Australia ever appeared in "forum" before? I cannot recall one, and if not, I hope this breaks the ice from down-under. Yes, we do read *Computers and Automation* (3 years now!) and think about computers down here.

Second, I was delighted to see Numbles appear in the magazine some months ago. I remember doing my first Numble during primary school years; it was:

```
  H O C U S
+ P O C U S
= P R E S T O
```

However, I have neither the key nor the solution now. Anyway it wasn't until Numbles appeared in C&A that I realised Numbles were a type of intellectual problem on their own. So far I have managed to solve all the Numbles, at least as far as values for the letters, but occasionally the sense of the solution message was hidden until the next issue arrived!

I am amazed at the variety in the Numbles presented each month. Each one demands a particular logical approach and I find most of the solution time is spent in delineating this approach. I have noticed that assumptions need to be made in some Numbles, e.g., if there are ten letters used then the digits 0 to 9 apply exclusively to each one of the letters, but I feel this need not be so.

Third, I would be appreciative if perhaps you could outline some of the restrictions that apply when designing Numbles. Obviously it is not just a matter of setting down letters and then assigning values. And ulteriorly, I would like to have a copy of your booklet on Numbles and their solution.

Incidentally, I am employed by Fibremakers Ltd., Bayswater, Victoria — manufacturers of synthetic fibres.

## II. From the Editor

Thank you for your interesting comments. We will be glad to send you a copy of our booklet on "Numbles". ☐

# THE POWER OF THE PRESS TO REDRESS A GRIEVANCE — A CASE HISTORY

Following is a round by round account of how a lady won her fight to obtain a refund of $1300 when her daughter withdrew from a course in electronic data processing.

Because the refund was achieved, all the names of persons, organizations, and places (except the Federal Trade Commission and the Better Business Bureau) have been changed to fictitious names. But the story is a true one.

## I. From Mrs. Isabel Cronin, 2104 Fox Rd., New Thebes, Tenarsippi, to the Editor (May 23, 1969):

The Better Business Bureau of New Thebes Chamber of Commerce has advised me to contact your organization since they have been unable to adjust my complaint.

Sharon, my daughter, Mr. Cronin and myself had a conference with Mr. D. S. Laird, director of Tenarsippi

Technical Institute, (115 East Main St., New Thebes, Tenarsippi) concerning future education. Sharon was employed on a night shift and was interested in taking a computer operator's course. This course was not offered during the day, so Mr. Laird suggested she try the course in computer programming and data processing. He said she would know within two or three weeks of classes if this course would be what she wanted. We discussed tuition and agreed to pay the year's tuition of $1611.00 with the understanding that a refund would be granted if Sharon withdrew in three weeks.

She withdrew in three weeks, and I have been trying to get a refund since August 1968. After nine months, I feel I should have results instead of promises.

It seems a shame that this school is allowed to operate and literally swindle people. There are other complaints besides mine on file with the Better Business Bureau.

Could you offer any help, advice or suggestions? Is there any way this practice can be stopped to prevent this same thing from happening to others? This school advertises regularly in our local paper and is G.I. approved.

**II. From the Editor to Mrs. Cronin (May 28, 1969):**

I am shocked at the story told in your letter. $1611 is a lot of money.

I am writing to the school. I enclose a copy of the letter. If I do not hear from them, or if I hear and if they have not or do not refund your daughter's tuition, I shall publish your letter in *Computers and Automation* and thus warn every prospective student against enrolling in any course in that school. I shall keep you informed of what happens.

Thank you for writing to me.

**III. From the Editor (by certified mail) to Mr. D. C. Laird with copy to New Thebes Chamber of Commerce and Mrs. Cronin (May 28, 1969):**

I have received the enclosed letter from Mrs. George G. Cronin. Would you be so kind as to tell me:

(1) Whether Sharon Cronin enrolled in your school for a course?
(2) Whether you received $1611 for her tuition?
(3) Whether Sharon Cronin withdrew after three weeks?
(4) Whether the tuition of $1611 has been refunded to Mr. and Mrs. Cronin or to Sharon Cronin?

If I do not hear from you by June 11, I shall assume that this report is true, and publish all the correspondence in *Computers and Automation,* with a recommendation to all our readers to avoid taking any courses in your school.

By copy of this letter to the Better Business Bureau of the New Thebes Chamber of Commerce, I request them to tell me what information they have which bears on this claim against you.

[The Editor received no reply to this letter.]

**IV. From Mr. Harry F. Bradstreet, Manager, Better Business Bureau, New Thebes Chamber of Commerce, New Thebes, Tenarsippi, to the Editor (June 10, 1969):**

Thank you for the copy of your letter written to Mrs. Cronin on May 28, 1969.

Our file, copies attached, will reflect the details as outlined in Mrs. Cronin's letter of May 23. We understand that Mrs. Cronin has also forwarded the information to the Federal Trade Commission, 730 Peachtree Street, Room 270, N.E., Atlanta, Georgia 30308.

If we may be of further assistance, please advise.

**A. Copy of Letter from Mrs. Cronin to Mr. Laird (August 12, 1968):**

Here is the letter you asked me to write asking for a refund on Sharon's tuition.

Before registering, Mr. Cronin, Sharon, and I had a conference with you. We knew nothing about a data processing and computer programming course. After talking to you, we felt the computer operator course offered three nights a week was really what she wanted. Since she is employed on the night shift and this course is not offered during the day, she agreed to take the above mentioned day course. We questioned you about a refund in case the course would be too difficult or not what she wanted. You said she would know in two or three weeks, and if she wanted to withdraw, we'd be given a refund. We paid her tuition in full because this promise was made.

After two weeks of earnestly trying, she asked to withdraw because she felt this course was an electronics course for men or boys with so much emphasis on wiring, magnets, brushes, etc. At your request, she agreed to stay on an extra week. She feels the course is "Greek" to her, dull, and uninteresting. As parents, we feel it is useless to force her to continue with this attitude. Naturally, we are disappointed but realize we cannot live her life for her.

**B. Copy of Letter from Mr. Bradstreet to Tenarsippi Technical Institute (March 19, 1969):**

We have written letters to your office on September 30, October 17, and November 18, 1968 in regard to the complaint above captioned.

Our file does not reflect a reply and we feel that you would like our file to show your position in this matter. May we please hear from you?

**C. Copy of Letter from Mr. Laird to Mrs. Cronin (April 1, 1969):**

This is to inform you that a refund for your daughter, Sharon, will be granted. I have sent the necessary forms to the home office for approval and you will be receiving a check from me no later than April 21, 1969.

**D. Copy of Letter from Mr. Bradstreet to Mr. Andrews, President, Tenarsippi Technical Institute (April 30, 1969):**

On March 26, 1969 we called you in connection with Mrs. Cronin's complaint regarding a refund from Tenarsippi Technical Institute. Shortly after our conversation with you, Mr. D. S. Laird, Director of Tenarsippi Technical Institute, advised us after further discussion with you, he would let us have a decision.

On April 1 we received a copy of a letter signed by Mr. Laird informing Mr. & Mrs. George Cronin a refund would be received by them no later than April 21. Mrs. Cronin advised on April 22 no refund had been received. On April 23 a call to Mr. Laird was placed by this office, whereupon we were informed he was not in but would return our call. As of this date we have not heard from him nor has a refund been received by Mrs. Cronin.

We are enclosing copies of correspondence in our file. Any assistance you may be able to give us will be appreciated.

Thank you.

**E. Copy of Letter from Mr. Bradstreet to Tenarsippi Technical Institute (June 6, 1969):**

We understand that Mr. Andrews is no longer the President of Tenarsippi Technical Institute. We would very much appreciate your advising us who the new president is in order that we may so reflect this in our file for future reference.

Thank you.

**IV. From the Editor to Mr. Harry F. Bradstreet, Tenarsippi Chamber of Commerce, with copy to Mrs. Cronin (June 13, 1969):**

Thank you for your letter of June 10. I have two questions.

1. Have you made any recent demand (by certified mail) for a refund to the Cronins from the school?

2. Do you know of any reasons why I should not publish the entire story in the pages of *Computers and Automation* with a warning to our readers not to have anything to do with this school?

**V. From Mrs. Cronin to the Editor (June 17, 1969):**

Thank you for your interest and effort concerning my complaint against Tenarsippi Technical Institute.

You have my permission to publish the entire story in *Computers and Automation.*

I had contacted a Mr. Andrews, President of this company, by phone, person to person, and he authorized my refund. When the refund was not received, I met with Mr. Laird and he said Mr. Andrews was no longer with the company and had no authority.

I have written to the Federal Trade Commission, who wrote back and said this school is presently under investigation by the office in Washington, D.C. 20580.

I have also notified the Tenarsippi Industrial Commission (the State Approving Agency for Veterans Training), Little Austinson, Tenarsippi.

I plan to contact the local Board of Education and Guidance Counselors of our high schools so that they may warn their students about this school.

**VI. From Mr. Henry F. Bradstreet to the Editor (June 24, 1969):**

Thank you for your letter of June 13, 1969, in regard to the complaint of Mrs. George C. Cronin, 2104 Fox Road, New Thebes, Tenarsippi, on Tenarsippi Technical Institute, 115 East Main St., New Thebes, Tenarsippi.

Mrs. Cronin has advised this department Mr. Laird of Tenarsippi Technical Institute has promised a refund of $1300, which she is willing to accept, by July 21, 1969.

We will keep you advised of the outcome. Your interest and efforts in our behalf and that of Mrs. Cronin we feel has been instrumental in bringing about this additional promise of settlement, and we are most appreciative.

Thank you for your assistance in this matter.

**VII. From the Editor to Mr. Harry F. Bradstreet, with copy to Mr. D. S. Laird, and to Mrs. G. C. Cronin (July 7, 1969):**

Thank you for your letter of June 26, in which you state that Mr. Laird of Tenarsippi Technical Institute has promised a refund of $1300 to Mrs. George G. Cronin.

A promise is not the same as a fact. Please let me know on July 21 whether or not Mrs. Cronin receives her refund. If she does not, we shall publish the whole story in *Computers and Automation.*

**VIII. From Mrs. Cronin to the Editor (July 25, 1969):**

Today, after a year of effort, a refund check of $1311.00 arrived from Mr. Laird of Tenarsippi Technical Institute for a year's tuition of $1611.00 paid in advance for Sharon Cronin.

I especially want to thank you for your interest, concern and effort in helping to adjust the complaint.

**IX. From Mr. Bradstreet to the Editor (July 30, 1969):**

We are pleased to advise that Mrs. George C. Cronin, 2104 Fox Road, New Thebes, Tenarsippi, has advised this department she has received a refund in the amount $1300 as promised from Tenarsippi Technical Institute.

We feel this refund resulted due to your efforts and interest in Mrs. Cronin's behalf. Thank you once again for your assistance. It is greatly appreciated.

If we can ever be of assistance to you, please do not hesitate to call on us. □

## SHOULD INFORMATION TRANSMITTED ACROSS INTERNATIONAL BORDERS BE SUBJECT TO IMPORT DUTIES?

**(Based on a report by Ian Rodger in the July 12, 1969 edition of *The Financial Post,* 481 University, Toronto 2, Ontario, Canada)**

The information industries may soon become major "smugglers" into Canada. A growing quantity of information products and services—such as computer programs and data, newspapers, magazines, books, architectural drawings and phonographic records and tapes—can be expected in the next decade to slip into Canada unnoticed and, more important, untaxed. They will come via telecommunications lines or between microwave towers pointed at each other from opposite sides of the border.

The sales value of these goods could well be several million dollars a year, but they will not come under the scrutiny of the customs and excise branch of the Dept. of National Revenue, because import duties apply only on commodities that cross the border in material form.

H. D. MacDermid, Chief of the Valuation Section of Customs and Excise in Ottawa, feels that there may need to be a new definition of goods to cope with this particular situation. In the meantime, the computer programming industry, in particular, is taking full advantage of it.

Take, for example, the case of a large Montreal-based firm which, six months ago, bought a computer program from a U.S. company for about $15,000. The supplier put the program on a magnetic tape and shipped it air express complete with invoice to Montreal.

Customs officers, seeing the invoice, claimed duty based not on the value of the tape itself (about $30), but on the value of the information product it contained ($15,000).

The company refused to accept the shipment (thus avoiding payment of the tax) and had it sent back to the supplier. The supplier then fed the program into a computer terminal and transmitted it over telecommunications lines to the Montreal firm's terminal. In so doing, they had no need for concern over lost or delayed shipments, or valuation wrangles with customs officials, or the inevitable import duties.

(An alternative way to avoid the import duties would have been for the supplier to send the program in the form of a deck of punched cards. The customs people classify these as used goods and therefore valueless.)

Most industry people believe this sort of telecommunications import does not happen very often yet, but they expect it to become a common practice fairly soon.

Because the Canadian programming industry is still basically in its infancy, Canadian companies rely heavily on

U.S. software products. If IBM Canada begins to charge for software as IBM in the U.S. did recently, more and more U.S. firms can be expected to plunge into the Canadian software market. And many of them, running into the same problem with customs officials as the Montreal firm in the example above, may decide to use telecommunications lines to import their products.

The major computer manufacturers in Canada, all of whom are subsidiaries of U.S. firms, stoutly deny that they are now importing software for commercial sale over telecommunications lines. And most say they won't do it for ethical reasons.

But there is some question as to whether concern over ethics and public image will prevent many entrepreneurs from indulging in "smuggling" with the aid of telecommunications technology. ☐

## NCR CENTURY USERS' GROUP IS FORMED

**R. E. Davis**
**Automated Systems Corp.**
**Houston Natural Gas Bldg.**
**1200 Travis St.**
**Houston, Tex. 77002**

An NCR Century System Users' Group has recently been formed for the benefit of all users of the Century 100 and 200 computer systems. The organization will allow NCR users to discuss system capabilities, problems, and experience gained during system development. In addition, NCR users will be able to make unified recommendations to NCR for both hardware and software changes which would enhance the Century Series Computer System.

Anyone interested in obtaining further information about the Group may write to the above address. ☐

## ACM GUIDELINES FOR DATA PROCESSING SCHOOLS

**Dr. Carl Hammer, Chairman**
**ACM Accreditation Committee**
**2121 Wisconsin Ave. N.W.**
**Washington, D.C. 20007**

The concern of the Association for Computing Machinery with the quality and performance of data processing schools led to the establishment of an Ad Hoc Committee on Accreditation in 1967. Recently, this Committee developed a Policy Statement on "Guidelines for Data Processing Schools" which was adopted as the official policy of the ACM during the Council Meeting in Boston in June.

Some of the points covered in this Policy Statement follow.

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### 1. Accreditation

Accreditation is generally understood to mean that an institution has been granted an official statement of approval and continued compliance with established minimum standards and criteria by one of the many organizations designated by the U.S. Commissioner of Education as nationally recognized Accrediting Agencies and Associations which are listed in the official roster of such agencies by the U.S. Office of Education under the provisions of Public Law 82-50 of Chapter 33, Title 38, U.S. Code, or of similar and/or subsequent legislation. Tax supported schools, such as public vocational high schools and junior colleges, which must meet the requirements of the public regulatory bodies, are not necessarily covered by one of the above-mentioned organizations.

### 2. Objectives

The prime objective of a data processing school should be to provide competency of sufficient depth so that each graduate technician may be employed in an appropriate occupation in the data processing field. Objectives in their conceptual content should provide a rational basis for planning and operation of a data processing school program. They should cover in detail: standards for operation; training objectives; externally generated standards on which training objectives are based; and areas of specialization, if any.

### 3. Institutional Policies Concerning Admissions, Retention, Placement, and Counseling and Drop-Outs.

Admission policies should be clearly defined and published in the school's official catalog or bulletin. The policies for admissions should include evaluation of (1) demonstrated aptitude for general learning; and (2) motivation sufficient to encourage completion of a study. General learning ability and aptitude may be in part estimated through use of various intelligence and aptitude examinations. It is expected that they will be administered under controlled conditions. Motivation should be evaluated either by means of an in-depth interview, or through use of such media as letters of reference.

Schools should employ steps to retain students. These steps should be complementary to the pre-qualifying procedures for admissions, and should provide the protection and assurance of the student and school objectives. Emphasis should be on completion of the vocational objective.

The school should accept responsibility for assisting its graduates in securing employment in the field for which they are trained, without charge to graduates. Referral should consider the capabilities and performance of the graduates; and they should be referred only to positions for which they have a reasonable probability of success. The school should prepare its graduates for interviews with prospective employers. The data processing schools should be encouraged to follow the careers of their graduates.

From the date of student entry, the school staff, instructors, and supervisors, should be looking at students with a view toward determining potential success in the field. Evaluations should be made at frequent intervals. Students whose achievements are not satisfactory in the classroom situation should be counseled at the earliest possible time to try another field.

Other points covered in the statement include: (4) Definition of Entry Level Programmer; (5) Faculty Qualifications (including academic background, programming background, personality, schedule, and continuing study); and (6) Curriculum, Text Materials, Testing, and Facilities.

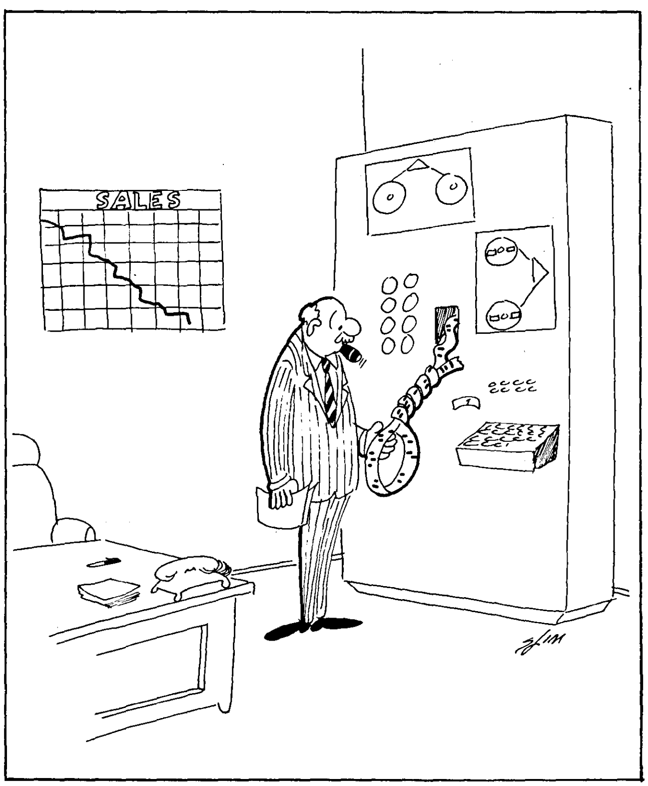
Anyone interested in obtaining additional information concerning accredited institutions is invited to write any of the following three agencies: Mr. William Goddard, Executive Director, The National Association of Trade and Technical Schools, 1601 18th St. N.W., Washington, D.C. 20009; Mr. Dana Hart, Executive Commissioner, United Business Schools Association, 1101 17th St. N.W., Washington, D.C. 20036; and Dr. David A. Lockmiller, Executive Director, The Accrediting Commission of the National Home Study Council, 1601 18th St. N.W., Washington, D.C. 20009. These are the three agencies specifically granted the power by the U.S. Office of Education to accredit non-degree granting institutions in the field of computer training, programming, or data processing. □

## NUMERICAL CONTROL SOCIETY'S 7TH ANNUAL MEETING — CALL FOR PAPERS

**Mary Ann DeVries**
**Numerical Control Society**
**44 Nassau St.**
**Princeton, N.J. 08540**

The seventh annual meeting and technical conference of the Numerical Control Society will be held April 8, 9, and 10, 1970, in Boston, Mass. Papers in all areas concerning numerical control are invited. Guideline topics include: What's New in NC; Computers and NC; NC Programming; NC Drafting and Program Verification; Adaptive Control; Management Implications of NC; NC Economics; Selecting NC Equipment; Inspection and Quality Control; Tooling; Training and Training Aids; NC Applications; and Early Days of NC.

Six copies of a one-to-two page abstract, accompanied by a biographical sketch, must be submitted by October 15, 1969 to the Program Chairman: Lawrence D. Levine, Hitchiner Manufacturing Co., Inc., Milford, N.H. 03055. Final papers will be due Dec. 1, 1969. □




## COMPUTER ART

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

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

## THE PHILOSOPHY OF COMPUTER ART

**Haruki Tsuchiya**
**Computer Technique Group**
**403 Shiba-Mansion**
**25 Shiba-Nishikubo-Hachimancho**
**Minato-Ku, Tokyo, Japan**

We can say that we have seen almost all the experiments in computer art that have recently been tried. So let us think about computer art for a moment.

First, what is computer art?

It is not easy to answer that question.

Artists who are not computer professionals are suspicious of computer art. Usually an engineer who produces computer art has no desire to know what art is. But he insists that a computer can be a good tool for artists, and that many kinds of works can be made utilizing a computer. I think the engineer is right, insofar that he remains an engineer.

But it is not enough only to say that the computer is a good tool for an artist—we must discuss what computer art is.

There are several important points which I found while producing computer art.

1. Computer art requires the clarification of the process of producing works. We must describe the process in the completely logical statement of a computer program. This is necessary so that the artistic process of producing works, which artists have ever cherished, can be transformed into mathematical language. The work is finally decoded into unit information in terms of 1 or 0; thus computer art describes our physical world in those terms.

2. Computer art has shown us that we can call out pattern, system, symbol, line, point and curve, etc., only by symbol. And we can transform these symbols only by logic. So we can see that our artistic works can be described and composed only by symbol and logic on paper. We must recognize the important relationship between the symbol-logic system and the semantic system used in the contemporary arts.

3. Computer art gives us the ability to have system and randomness at the same time. Many computer artists use random numbers to give a sense of freedom to their works. This is a reflection of the combination of system and randomness they have in themselves as human beings. In the area of information aesthetics, system means nega-entropy, and randomness means entropy. We can find the secrets of wonderful works in the balance of system and randomness that computer art provides.

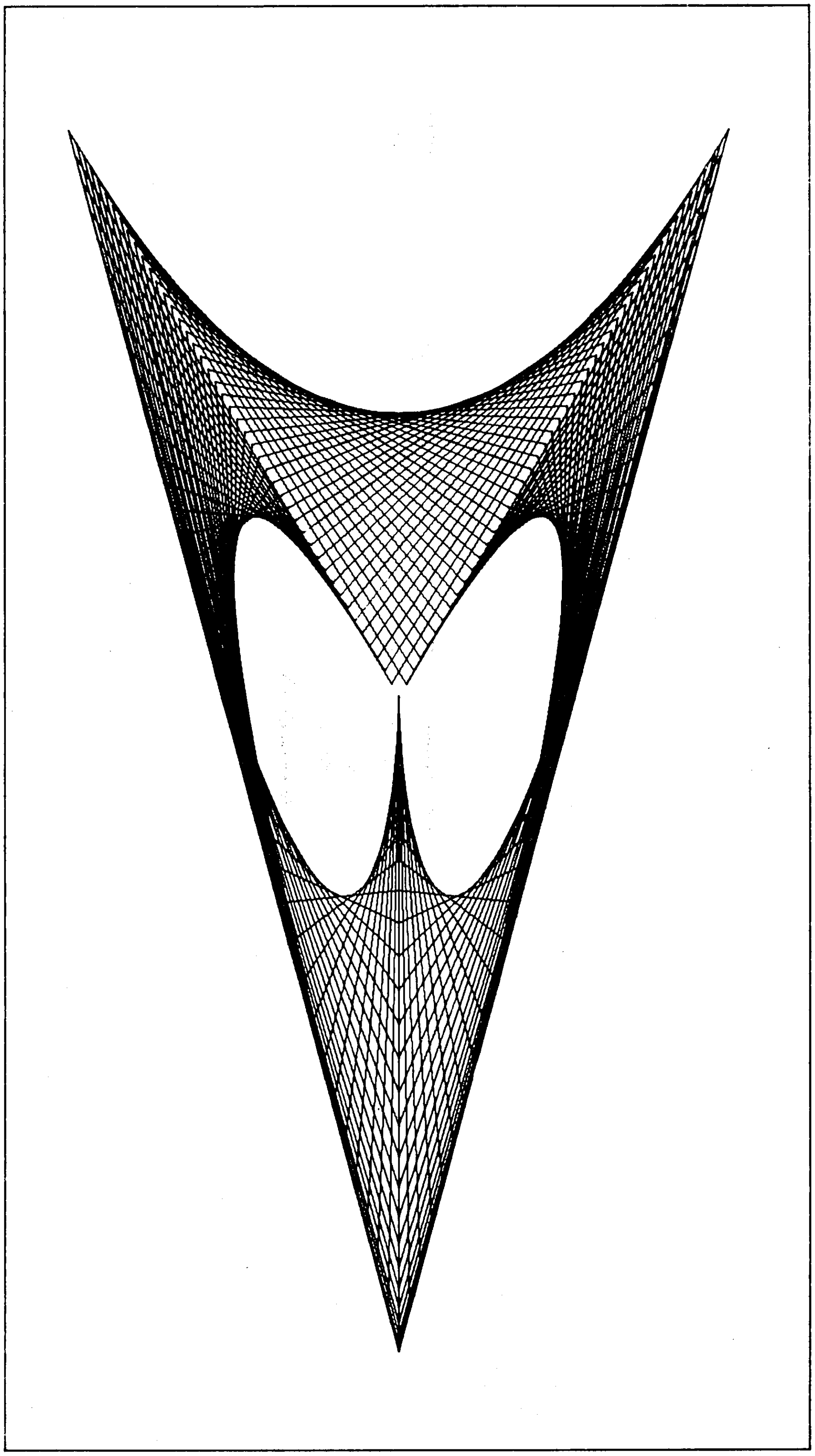
These are only some thoughts relative to computer art.

The question for the future is: Can the computer art that is a hobby of engineers and automatically-made art become a new world of aesthetics? □

WATCHING

— James S. Lipscomb
26 Woodfall Rd.
Belmont, Mass.

This entry in C&A's 1969 Computer Art Contest was programmed in Fortran on an IBM 1620 computer and drawn on-line by a CalComp 565 plotter.



# RIGHT ANSWERS — A SHORT GUIDE FOR OBTAINING THEM

Edmund C. Berkeley, Editor
Computers and Automation

In the editorial "The Cult of the Expert", in the May 1969 issue, in the discussion of expertness and common sense, I said:

> But how does one learn common sense? particularly "enlightened common sense"?
> Some would say "in the school of hard knocks". A good textbook on common sense would be helpful in getting through this school. I have often searched for such a book but never found one, and so I have begun to put one together; it is tentatively entitled: "Common Sense: Elementary and Advanced". (The effort so far has produced some 90 pages of manuscript and a two-page publication "Right Answers — a Short Guide to Obtaining Them".)

And we offered to send a copy of this to any reader who circled a certain number on May Readers' Service Card.

Over 600 requests have so far been received; so, it seems desirable to reprint this "Short Guide" in the magazine, to satisfy these requests, and possible interest from other readers.

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The following is a summary (to be expanded in a forthcoming book) of remarks, maxims, questions, proverbs, etc., that relate to getting answers that are correct and reliable. Some readers of this will not understand some of the allusions; but that is not necessary at this time.

## 1. The World

The world is more complicated than most of our theories make it out to be.
(Story of the Six Blind Men and the Elephant)
Cultivate an objective viewpoint: try to see the world as it really is.
Ignorance is no excuse.
What you want to be true and what is actually true may be very different. (The wish is father to the thought.)
Often there is a wide difference between truth and believability. (Story of the Iron Barrels and the Pittsburgh Manufacturer)
Never decide to buy something while listening to the salesman. (Timeo Danaos et dona ferentes.)
Think over an argument from the opposite point of view as well as your own.
Your views can never attain correctness unless you can change your mind.
An educated man is prepared to change his mind on good evidence.

## 2. Lies

Try not to take false or misleading information into your mind: it clogs the channels of correct thinking.
Lots of people bring you false information.
"A government has a right to lie to save itself" - Sylvester, former Assistant Secretary of Defense. (It can be shown that this statement is false.)
You can classify most sources of information into three kinds:
- those who will tell the important truth even if painful;
- those who will tell only so much of the truth as fits with their interests; and
- those who will tell most of the truth from time to time but forget about correcting past errors or lies.

Information which is true meets a great many different tests very well.

## 3. Answers

Most problems have either many answers or no answer. Only a few problems have a single answer.
An answer may be wrong, right, both, or neither. Most answers are partly right and partly wrong.
A chain of reasoning is no stronger than its weakest link.
True conclusions can be deduced logically from false premises. ("A false proposition implies any proposition." - Bertrand Russell)
A statement may be true independently of illogical reasoning.
There are general statements, universal statements, and particular statements. The chance of a particular statement being true is much higher than the chances of the other two kinds of statements being true.
A single counter-example disproves a universal rule.
A flock of counter-examples makes a general rule unreliable.
Most general statements are false, including this one.
An exception TESTS a rule; it NEVER PROVES it.
There is no substitute for honest, thorough, scientific effort to get correct data (no matter how much it clashes with preconceived ideas). There is no substitute for actually reaching a correct chain of reasoning. Poor data and good reasoning give poor results. Good data and poor reasoning give poor results. Poor data and poor reasoning give rotten results. As computer people often say, "Garbage in, garbage out".

## 4. Mistakes

The moment you have worked out an answer, start checking it — it probably isn't right.
If there is an opportunity to make a mistake, sooner or later the mistake will be made.
Being sure mistakes will occur is a good frame of mind for catching them.
Your personal attitude about all your mistakes drawn to your attention MUST BE "Thank you! I'll try to fix that."
Learn from your mistakes. Every mistake is a lesson in disguise. (Story of the Oldsmobile Fuel Line.)
Do not copy mistakes. If in doubt, inquire.
Always use your head — never do something stupid — and if a superior instructs you to do something that seems stupid, inquire or protest or balk.
Check the answer you have worked out once more, before you tell it to anybody.

## 5. Checking Work

Is it accurate? or appropriately accurate?
Is it complete? or sufficiently complete?
Has anything been left out which should be in?
Has anything been put in which should be left out?
Is it right? Is it correct?
Does it make sense? Is it reasonable?
Is anything obscure? Can anything be misunderstood?
Have I read it over once more to catch errors?
Has it been considered from the other person's

point of view?
Have I made any assumptions? If so, have I called attention to the assumptions?

6. Checking Figures

Are the figures arithmetically correct?
Are any digits written obscurely?
Have the figures been inspected?
Are the figures reasonable?
Are the figures consistent? Do they change from one value to another by reasonable differences?
Has the right starting data or source information been used?
How do the figures compare with prior figures? the figures for last year? the figures the last time the calculation was made?
Has anything been left out that should go in?
Has anything been put in that should be left out?
Does the description of the figures specify precisely what they are?
Has the calculation been made precisely in accordance with the proper instructions?

7. Estimating

The habit of estimating the range in which a figure should lie is really valuable.
Estimating ahead of time what a figure should be, and then comparing the estimate with the figure when it becomes known, catches many mistakes.
Estimating a figure may be enough to catch an error.
For estimating answers it is helpful to know a number of scales on which to locate figures reasonably: distances, times, weights, values, prices, populations, dates, etc.
Figures calculated in a rush are very hot; they should be allowed to cool off a little before being used; thus we will have a reasonable time to think about the figures and catch mistakes.
Every figure should be taken with a spoonful of caution until confirmed by an independent estimate.
A great many problems do not have accurate answers, but do have approximate answers, from which sensible decisions can be made.
The cultivated habit of applying principles of estimating in order to be right and not wrong, can become a keystone to success in many fields.

8. Avoiding Common Fallacies in Thinking

(Based on a contribution from Munson B. Hinman, Jr., Nov. 20, 1961)

Over-generalizing: Jumping to conclusions from one or two cases.
"Thin entering wedge": A special type of over-generalizing involving prediction. If this is done, then that - usually dire - will follow.
Getting personal (Argumentum ad hominem): Forsaking the issue to attack the character of its defender.
"You're another." My point may be bad but yours is just as bad, so that makes it quits.
Cause and effect (Post hoc ergo propter hoc): If event B comes after event A, then B is assumed to be the result of A.
False analogies. This situation, it is argued, is exactly like that situation - when it isn't.
Wise men can't be wrong (Argument from authority): Trying to clinch an argument by an appeal to authority.
"Figures prove," "statistics show," "the computers say": A subclass of the above.
Appeal to the crowd. Distorting an issue with mass prejudices.
Arguing in circles. Trying to use a conclusion to prove itself.
"Self-evident truths." Trying to win an argument by saying "everybody knows" it must be true.
Black or white. Trying to force an issue with many aspects into just two sides, and so neglecting important shades of gray.
Argument of the Beard. Trying to force an issue with just two sides into many aspects, where there are so many shades of gray that no conclusion can be drawn. Examples: (1) The jalopy that can carry "just one more" passenger. (2) Do 350 whiskers make a beard? Do 349? Do 348? ....Do 2? Does 1? Even though one cannot specify a number of whiskers where the change takes place, there is such a thing as "having a beard" and such a thing as "not having a beard".
Guilt by association. Making a spurious identification between two dissimilar persons.
Appeal to pity.
Appeal to fear.
Appeal to ignorance.

9. Murphy's Laws

If something can go wrong, it will.
If left to themselves, things always go from bad to worse.
Nature always sides with the hidden flaw.
(quoted in "The Scientific American" magazine, April, 1956.)

## WARNING 5 . . 4 . . 3 . . 2 . . 1 . .

**America is a land of numbers,**
**From the cradle to the grave,**
**Think how efficient this all makes us,**
**Think of all the time we save.**

**The neighbor's voice is seven digits,**
**The old friend's address ends in five,**
**While the nine of social security,**
**Make us glad to stay alive.**

**College students all are numbers,**
**So are classes, tests, and grades,**
**As are men in corporations,**
**In a thousand different trades.**

**Eating, too, is a game of numbers,**
**So is working by the hour,**
**And how ever could a guy describe a girl,**
**Without the use of number power?**

**And when the computers do take over,**
**They'll be all lit up to find,**
**That each American has a number,**
**And most of them are self-assigned.**

*Miss Carolyn Kluball*
*3007 Loch Laurel Road*
*Valdosta, Georgia 31601*

# WHO'S WHO IN THE COMPUTER FIELD — ENTRIES

Who's Who in the Computer Field will be published by Computers and Automation starting in the fall of 1969. The Fifth Edition 1969-70 (the first annual edition) will include three separate hard-cover volumes, containing upwards of 7000 capsule biographies of computer people; publication is scheduled as follows:

Vol. 1 — Systems Analysts and Programmers — Oct. 1969
Vol. 2 — Data Processing Managers and Directors — Dec. 1969
Vol. 3 — Other Computer People — Feb. 1970

Following are sample capsule biographies which we shall publish in the 5th edition of Who's Who in the Computer Field.

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

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

If you wish to be considered for inclusion in the Who's Who, please complete the following form or provide us with the equivalent information. The deadline for receipt of entries in our office for Vol. 2 is Fri., Oct. 31, 1969. (If you have already sent us a form some time during the past eighteen months, it is not necessary to send us another form unless there is a change of information.)

SEND US YOUR ENTRY TODAY!

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(may be copied on any piece of paper)

1. Name? (Please print)__________
2. Home Address (with Zip)?__________
3. Organization?__________
4. Its Address (with Zip)?__________
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 Distinctions?__________

(attach paper if needed)

12. Do you have access to a computer? ( )Yes ( )No
    a. If yes, what kind of computer?
       Manufacturer?__________
       Model__________
    b. Where is it installed:
       Manufacturer?__________
       Address?__________
    c. Is your access: Batch? ( ) Time-shared? ( )
       Other? ( ) Please explain:__________
    d. Any remarks?__________
13. Associates or friends who should be sent Who's Who entry forms?

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# MANPOWER STATISTICS IN THE INFORMATION PROCESSING FIELD

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*"Unlike hardware, which nowadays is almost available off the shelf, good people take years to train and educate. It will be a national disgrace if we train them for the wrong jobs."*

Employment in the information processing field is increasing rapidly and it is generally accepted that good people are in great demand. At the same time, the educational system, from proprietary programming school to top rank university, is rapidly expanding its programs to produce trained people. These two qualitative sentences will find few challengers, but what can be offered if a demand is made for quantitative data to support these contentions, or for information on when a balance will be achieved between supply and demand for trained personnel? The purpose of this article is to outline some of the difficulties in getting such quantitative data, review what data is available, and suggest some things for the future.

### Relevant Data

First, we should examine the type of data which might be useful. On a national level, projections of employment and salary levels for various categories of jobs are essential for career guidance purposes. For example, a widely used government publication is the ***Occupational Outlook Handbook***[1] which gives advice as to the future of almost every imaginable occupation, including three in the information processing field. Again on a national level, governmental support of education can only proceed in an orderly fashion if requirements are reasonably well known so that logical priorities can be established.

Bruce Gilchrist received his Ph.D. from the University of London in 1952 and subsequently was a staff member at the Electronic Computer Project at the Institute for Advanced Study, Princeton, New Jersey from 1952 to 1956. He then became Director at the Syracuse University Computing Center for three years and from 1959 to 1968 was employed by IBM in various technical management positions. He served on the Council of the ACM for ten years, being Secretary from 1960 to 1962 and Vice President from 1962 to 1964. He served as President of AFIPS from 1966 until 1968. In October of 1968, Dr. Gilchrist became the first full time Executive Director of AFIPS.

On a smaller scale, data on manpower availability and salary level by geographical area and/or industry can be very important inputs to corporate planning. This is true, both for planning internal employment, and for determining whether or not potential buyers will have the trained manpower to utilize the proposed product or service.

Whether the data is for national or local use, it must be specific enough for decision making. The degree of specificity will, of course, vary. The Bureau of Labor Statistics finds the general categories of programmer, systems analyst, and computer operator sufficient, but the individual company planning to establish a computing center will probably want information on salary ranges for programmers by level of experience.

### Job Classification

As soon as data by employment category is required, the problem starts to become difficult. ***The Dictionary of Titles,*** published by the U.S. Department of Labor[2] provides a good start, but is only applicable if the individuals who are to be counted or surveyed are classified according to those titles. For example, an employee with an engineering degree may well be classified by his employer as an engineer, even though he is spending all his time programming. Similarly, the trained accountant may be functioning as a systems analyst while still preferring to be called an accountant because he feels that his long term career opportunities are in accounting rather than systems analysis.

Closely related to the classification problem is that of the individual who spends a portion of his time programming. The engineer, scientist, or accountant who programs part of his time is quite common in the batch-mode computing center. With the rapid growth of terminal-oriented systems, such people are becoming very numerous. How should they be counted? They cannot be ignored since their requirement for education in information processing, while perhaps only one or two courses per individual, may exceed in total that for individuals preparing to be full-time programmers. (A report to the President's Scientific Ad-

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visory Committee[3] estimates that 75% of students should receive some computer training while in college.)

Existing data falls into three broad classifications – total employment, results of samples from general groups, and samples from specialized groups. Data has been collected and/or published by the government, professional societies, and private industry. The examples given below are representative and do not necessarily include all available sources. (The author would welcome correspondence from individuals knowing of additional reliable sources.)

### Estimates of Total Employment

The best estimates of total employment appear to be those of the Bureau of Labor Statistics. Their published data from recent years is summarized in Figure 1 in which the occupational titles included are those of Figure 2. These figures are apparently derived by applying staffing ratios to the number of computers installed. While the number of installations is known reasonably well, considerable doubt can be cast on the reliability of average staffing ratios. From the figures of current and past employment, the Bureau of Labor Statistics estimates future needs in the light of national growth, expected growth of the computer industry, and possible productivity improvements. Numerical projections are not given, but are used in deriving the published prediction that employment outlook will be excellent in all three categories.

For career planning purposes, the Bureau of Labor Statistics' data is probably sufficient. It is questionable, however, whether it is accurate enough to form a base on which detailed governmental planning, such as for the financing of educational facilities, can be built. The 1970 Census may provide the required base provided that the census returns are accurately coded as to occupation. At the present time, AFIPS and other professional societies, as well as government departments are exchanging ideas on possible classification schemes.

### Salary Data

Although the *Occupational Outlook Handbook* includes some general salary data, the most extensive published salary data appears to be that given annually in *Business Automation*[4]. Ranges of actual salaries for 22 different job classifications are included. Sample sizes and details of the survey and analysis techniques used are not given and thus the statistical reliability of the data is unknown.

Data resulting from sampling specialized groups are published frequently. Problems common to most of the reports are the lack of standardized occupational classifications, imprecise sampling techniques and lack of a clear definition of the sampled population. These problems make it very difficult to compare surveys to corroborate findings. For example, 7.0% of degree holders listed as computer scientists in the latest report of the *National Register of Scientific and Technical Personnel*[5] hold Ph.D.'s, whereas 10.6% of degree holders surveyed by AFIPS[6], were found to have Ph.D.'s. A superficial examination of the samples used in the two reports leads one to conclude that the National Register should include a higher percentage of Ph.D.'s. A detailed examination of the results is virtually impossible due to the imprecise and inhomogeneous way in which both samples were chosen.

The *National Register of Scientific Technical Personnel* includes 6,972 individuals using criteria which tend to exclude the non-mathematically-oriented computer scientist. The data covers types of employer, salary levels and age distribution. The AFIPS sponsored *Information Processing Personnel Survey, 1968* is based on 29,826 (out of a possible 70,000) questionnaires completed by members of eight professional societies in the information processing field. The three largest societies included were The Data Processing Management Association, The Association for Computing Machinery and the Computer Group of the Institute of Electrical and Electronics Engineers. The published data includes age, sex, employment, professional activities, as well as extensive salary breakdowns. While the AFIPS survey is probably one of the most extensive ever conducted in the industry, it was limited to members of professional societies. What is not known is the relationship between those people who join professional societies and

Figure 1

Summary of employment statistics included in recent issues of the Occupational Outlook Handbook.

| | Programmers | Systems Analysts | Operators |
|---|---|---|---|
| 1955 | - | - | - |
| 1956 | - | - | - |
| 1957 | - | - | - |
| 1958 | several thousand | - | - |
| 1959 | - | - | - |
| 1960 | - | - | - |
| 1961 | 40,000 | - | a few thousand |
| 1962 | over 50,000 | - | - |
| 1963 | - | - | - |
| 1964 | - | - | - |
| 1965 | 80,000 | - | 50,000 |
| 1966 | over 100,000 | over 60,000 | 100,000 |
| 1967 | - | - | - |
| 1968 | 175,000 | 150,000 | 175,000 |

Figure 2

OCCUPATIONAL TITLES USED BY BUREAU OF LABOR STATISTICS

A. Systems Analysts

1. Applications Engineer
2. Engineering Analyst I
3. Systems Analysts, Business Electronic Data Processing
4. Systems Engineers, Electronic Data Processing
5. Operation Research Analyst

B. Programmer

1. Programmer Business
2. Programmer Chief Business
3. Programmer Engineering and Scientific
4. Programmer Detail
5. Coding Clerk

C. Electronic Computer Operating Personnel

1. Digital-Computer Operator
2. Computer-Peripheral Equipment Operator
3. Card-Tape Converter Operator
4. High Speed Printer Operator
5. Sorting Machine Operator
6. Verifier Operator
7. Tape Librarian
8. Data Typist
9. Key Punch Operator
10. Supervisor, Computing Operator

those who do not; 70,000 is clearly only a minority of the professional level people employed in the industry.

### Specialized Surveys

Specialized salary surveys are frequently conducted within industry groups, but seldom receive wide circulation. Among unpublished surveys, the annual National Salary Survey[7] is probably the most extensive. The coverage is of approximately 20,000 full time programmers employed by 150 organizations. Unfortunately, the results of this detailed survey are restricted to the participating employers.

Recently, recruiting firms have used salary surveys to assist or encourage clients. In the case of such surveys, it is important to remember that they may be including in the sample, only people who have moved to new jobs. This can give an inflated view of salary levels.

In a rapidly growing and changing field, we must always be careful not to concentrate on outmoded or irrelevant statistics. It is wrong just to count how many programmers exist today, find how many additional one's employer would like to hire, and then tell our educational system to get to work to produce the required people. Rather, we must repeatedly ask questions such as, "Do we need more people, or do we really want better or differently trained people?" Unlike hardware, which nowadays is almost available off the shelf, good people take years to train and educate. It will be a national disgrace if we train them for the wrong jobs.

### Projections

Collecting manpower statistics is too big a job and has too many aspects to be left to one agency or organization. However, this does not mean that there should be multiple unrelated and possibly overlapping efforts. AFIPS, representing ten professional societies in the information processing field, believes that it has a legitimate role to play in trying to coordinate the many activities in the area while, of course, continuing to contribute by surveys of its own, etc. There seems to be ample room for everyone who wants to work in the manpower field. By exchanging ideas, plans and results, everyone's progress may be accelerated. As a first item on a cooperative agenda, I would suggest that all interested groups assure themselves that the best possible use is made of the 1970 Census. It is a once-in-ten-year opportunity to establish a firm base for future projections and it should not be missed because of faulty classifications or imprecise instructions to the enumerator and coder. □

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# HOW CAN WE "PRODUCE" MORE PEOPLE FOR THE

*J. A. McMurrer and J. R. Parish*
*Honeywell EDP*
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*"We buy or lease computers for sums which total hundreds of thousands or millions of dollars. Isn't it paradoxical that we won't invest the final few thousands necessary to truly educate our computer people to the required level for reaping dividends from these computer dollars?"*

The greatest challenge faced by the computer industry today originates from within its own structure. It has failed to propagate its own kind. Our industry is underpopulated. The magnitude of the current manpower shortage demands that we recognize our collective errors and take action.

Perhaps our most serious failure has been our inability to communicate effectively with the academic community. For the first time perhaps in modern history, a profession has been forced to develop with little participation from the universities.

In the past, when industry has needed engineers, accountants, or geologists, the need was made known and the colleges responded. Within a reasonable period of time, adequate numbers of trained personnel became available.

But we, the computer industry, have never adequately voiced our growing personnel requirements to the academic community. We have never clearly indicated what it is we need. As a result of our inaction, few universities have initiated meaningful degree programs leading to career positions in data processing. Unfortunately those schools frequently give the curriculum too much of a scientific orientation. In so doing, they misrepresent to the student body at large the type of skills which are in tremendous demand throughout industry.

We therefore conclude that only token assistance will come from the universities in the next decade or so. We review this limited response by the academic world to demonstrate that it provides no panacea, and that the solution must be generated by concerned management within industry.

In our search for this solution, we must become aware of existing practices which work to the detriment of our overall personnel objectives.

### Hiring Experienced Personnel Only

One of the most obvious problems is the common policy in the industry of hiring experienced personnel only. Rather than "produce" the programmer or specialist needed to meet a predictable requirement, the EDP manager too often turns to the open market. He "buys", at the going price, an individual whose resume indicates the desired qualifications. As a group, EDP managers have become "buyers" to such a degree that fifty thousand technical positions remain unfilled today in the industry.

Why this swing to "buying" rather than "producing" the programmers and other computer-knowledgeable people who are needed?

The typical reasons set forth are:

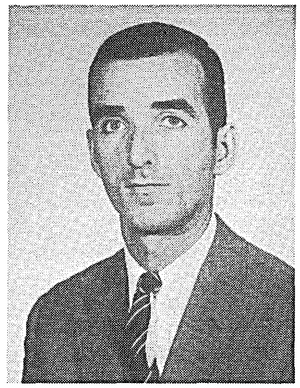
- We inherited rather than created the current manpower dilemma. We are so fiercely engaged in solving today's problems (and sometimes yesterday's) that we have no time to find and train new people.
- We are reluctant to invest in more than preliminary training of our people. Experience has taught us that when they reach a respectable level of EDP knowledge, they will be "purchased" by a "buyer" in the marketplace.
- It is difficult to schedule a comprehensive training curriculum from the list of available courses offered by computer manufacturers.
- The dollar cost involved in thoroughly training our computer people often causes a luxury tag to be placed on our efforts.

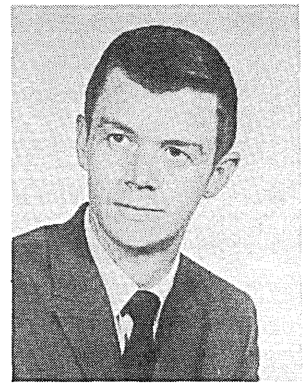
Each of these philosophies of management requires close examination, lest they be allowed to excuse our "buyer" club membership. Taking them in order, let us challenge the validity of each.

### Creating a "Good" Employee

1. The philosophy which allows us to "live it one day at

## COMPUTER INDUSTRY?





Mr. McMurrer (left) is currently directing the Postgraduate Education Program at Honeywell EDP. Prior to this he was Manager of Systems and Education for Honeywell in Cincinnati. He has a B.S. degree in Economics from Boston College.

Mr. Parish (right) is Manager of Education Services within Honeywell's EDP Division. Prior to this he was the division's East Central Region Education Manager. He holds a B.S. degree in mathematics from Michigan State University.

a time" has no more justification in computer work than in any other professional business activity. A manager must always look to the future, for the good of his company, his staff, and more personally, in the interest of his own career.

Of the many resources which he must manage, his people become his primary concern. If he has a personnel shortage or an inadequately trained staff, he must recognize this deficiency and take steps to correct it.

Many managers overlook the most practical answer in favor of a short-range solution of their programmer shortage. New, inexperienced personnel *can* be made productive in a realistic time frame. An efficient training program *can* be designed to meet the requirements of any data processing environment. The training may be a program 6 to 12 weeks in length. The cost will vary depending on the approach taken in designing the programs: the site chosen, internal education strength, degree to which standard manufacturer courses apply, contractual services required, amount of computer time utilized, etc.

The important fact is that good professional people can be created in a short period with the proper initiative and investment through training. Honeywell regularly conducts such programs for its own entry level personnel, and over the years has found them as productive as individuals "bought" in the marketplace with up to two years of experience.

### Keeping Employees

2. The philosophy which asks "Why propel a man, via good training, into an ex-employee status?" speaks of weak management. It darkly hints of resume updating and weekly screening of newspaper employment sections. Yet, industrial psychologists assert that the appeal of money runs far behind achievement, responsibility, recognition, and growth as dominating factors in employee motivation.

The EDP manager faced with "buying" an employee to stay in the organization after the employee has atained advanced EDP training is indeed in an unfortunate position.

The manager without this problem is the one who wisely helps his people grow professionally through training and other means. Satisfied employees seldom can be "bought" away by another company solely by the standard 10 to 15 percent increase in salary.

### Education from Manufacturers

3. The philosophy which cries "The manufacturer is to blame for my education problems because his schedules won't allow comprehensive training in a reaonsable length of time" is invalid today. While not all manufacturers can plead total innocence of this charge, we have seldom seen a bona fide case of a well motivated manager being foiled in his attempt to send an employee to school because a manufacturer's schedule wouldn't allow it. When a reasonable effort is put forth by management in terms of flexibility in schedule and in travel policies, it is certain that his education request will be met.

### Costs

4. The philosophy of 'My gosh, do you realize what it costs me to send one man to a two-week course in . . . . . ." is a short sighted one. The real expense here, unfortunately, is the cost involved in "not" sending the man to the given course, assuming that he needs the training.

The computer, we assert, is a tool like no other tool. Its potential has yet to be measured. Its ability to simulate the marketplace, control inventory, load the factory, forecast sales, and generally help move the company ahead is widely acclaimed. We buy it or lease it for sums which total hundreds of thousands or millions of dollars. Isn't it paradoxical that we won't invest the final few thousands necessary to truly educate our computer people to the required level for reaping dividends from computer dollars? The dilemma of modern management is that sufficient numbers of computer-knowledgeable people are unavailable "anywhere" to help harness the total potential of management's greatest tool.

### Constructive Action

Various philosophies effectively impede proper use of and proper return from computer systems today. We will have matured as an industry when we are able to face the problem collectively, in full awareness of the causes, and in full resolve to effect a successful solution. These manpower philosophies must be eliminated. But this will not be enough. They have already done tremendous damage. Constructive action is called for. It must be positive; it must be massive; and it must be effective.

We must start now. Our industry needs a massive influx of new people if it is to grow at predicted rates. We need to put forth a unified campaign to attract qualified people to our industry. We must start now by selling our industry to qualified people seeking a career. In so doing, we must tear away the mysticism which shrouds computers and the EDP industry in the eyes of the public in general.

In this regard, we must eliminate the ignorance which caused a college senior last fall to give us this evaluation of our industry: "I wish I understood where there is any room for personal creativity in the field of data processing." Another senior started his evaluation in these words: "This era has been called the Age of Computers, and I'm afraid it is so . . . . . . .".

The public does not recognize, as we would like to think, that computers are ingenious "tools" which require high imagination and intelligence on the part of the people who program and otherwise direct them. The young people who might enter the field are discouraged by the seemingly cold, structured, and passive role played by the people in our EDP industry.

Too many of the highly motivated and idealistic people our industry needs are rejecting EDP as a career. We never get the chance to reveal the opportunities in computer-related work.

We must change this situation. Computer involvement represents unexcelled career satisfaction. It is a further paradox of our industry that, having so much to offer, we attract so few people.

### Training College Graduates

Honeywell EDP has addressed itself to this overall problem. It has instituted a tuition-based "Postgraduate Education Program." College graudates attend the program for twelve weeks. They participate in an intense curriculum which is designed to equip them as systems programmers with an understanding of the primary management role of computers. The program stresses a high ratio of computer interaction with lecture, workshop, and case study modes of learning. Upon graduation, students may assume technical positions throughout the industry.

Over 200,000 college students have had the career potential of computer-related work revealed to them through Honeywell's efforts to recruit students for this course. Results have been significant. The campaign has rooted out misconceptions and apprehensions concerning computers and related career positions. Students who might otherwise have eliminated EDP because of their liberal arts or business administration backgrounds are learning that computers have diverse areas of application. The misconception of mathematical wizardry being required for computer-related work is debunked.

The Honeywell "Postgraduate Education Program" is one example of what a computer manufacturer can do toward helping to solve the people problem in the EDP industry. More effort from computer manufacturers is needed.

### Responsibilities of Computer Users

But computer users also have a duty to perform in this industry campaign. They must act now and with determination. "Buying" must give way to "producing". The employee merry-go-round must be stopped. EDP managers must discard the manpower philosophies discussed above and start applying good management techniques to their personnel problems.

Every opportunity must be taken to train existing employees. This will produce several values. It will guarantee a productive employee, whose knowledge will exceed the actual requirements of the job. It will provide a challenge, which may be the missing ingredient in an otherwise satisfactory position. It will insure continual flow of ideas which is the lifeblood of an effective computer operation.

### Professional Growth

Hand in hand with formal training should be a program designed to provide professional growth. Allow each staff member to represent your company to a professional society. Encourage him to use and contribute to your manufacturer's user group resources. Provide a library and applicable textbooks or at the very least, pay the cost for a periodical of his choice.

Develop career paths and goals for individual employees and assist each along the path towards meeting his particular objective. A useful step toward management responsibilities might be the assignment of a junior man for counseling and professional guidance. In any environment, an individual's self-esteem can be enhanced by having him teach his fellow employees in a subject in which he has an outstanding capability.

Look ahead to future personnel needs. Your present employees will do so, and if they sense inaction on your part, their resume will soon appear in the marketplace.

Be determined to have one or more trainees in your department at all times. Look inside your company for these people. Take the individual who may be going stale in his present occupation, yet exhibits aptitude for EDP. After a three-month coordinated training effort, you will often have an employee who is "turned on" by the challenge of EDP. Incidentally, he will display a degree of loyalty to you and your company unparalleled by the experienced fellow you may be tempted to "buy" from external sources.

### Greater Stability

These recommendations sound expensive, but they are aimed at establishing greater stability within your operation and within the overall industry. A reduction of a modest 25 percent in your employee procurement costs would provide sufficient funding to cover these recommendations.

Our industry is being challenged from within. Only through concerted effort by the manufacturer and user segments of the industry can the challenge be answered. Together, they must address themselves to the single imperative: "produce". ☐

# A SUGGESTED UNIVERSITY-LEVEL CURRICULUM FOR BUSINESS-COMPUTER SYSTEMS

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*"We must openly challenge the attitude that the kind of expertise needed by the business-computer systems analyst is an art that has developed only through extensive experience and on-the-job training by working analysts."*

Traditionally, business management has concentrated on automating those areas which had been well defined and systematized for manual handling. It has been only recently that management has begun to expand the use of computers into unique, sophisticated, and unstructured areas of business operation. The application of computers to these previously ill-defined areas has created a need for a particular type of computer professional.

### The Role of the Business Systems Analyst

He must be knowledgeable in the traditional business disciplines, systems and procedures techniques, and computer technology, for he will be responsible for analyzing the requirements of new areas of concern and formalizing new systems and procedures required by each application so that it can be efficiently and economically handled by a computer. This business-computer systems analyst, as he will be called here, is not now generally available. Prior to the new expansion in scope of computer application, the trend had been toward separation of the business systems analyst and the computer systems analyst. However, business management is now in need of individuals with expertise in both areas to provide the crucial link between the existing "traditional" business organization and the world of computer technology.

The prevalent attitude in industry today is that the kind of expertise needed by the business-computer systems analyst is an art that is developed only through extensive experience and on-the-job training by working analysts. This attitude has been subject to challenge for years but at this point in time, must be openly challenged!

**Mr. Guerrieri currently holds the position of Assistant Education Director with the Data Processing Management Association. In this position he is concerned with the methods of educating members of the Association and others in the latest tools and techniques of information processing and computer technology within a business framework. Mr. Guerrieri has previously held positions in the areas of programming, systems analysis and consulting with both manufacturers and users of computer equipment. He holds a B. A. in Mathematics from Northwestern University and an M.B.A. from Loyola University of Chicago. He was awarded the Certificate in Data Processing by DPMA in 1968.**

The traditional method of developing competent systems analysts, experience and on-the-job training, requires too much time to be able to meet the increasing demand for competent business-computer systems analysts. The only reasonable alternative available is to train these individuals in college and university programs. Unfortunately, industry has given too little attention and support to this alternative over the years. Very few educational programs of this type exist.

There has been little concern to date over the lack of an adequate university level curriculum in the business computer systems, for primarily two reasons:

1. Until recently, industry has been generally able to meet its requirements through internal training programs.
2. Industry, on the whole, does not believe that a formal educational program can adequately prepare an individual to perform the business-computer systems function.

It is generally recognized that the first point is no longer true. The demand for business-computer systems analysts is now significantly in excess of the available supply of prospects. As for the second point, I think an industry view point is growing that formal academic training in business-computer systems is not only possible, but will produce a competent and knowledgeable supply of analysts. On this basis the following suggestions for a university level curriculum in business-computer systems analysis and design are presented. The suggestions are made subject to the assumptions that the curriculum will be conducted under the quarter-system and will lead to a Bachelor's degree.

### A Five-Year Program

First, it should be noted that the suggested curriculum will span five years as opposed to the normal four years. This is the result of structuring this curriculum proposal as a cooperative program of study. In this type of program the first two years are devoted to full-time academic study. The last three years consist of alternating quarters of full-time study and full-time employment. In this way the student will gain one year of actual job experience in addition to his formal training. Although the tools and techniques of business-computer systems analysis and design are teachable in an academic surrounding, yet actual and valuable experience in a business environment develops the facility for applying the tools and techniques. Note, also, in Figure 1 that work assignments are suggested for each quarter of full-time employment, since competency is most easily developed in a logical, building-block manner consistent with accepted patterns in the business community.

This is a suggested curriculum in business-computer-systems analysis and design. Therefore the course work should include instruction in the traditional business disciplines, computer technology, systems analysis, and design techniques. It is expected the curriculum would provide the student with the ability to recognize the degree of applicability of computer technology in any given business situation.

### Introducing Computer Concepts

To accomplish this, the influence of computer technology should be felt in each of the required courses. In order to insure this, the student should become familiar with basic computer concepts as early as possible in the curriculum. The first course should cover basic computer concepts and, in addition, an introduction to programming through a high-level language, such as COBOL or PL/1. All succeeding business-computer-systems courses should attempt to contrast traditional methods with computer-oriented methods to give the student greater insight into both environments.

The first two years of study should attempt to give the student a working knowledge of the basic concepts and terminology of the various "established" or more traditional business disciplines. The entire business sequence should be given in the first two years, to insure that the student will enter his first quarter of employment with sufficient knowledge to be an asset to his employer in whatever area of the business he may be assigned. Also, since the first suggested work assignment calls for the first quarter of employment to be spent in a computer programming environment, it would be advisable to include, in the first two years, a course in assembly language programming and operating systems. Therefore, it is suggested that the following courses be considered mandatory in the first two years of academic study:

1. Basic Computer Concepts
2. Elementary Accounting
3. Cost Accounting
4. Economics
5. Financial Management
6. Production Management
7. Personnel Management
8. Marketing Management
9. Managerial Psychology
10. Business Law
11. Business Organization and Policies
12. Assembly-Language Programming and Operating Systems

It should be emphasized that the recommended business sequence has not been designed to make the student proficient in any one area, but to give him an understanding of the concepts and the vocabulary of the entire business organization.

**Figure 1**

**Suggested Sequence of Courses for a Curriculum in Business-Computer Systems Analysis and Design (Required Courses Only)**

<u>Quarter 1</u>
- Basic Computer Concepts
- Elementary Accounting

<u>Quarter 2</u>
- Cost Accounting
- Economics

<u>Quarter 3</u>
- Financial Management
- Production Management

<u>Quarter 4</u>
- Personnel Management
- Marketing Management

<u>Quarter 5</u>
- Managerial Psychology
- Business Law

<u>Quarter 6</u>
- Business Organization and Policies
- Assembly Language Programming and Operating Systems

<u>Employment Assignment</u> — Computer programming environment

<u>Quarter 7</u>

Introduction to Systems Organization and Management
- a. Needs, objectives, and goals of the systems function
- b. MIS
- c. The Feasibility study
- d. Organization and Staffing of a Study Team
- e. Tools and Techniques of Systems Analysis and Design

Techniques of Information Gathering
- a. Preliminary Survey
- b. Sources of Needed Information
- c. Sequence of Interviewing
- d. Effective Interviewing Techniques
- e. Types of Questionnaires
- f. Organization of the Information Gathering Function

<u>Employment Assignment</u> - Member of study team engaged in the information gathering phase of a study.

<u>Quarter 8</u>

Techniques of Information Recording
- a. Methods of Charting
- b. Preparation of Job Breakdowns and Correlations
- c. Preparation of Activity and Task lists.

Techniques of Information Analysis
- a. Reducing, Combining, and Evaluating of Data
- b. Methods of Resolving Conflict of Data
- c. Preparation of Manual of Procedure

<u>Employment Assignment</u> - Member of study team engaged in the information analysis phase of a study.

<u>Quarter 9</u>

Standards and Documentation Techniques
- a. Representation of Raw Information
- b. Documentation of Analysis Methodology
- c. Presentation of Conclusions
- d. Documentation of Bases for Conclusions

Systems Design I
- a. Clerical Systems - Forms Design and Control
- b. Computer File Organization and Design
- c. MIS Data Base

Employment Assignment — Member of design team engaged in file organization and design.

Quarter 10

Systems Design II
- a. Methods and Techniques of Computer Procedure Design
- b. Comparisons of Manual and Automated Procedures
- c. Economy and Efficiency as criteria

Operations Research I
- a. Probability and Statistics
- b. Mathematical Models
- c. Queuing Theory
- d. Decision Theory
- e. Game Theory
- f. Sampling methods
- g. Mathematical Programming
- h. Simulation

Employment Assignment — Member of design team engaged in procedures phase of design project.

Quarter 11

Preparation and Presentation of Project Reports
- a. Content of Reports
- b. Exhibits to be Included
- c. Form of Reports
- d. Methods of Presentation
- e. Visual-aids

Operations Research II
- a. Mathematical Programming Development
- b. Simulation Developments
- c. Survey of other New Developments
- d. Discussion of Future of OR

Employment Assignment — Member of team engaged in preparation and presentation of project report

Quarter 12

Project Implementation and Follow-up, Management Audits
- a. Preparation for Implementation
- b. Implementing the system
- c. Evaluation of system after Implementation
- d. Audits

Management of Systems Personnel
- a. Selection and Training of Personnel
- b. Managing the Personnel

### Systems and Management Science Courses

The coursework in the three remaining years of the curriculum should be devoted to the techniques of systems analysis and design, and to developments in the field of management science. In this way, the student should be able to relate his new knowledge to his understanding of the business world. Systems and management science courses should be logically sequenced so that each succeeding quarter of study builds on the previous quarter; and fosters the orderly development of the student's ability to do systems work, as practiced in a business environment, in succeeding quarters of employment. Therefore, courses in this area will be discussed in the sequence believed to be most beneficial to the student's ultimate development as a business-computer-systems analyst. There are twelve courses in the suggested systems and management science (SMS) sequence.

The SMS sequence should begin with a general introduction to systems organization and management. This course should cover the basic framework of the systems function. It should cover topics such as: the needs, objectives, and goals of the systems function; Management Information Systems; Feasibility studies; organization and staffing of a systems study; and, the basic tools and techniques of systems analysis and design. This course should be considered a foundation course and should be a prerequisite for all others in the SMS sequence.

Next in the sequence should be a course on the techniques of problem identification and information gathering. Though often neglected, these are highly important subjects; the results of the system study depend wholly on the quality of the information available for evaluation. Topics in this course should include: problem definition; conducting a preliminary survey; determining sources of needed information; the sequence in which various levels of personnel should be interviewed; conducting an effective interview; types and use of questionnaires—their advantages and disadvantages; and organization of the information gathering function. The background acquired in this course should be reinforced by a subsequent quarter of employment in which the student is assigned to a study team engaged in the information gathering phase of a study.

### Recording and Organizing Information

The next course in the SMS sequence should concentrate on various methods of recording and organizing information. The topics covered should include: process charts, operations charts, man-machine charts, flow charts and distribution charts; preparation of job breakdowns and correlations; and preparation of activity and task lists. It is important to record information in a meaningful fashion so that it will be available for later steps in the study.

In conjunction with the course on recording of information there should be a course on Techniques of Information Analysis. This course should cover, in detail, the methods of reducing, combining, and evaluating raw data for a Manual of Procedure which applies to the operation under analysis. Methods of resolving conflicts in the information gathered during the study should be especially stressed. The Manual of Procedure should be discussed as to form and content; and, it should be observed that it is the end document of the analysis function. The next employment assignment should give the student an opportunity to exercise the techniques of information analysis.

The next course in the SMS sequence should concentrate on the standards that should be maintained in a systems study and the types and detail of the documentation to be prepared. This course is important to insure that a system study has been subject to a minimum of personal distortion and that the results are able to be interpreted by management. Topics to be covered should include: representation of the raw information; documentation of the analysis methodology; presentation of conclusions; and documentation of the bases for the conclusions. This course should stress that all systems studies for a given organization should be conducted within the same general framework to insure consistency and uniformity.

### Systems Design

In the same quarter the student should be exposed to the first course in systems design. This course should begin with a brief discussion of the design of clerical systems and then move into the area of computer systems design. This first course should concentrate heavily on file organization and design. The data base concept for management information systems should also be considered. The student should be given an opportunity to participate in the area of file design and organization during his next employment assignment.

A continuation of systems design should be the subject of the next course. In this course the student should be presented with methods and techniques of designing various business procedures to take maximum advantage of computer characteristics. Comparisons of manual and automated procedures should be presented to illustrate the differences involved. It should be stressed that the systems design selected should be the most economic and efficient one consistent with the objectives of the organization.

### Operations Research

In this quarter, the student should have his first introduction to the field of management science through an introductory course in Operations Reserach. The major topics of Operations Reserach (for example, queuing theory, mathematical models) should be presented in such a way that the student will realize the more mathematical orientation of modern management. The student should work on a detailed systems design project, preferably with OR overtones, during the next work assignment.

A course on project report preparation and presentation should be included in the next quarter of study. The topics included might be: content and length of the report; exhibits that should be included in the report; form of reports; methods of presentation; and types of visual-aids available. This course is extremely important, because the presentation of the results of a systems investigation is often what determines whether a project will be accepted or rejected by management.

A more advanced course in Operations Research should be presented in the next quarter. In this course new developments and future developments in the operations research field should be surveyed to give the student some insight into the future of his field. It is suggested that topics be kept in the general concept stage only. Following this quarter, the student should receive a work assignment involving the preparation and presentation of a project report.

The final quarter of study should include a course covering, in general terms, project implementation, project follow-up, and management audits. This course should include topics such as: preparation for implementation; implementing the system; evaluation of the system after implementation; and, methods of periodically auditing the system to determine its effectiveness.

### Personnel

The last course in the SMS series should be a course on the Management of Systems Personnel, with emphasis on how management techniques vary with the individual being managed. However, the course should attempt to present a general picture of systems personnel, how they might react to various situations, and their typical motivations. This course should be designed to acquaint the student with the type of environment he will be entering.

The preceding discussion has attempted to present one view of what the potential business-computer-systems analyst should receive in the way of formal education and training. It is hoped that the views presented will serve to provoke additional thought and consideration with respect to a formal curriculum in business-computer systems. ☐

# Honeywell Keytape* can feed a computer a thousand miles away.

It phones data directly to the computer site.

From magnetic tape to magnetic tape.

So you can link all your branch offices to one computer in the home office.

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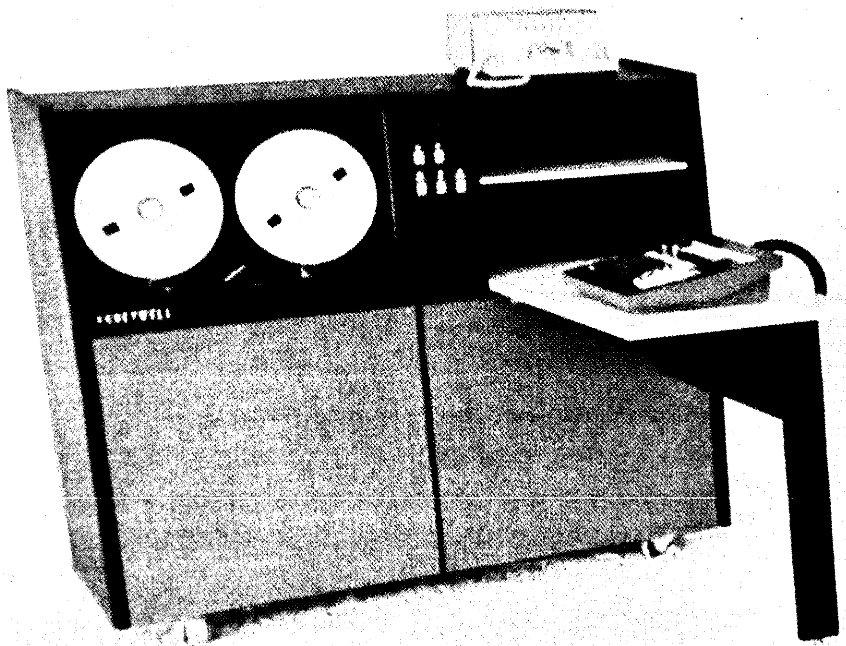

# INTERNAL RECRUITMENT AND TRAINING OF DATA PROCESSING PERSONNEL

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*"Companies with large data processing departments must consider imaginative solutions to their data processing personnel needs."*

Mr. Davis is president of Electronic Computer Programming Institute. He has been a pioneer in the application of data processing to business needs for over 20 years.

In 1956, aware of the growing shortage of trained programmers, he co-founded ECPI, which has since grown to be one of the largest computer school networks in the country.

It is surprising in today's personnel-hungry market that so many companies seem to ignore an available and potentially fruitful manpower pool from which to fill their data processing department vacancies–their present administrative and clerical personnel.

These people know the company's operations, have proven employment histories, have evidenced a degree of loyalty, but lack one thing–data processing and computer programming knowledge and training, a factor that can be remedied.

If these people have the aptitude, and this can be determined by testing, they may, with proper education and training, be upgraded to data processing personnel. This is not theory. This has been done successfully at a number of far-sighted companies.

Widespread training and upgrading and transferring of personnel from other departments into DP will probably become more frequent in the next few years.

### Available Manpower

All available information indicates that the gap between trained computer data processing personnel and job openings will continue to widen for at least the next few years.

The widening gap between personnel needs and available manpower is basic to the rapid pace of computer installations. Computer production and installation is simply outstripping DP personnel training.

Where are these people going to come from? Present training falls far short of the constantly expanding need. Just consider promoting 30,000 experienced programmers to fill the demand for analysts and managers.

Obviously, companies with large DP departments must consider imaginative solutions to their data processing personnel needs.

## Advantages of Internal Recruitment

One answer is an internal recruitment and training program. There are several factors in its favor:

1. Retraining in computer programming usually means upgrading and promotion from within—a policy that builds employee morale and helps attract new employees.

2. Recruiting and training from among present company personnel also can be an effective method of reversing the high rate of turnover that is common in many DP departments.

As pointed out earlier, by promoting people with several years experience in the company, DP employees are selected who have demonstrated a tendency to stay with the company—they evidence loyalty and have seniority.

3. If the company has a pension or retirement plan, or a profit-sharing program, the employee with several years' experience would hesitate to leave for a small or moderate increase in salary and risk loss of other benefits.

4. Training these people can be done in the evening, during non-working hours through a recognized responsible programming training school. Thus, the employees would remain productive in their present positions, and could be transferred into entry-level DP positions at the appropriate time in their training.

## Turnover

As any DP department manager knows, keeping trained personnel is as difficult as finding them. Turnover continues at a frightening rate. The pressure of supply and demand tends to cause salaries to rise rapidly after only a year's experience—and usually at a faster pace than in other areas in the company. The allure of higher salaries elsewhere—combined with the possibility of working with highly advanced and more sophisticated machines and applications—are principal reasons for high turnover of DP personnel. The influence of these factors can be lessened by training and promotion from within.

There has been, traditionally, one other brake applied to the attraction of computer programmers, the demand for a college degree. Happily, this arbitrary requirement is no longer as widespread, and we find more and more non-college graduates being hired for business applications programming.

The non-college graduate can do the job. For over a dozen years, high school graduates have been trained in computer programming, and successfully placed in thousands of companies across the nation.

## Qualifications

What are the general qualifications that a programmer must have? It is generally accepted that the ingredients necessary for programming are aptitude and motivation.

Computer programming does not require a heavy background in advanced mathematics. Rather, it calls for an orderly, logical mind that can analyze business information and instruct the computer to process it. It requires a grasp of basic numbers, of arithmetic, and an aptitude for working with these figures.

Aptitude tests to be used for screening company personnel are available from several sources. Electronic Computer Programming Institute (ECPI), for example, has administered such tests to company personnel, and has assisted in screening potential programmers for computer training.



It is interesting to note that many DP departments recruited their programming staffs from within the organization when computers were first being introduced. A principal yardstick used to measure an employee's potential was his past history and record with the company.

"Had he performed well? Yes! Does he have the aptitude? Let's test him and find out! Let's send him to programming school and see how he performs." And the system worked.

Yet, these same companies, when replacements or expansion required them to hire additional programmers, sought men with past experience and often with college degrees. They forgot or ignored, their earlier successful recruitment techniques.

## Getting the Job Done

The existence of functioning, qualified computer training schools means that companies interested in recruiting and training data processing personnel from their present employee group, need not set up self-administered screening, training and computer education programs . . . with the operational and manpower investment it would entail.

The entire training program could be accomplished with the cooperation of any one of a number of outside organizations. ☐

# A PERSONNEL DIRECTOR EXAMINES THE NEED FOR EDP PERSONNEL SYSTEMS

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*"Because people are the product, the essence of personnel reporting does not lie in regular reports; it lies in the ability to respond to different requisitions as the need arises."*

The computer is rapidly becoming an invaluable tool in the efficient and rapid control of a company's most important assets—its people. An industry-wide move toward computerized personnel data systems has put the personnel manager in the spotlight of corporate activity.

### Changing Role of the Personnel Manager

Years ago, personnel managers took a rather pragmatic approach to their duties. It was sufficient in order to meet manpower requirements to toss a few names around or dig into stacks of personnel files searching for pertinent information.

Nowadays, the functional and geographical diversity of many companies, coupled with the often desperate hunt for talent in a world where the skilled labor force has lagged behind business's demands, have pushed the personnel manager into the role of decision-maker. The decisions that personnel managers must now make can often affect the organization as a whole. To make these decisions, he must have available a large, consistent and up-to-date personnel data base. Yesterday's methods of personnel management have become impractical, and in some cases, unfeasible.

### College Recruitment

One area of personnel management is college recruitment. When a company is out on the campus making a lot of promises to members of the graduating class, it becomes paramount for that company to have a system that will allow it to keep those promises. As the rate of hiring increases, faster and more effective means of keeping track of the young people coming into the organization must be developed.

### Overseas Personnel

Overseas personnel are a real concern. Mobile individuals within a company are often the fastest growing; to make sure that a man in the Far East has a chance at a management job in Europe, a personnel system must be able to integrate information on all individuals into a single, reliable central source.

The labor force in our presentday world is continually changing. Longer schooling and improved pension schemes have put business in the unenviable position of having a smaller block of the population from which to draw manpower. Experts have predicted that by 1972, business demands for management talent in the United States will exceed supply by 14 percent. This shortage in current and future manpower can have a marked adverse effect on companies with definite growth potential. A personnel management system is needed that will insure the maximum development of current organizational manpower, as well as provide a base for the development of future employees.

How can a computerized personnel data system help solve these problems? Let us look at the basic principles underlying such a system. Although it is difficult to generalize, for each system is unique to the company it serves, the principles apply to almost all companies.

### Establishing a Data Base

The first principle is to establish a data base that incorporates each piece of personnel information you should know about your employees. This means identifying all personnel data meaningful to an organization and excluding data that can cause costly duplication. The process is more than a simple matter of transferring information from the old records onto punch cards.

Now that a company has electronic processing at its fingertips, consideration should be given to profiles never before possible. At CPC International, with over 41,000 employees throughout the world, our personnel data system calls for input of two unusual items: management experience; and employee preference in work assignments. Not only do we know what our people are capable of doing, but we also know what they want to do. This has helped us convince our employees that the company at last has a technique to effectively watch over them and their futures.

Once pertinent data has been thus determined, it must then be incorporated into a single, reliable file of personnel information, to eliminate redundancies of multiple handling and storage. This implies the firm establishment of responsibility for the accuracy and the currency of data.

### Updating

To the personnel manager, this is his control of the man in the Far East. Accurate and timely reports on the activities, salary record, benefits participation, education and training, and development of every individual in the

Leroy F. Reiser joined CPC International in May 1947 as a trainee in the junior engineering program at that company's Argo, Illinois plant. In 1956 he was named Assistant Personnel Manager at Argo, a post he held until 1960, when he was transferred to CPC's New York headquarters. In February of 1967 he was named Director of Corporate Personnel and Industrial Relations, with responsibilities involving CPC International's 41,600 employees throughout the world.

Mr. Reiser is a member of the New York Personnel Management Association, the American Management Association, the National Association of Manufacturers, the National Industrial Conference Board, and the Naval Institute.

C.a IDEAS: SPOTLIGHT

# A Laboratory in a Computer

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**(Based on a report in the "New Scientist", published by IPC Magazines Ltd., 128 Long Acre, London, WC2, England, March 13, 1969)**

To recognize the scope for the computer as a form of laboratory we must first remember that laboratories are, obviously, to do experiments in. Properly planned experiments call for exact control of the environment so that only the few parameters being measured can vary, and then only when and how we wish. Such control may demand the conditions of a laboratory. In biological experiments, for instance, elaborate steps are taken to discount the effects of uncontrollable variations in environment or experimental subjects. In a computer what happens is entirely determined by the program and all happenings can, in principle, be recorded automatically. Thus any experiment replicated by the execution of a program is under complete control; only those parameters we choose may vary. Furthermore, the results may be worked out and recorded automatically, which can save a great deal of work and time.

It might be imagined that because a computer only does what it is told to do there is no point in using it as a laboratory. This would be true if the outcome of any prescribable computation or logical procedure could be foreseen. But of course we cannot do this even in everyday life. The processes which can now be prescribed in advance for a computer to follow through with all the variations and changes resulting from decision criteria in the program are in practice quite unpredictable, often even in outline. Needless to say, if they were the computer would not be the powerful tool that it is.

How then can a computer really be used as a laboratory? In practice by creating some model, some working hypothesis about the nature of the physical world, and having the computer work out the consequences. The closer the model is to reality and the more exact and detailed the information that can be fed in, the more likely is it that the results will conform to observation. Exactly the same criteria that apply to results of ordinary experiments must apply to those of computed experiments. If the results do not fit the observed facts so much the worse for the model. □

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entire organizational structure can be kept under continual scrutiny. Valuable manpower will never be left waiting on the ladder.

With identification and storage of information decided, all data must be integrated into a useful composite record with provisions made for simplified methods of updating. This is especially important in companies with a steady growth in numbers of employees, departments and facilities. When decisions on employees are made, the data available must be current, to insure that these decisions are based on the best possible information.

The most important principle is the establishment of a retrieval system that will allow complete accessibility to the information record. Identification, storage, and maintenance are useless if the data cannot be rapidly and efficiently retrieved. In other words, a system must be able to translate any and all "report" requirements into reliable "search" instructions. Because people are the product, the essence of personnel reporting does not lie in regular reports; it lies in the ability to respond to different requisitions as the need arises.

### Morale

Finally, and this principle is the basis for a company's use of the personnel data system, an approach must be adopted that will convince employees that the organization's personnel policies are being consistently applied. The company must prove by action that "it cares." When the employee knows that the company has the ability to place the right man in the right job at the right times, the important factor of morale zooms.

I think it is now clear that a successful computerized personnel data system is the hub of manpower development in business today. It provides an excellent tool for companies wanting to broaden the individual responsibility of the capable people coming from college campuses. This takes on an aura of being "vital", especially as the use of electronic data processing and other equipment within a company shrinks the organizational structure from top to bottom.

Of course, the more efficient a company's personnel management function becomes, the more apparent become the direct cost savings from reduction of paperwork and the manual handling and storage of employee information. This is the road most companies start down—to do a better job with fewer people.

### Computer Service Centers

But most personnel managers are not computer experts. There are many pitfalls between a feasibility study and a completely operational system. Many companies simply do not have the personnel to spare or the know-how to cope with technical roadblocks they may encounter. To serve the personnel manager, specialized companies have been formed that offer their services in the complete design, development, installation and operation of a computerized personnel data system.

These companies have become as essential as the systems themselves. One of the pioneers in the field is Information Science Incorporated of New York City, New York, which supplied a system for CPC International.

Small organizations can reap the rewards of an electronic personnel system as effectively as large organizations. In fact, many larger companies have time-sharing programs that allow for multi-company input to their computers. This provides the smaller firm with a convenient, adequate, and totally independent system of computerized personnel data control, at substantial monetary savings.

Continued manpower development within businesses today cannot be overestimated. These are times when companies cannot rest with "stepping into the future", but must often hurtle into it, and this "discontinuous change" needs control. To the personnel manager, the computerized personnel data system is the key to this control both now and in the future. □

# COMPUTERS IN USE, ANALYZED BY STANDARD


*Ed Burnett, President*
*Ed Burnett Inc.*
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*New York, N.Y.*


The vast proliferation and penetration of computers into the fabric of modern life marks the true beginning of a second industrial revolution. Knowledge, provided by this revolution, not electrical and mechanical power as provided by the first industrial revolution, is nowadays the true measure of effective force for the future.

An analysis of computers in use is reported in this article. The data were derived from a mailing list including over 20,000 records of computer installations; the list belongs to ***Computers and Automation*** and is maintained by Ed Burnett Inc. This list is now on magnetic tape and the SIC (Standard Industrial Classification) numbers have now been determined and entered for over 95% of the records.

### The Major Thrust

From a penetration point of view, the major thrust of computers has been into manufacturing, services, and finance. Over 80% of all computers are found in these three classifications.

One third of all computers are found in manufacturing. When the penetration ratio (number of computers per X employers in the given universe) is arrayed in descending order (see table IV) virtually every classification of 1 in 10 or higher is in manufacturing.

It is perhaps worthy of note that 2 out of every 3 computers installed are in some non-manufacturing entity . . . a ratio possibly higher than might have first been imagined.

About half of the computers in use in manufacturing are in metalworking plants or companies. This is somewhat higher than the proportion (35%) that metalworking is to all manufacturers. Of those SIC's with penetration of 1 in 10 or better, metalworking is again just about 50%. There is fair indication here that computers are affecting every form of manufacturing. But there are some laggards — as might be expected.

Arraying the Penetration Ratios by 2-digit SIC in manufacturing (see table V) the penetration drops from a high of 1 in 6 (in Ordnance and Petroleum) to 1 in 200 or 300 in Furniture and Wood Production.

If computers are destined to double, as seems rational, by 1972 and double again by 1980, it is likely the average in manufacturing will move from 1 in 40 to 1 in 20 and then to 1 in 10. By that time, every other firm in the higher penetration quartile (about 1 in 2 plants in manufacturing now have ***10 or less*** employees) can be expected to have its own computer . . . in house.

### Social Services

The tremendous social impact of computers is clearly evident from the data. Better than one in five computers in use is now to be found in one of the social services.

The actual number of computers in use in social services (SIC 8000-9300) is greater than the total number found in finance . . . and is, remarkably enough, two thirds as many as all of those found in manufacturing.

Of the total for social services, almost one half are found in governmental services (SIC 9100-9300) . . . and the majority of these (1203 of 1910) are locations in the federal government. (It should be noted that this study deals with locations of computers, not computers per se. In the federal government the proliferation of computers per location (about 4 to each address) exceeds the ratio in private business.) It is significant that of the 1203 locations in the federal government, 830, or over two-thirds, are for the exclusive use of the armed services. This ratio happens to be an absolute, coming as it does from a published government inventory of computers entitled "Inventory of Automatic Data Processing Equipment in the Federal Government."

The high figure for education is inflated by the thorough data available on college computer operations. The number of computers found in colleges and education in general is equal to all governmental installations, including the Armed Forces.

Hospitals and Associations and to some extent social service organizations (primarily, it might be inferred, to control recency, frequency, and dollars of donations) are the chief other social service functions so far penetrated. Church groups, labor, medical services other than hospitals, show little penetration, so far.

If some 300,000 trained minds are now working on, with, and for computers, some 65,000 are now likely to be working in some form of social service (non-profit) applications. It is possible, in fact even likely, that this important minority will produce greater changes in the coming years than all the 240,000 or so computer specialists working in the profit sector of our economy.

Overall, these data indicate computers have invaded about 1 in 100 establishments in the United States. Over the next few years this penetration will probably move to 1 in 50, and then 1 in 25.

# INDUSTRIAL CLASSIFICATION

*"The tremendous social impact of computers is clearly evident from the data. The actual number of computers in use in social services is greater than the total number found in finance, and is, remarkably enough, two-thirds as many as all of those found in manufacturing."*

It is likely, at least for the short term, that increased penetration will parallel that which we find in 1968. (The incidence of computers in the federal government and colleges and computer services will not show as much growth as the rest of employers mainly because we start with a thorough record of their present penetration.)

A quite thorough 1968 enumeration of all listings of Computer and Data Processing Services in every classified phone directory for every city of 10,000 or above in the United States (sorted out by phone number to eliminate duplication) disclose some 7,000 firms offering computer based schooling, services, computer letters, tabulating, programming, analysis, systems, computer and peripheral equipment rental, sales and service. (As late as 1965, a similar enumeration disclosed no more than 1,000.)

From an SIC standpoint such services are mainly pigeon-holed in code 7399, "Business Services Not Elsewhere Classified." Dun and Bradstreet, in its large credit reporting service, lists just 9,000 in this SIC. A fair guess of the universe is 50,000. Were it not for the burying of computer services in this classification, a penetration like unto other business services (1 per 2,000 or less) could safely be predicted. It is evident, thus, that the penetration of 1/25 in business services really conceals a penetration of about 1/4 in the computer services portion of 7399.

### The Financial Field

Approximately 1 in 7 computers in use is found in the financial field.

Penetration here is somewhat deceptive. Insurance, overall, shows up as 1/80 – but when home offices of insurance companies are divorced from the insurance world (adjusters, agents, agencies, brokers, special agents, branch offices, general agents) it is seen that the penetration in this small segment of just 1,800 companies is extremely high.

When banking is combined to include commercial banks, savings and loan institutions, and branch operations, there are some 35,000 establishments in this business universe to consider. On this basis, banking shows a 1 for 25 penetration.

If the number of computers found in banking in this study (1,200) is projected against the 14,000 home offices of commercial banks (which is where virtually all can be found), the penetration ratio drops to 1 in 10. And, in the same 5,000 banks rated $500,000 and over in net worth, this ratio already approaches 1 in 4 or 5. (Since financial institutions are less likely than most business entities to seek publicity, the penetration here is probably somewhat understated.)

The overall penetration of the offices of stockbrokers is about equal to that shown for all banks. It is probable, if the some 1,100 broker members of the New York and American Exchanges were segregated out, the penetration would, as in major banks, approach 1 in 4 or 5.

For loan and credit offices, where branch operations outweigh home offices by some 4 or 5 to 1, the penetration shown (1/100) is obviously nearer 1 in 25 when home offices only are checked. And if most, which is likely, are in the 500 or so firms in this field with some 15,000 branches, then the penetration ratio approaches 1 in 2 or 3.

The proliferation of small entities in real estate is emphasized by the extremely low (1 in 1,500) penetration by computers in this field. Interestingly enough, insurance agencies, which are often equated with real estate so far as size and market for business services are concerned, show far greater penetration.

In retailing (4% of computers), only department stores show greater penetration than business as a whole. Large department stores, those rated $20,000 and over, show a penetration of 1 in 6. While department stores are roughly 1% of all rated and/or listed retail, they account for 30% of those computers found in retailing. This might be considered surprisingly high until it is recalled that all chain operators in the country with 3 or more outlets do not total over 10,000 – and it is likely a goodly proportion of that other 70% of computers in retailing will be found in chain operations.

Wholesale Trade (6% of computers) shows a penetration ratio approximately 10 times as great as retail, and about one fifth as great as manufacturing. Only drugs, chemicals and allied wholesalers with 1 in 80, and electrical goods wholesalers (1 in 100) are equal to or higher than business penetration as a whole. The range of penetration, which might have been anticipated, is much smaller for various classes of wholesaling than for other business segments – spreading from 1/80 to 1/400 (a range of some 5 to 1). Manufacturing, for example, utilizing 2-digit SIC's, shows a range of 50 to 1 (from 1 in 6 to 1 in 300). Higher ranges can be found in retail, finance, services. It is instructive to note that the pressure of the workload, not the kind of wholesaler is the key to penetration. As manufacturers and software producers bring to bear computerized thinking into the handling, picking, stocking, storing, shipping and recording of wholesale inventories, the infiltration of computers is likely to increase even more rapidly than in some of the other easier-to-penetrate business classifications.

## The "Industrial Complex"

Some business analysts expand manufacturing into what they term an "industrial complex" ranging in SIC terms from Mining through Contracting, Manufacturing and Transportation, Communication and Utilities.

From the point of view of computer penetration, there is something to be said for this grouping.

Transportation, Communications, and Utilities (SIC 4000-4999) with 6% of computers, shows a 1 in 80 penetration — or about 1/2 of manufacturing.

Mining (1% of computers) is next in line with a ratio of 1 to 100.

The theory breaks down, however, when one turns to Contracting (1/2 of 1% of computers) — where the penetration ratio is only one in 2,500. There are as many Research Laboratories (96) and Management Consultants (80) and Engineering and Architectural Firms (76) with computers as all Contracting Firms (98) with computers.

Breaking down the major business classification, "Transportation, Communication, and Utilities", into its three major components provides the following penetration ratios:

| Classifications | Computers | Universe | Penetration |
|---|---|---|---|
| Total | 1,172 | 90,000 | 1/80 |
| Transportation | 583 | 75,000 | 1/100 |
| Communication | 294 | 9,000 | 1/30 |
| Utilities | 295 | 6,000 | 1/20 |

However, transportation includes "local transportation" (40% of the transportation universe) where the penetration is something like 1 in 1,500. Other transportation is much higher — the range being as follows:

| Classification | Quantity | Universe | Penetration |
|---|---|---|---|
| Railroads | 128 | 1,000 | 1/8 |
| Air Transportation | 114 | 1,200 | 1/10 |
| Pipeline Transportation | 10 | 180 | 1/20 |
| Transportation, Misc. | 42 | 1,300 | 1/30 |
| Water Transportation | 37 | 2,200 | 1/60 |
| Storage | 49 | 6,000 | 1/100 |
| Over-the-road Trucking | 148 | 15,000 | 1/100 |
| Bus Transportation | 36 | 10,000 | 1/300 |
| Local Trucking | 20 | 30,000 | 1/1,000 |

Only one classification of contractors (Heavy Duty Construction — SIC 1621) shows any appreciable penetration — and even here, the ratio is one computer for every 200 entities. This does compare most favorably, however, with Plumbing, Heating, and Air Conditioning where 1 computer per 10,000 firms has been reported. For General Contractors, less than 1 computer per 1,000 firms shows up.

Penetration of extractive industries (Mining, including Petroleum) shows a rather narrow range from 1 in 40 to 1 in 200. In line with the extremely high penetration shown in Petroleum Manufacturing, the highest penetration here is found in Crude Petroleum operations.

The ninth and last major classification is "Agriculture, Forestry, and Fisheries" (SIC codes 01 through 09). This classification represents about 1/4 of 1% of computers located . . . and computer penetration as yet is very modest.

TABLE I

PERCENTAGE OF COMPUTER INSTALLATIONS BY MAJOR SIC CLASSIFICATIONS WITH PENETRATION RATIOS

| SIC | Classification | Computer Count | (% of U. S. Total) | Universe (all rating) | Penetration of Universe | Firms Rated $20,000 Net Worth | Penetration Of Upper Net Worth Group |
|---|---|---|---|---|---|---|---|
| All | U. S. Total | 19,357 | (100.00) | 3,600,000 | 1/200 | 855,000 | 1/40 |
| 01-09 | Agriculture, Forestry, & Fisheries | 56 | (.29) | 21,000 | 1/400 | 11,200 | 1/200 |
| 10-14 | Mining Industries | 170 | (.88) | 17,000 | 1/100 | 9,000 | 1/50 |
| 1511-1799 | Contracting | 98 | (.51) | 250,000 | 1/2,500 | 63,000 | 1/700 |
| 19-3999 | Manufacturing Industries | 6,498 | (33.56) | 246,000 | 1/40 | 125,000 | 1/20 |
| 19 | Ordnance | 32 | (.165) | 180 | 1/6 | 50 | 1/2 |
| 20 | Food | 639 | (3.30) | 25,000 | 1/40 | 15,100 | 1/20 |
| 21 | Tobacco | 35 | (.180) | 350 | 1/10 | 100 | 1/3 |
| 22 | Textile Mill Products | 201 | (1.03) | 6,500 | 1/30 | 4,400 | 1/20 |
| 23 | Apparel | 249 | (1.28) | 16,700 | 1/70 | 8,300 | 1/30 |
| 24 | Lumber & Wood Products | 64 | (.330) | 16,700 | 1/300 | 8,100 | 1/100 |
| 25 | Furniture & Fixtures | 68 | (.351) | 11,400 | 1/200 | 4,400 | 1/60 |
| 26 | Paper & Allied | 187 | (.966) | 5,800 | 1/30 | 4,300 | 1/25 |
| 27 | Printing & Publishing | 521 | (2.69) | 32,400 | 1/60 | 12,000 | 1/20 |
| 28 | Chemical & Allied | 524 | (2.70) | 12,800 | 1/25 | 8,900 | 1/15 |
| 29 | Petroleum Refining & Allied | 227 | (1.17) | 1,900 | 1/6 | 1,000 | 1/4 |
| 30 | Rubber & Plastics | 141 | (.728) | 4,300 | 1/30 | 2,400 | 1/20 |
| 31 | Leather & Leather Products | 72 | (.372) | 3,700 | 1/50 | 1,000 | 1/15 |
| 32 | Stone, Clay, and Glass | 144 | (.744) | 12,900 | 1/100 | 6,800 | 1/50 |
| 33 | Primary Metal Industries | 354 | (1.83) | 6,500 | 1/20 | 4,800 | 1/10 |
| 34 | Fabricated Metal Industry | 301 | (1.55) | 22,700 | 1/80 | 11,100 | 1/40 |
| 35 | Machinery Except Electrical | 977 | (5.05) | 32,900 | 1/30 | 17,100 | 1/20 |
| 36 | Machinery, Electrical | 948 | (4.90) | 8,900 | 1/10 | 6,800 | 1/5 |
| 37 | Transportation Equipment | 432 | (2.23) | 5,900 | 1/10 | 4,800 | 1/10 |
| 38 | Prof. & Scien. & Control Instru. | 244 | (1.26) | 4,800 | 1/20 | 2,400 | 1/10 |
| 39 | Misc. Manufacturing Industries | 138 | (.713) | 13,800 | 1/100 | 4,900 | 1/30 |
| 40-49 | Transportation, Comm. & Utilities | 1,172 | (6.05) | 90,000 | 1/80 | 26,600 | 1/20 |
| 50 | Wholesale Trade | 1,232 | (6.36) | 230,000 | 1/200 | 100,000 | 1/100 |
| 52-59 | Retailers | 792 | (4.09) | 1,300,000 | 1/2000 | 328,000 | 1/400 |
| 60-65 | Finance | 2,967 | (15.33) | 300,000 | 1/100 | 100,000 | 1/30 |
| 70-79 | Services, Business (non-computer) | 398 | (2.05) | 250,000 | 1/600 | | |
| 7399 | Services, Business (computer, mainly) | 1,768 | (9.11) | 7,000 | 1/4 | 56,000 | 1/150 |
| 80-93 | Services, Social | 4,206 | (21.77) | 430,000 | 1/100 | NA | |
| 82 | Services, Educational | 1,830 | (9.53) | 110,000 | | | |
| 91-93 | Services, Governmental | 1,910 | (9.84) | 40,000 | | | |
| - | Services, Other | 466 | (2.40) | 280,000 | | | |

NA = Not Available

TABLE II

PERCENTAGE OF COMPUTERS BY MAJOR CLASSIFICATIONS
ARRAYED IN DESCENDING ORDER (WITH PENETRATION RATIOS)

| | Percent | No. | Penetration | |
|---|---|---|---|---|
| | 100.00 | 19,357 | Universe | Rated $20,000 net worth + |
| Manufacturing | 33.56 | 6,498 | 1/40 | 1/20 |
| Services | 32.93 | 6,372 | 1/100 | |
| Social | 21.77 | 4,206 | 1/100 | NA |
| Business (non-computer) | 2.05 | 398 | 1/60 | 1/25 |
| Business (computer) | 9.11 | 1,768 | | |
| Finance | 15.33 | 2,967 | 1/100 | 1/30 |
| Wholesale | 6.36 | 1,232 | 1/200 | 1/100 |
| Transportation, Communication & Utilities | 6.05 | 1,172 | 1/40 | 1/20 |
| Retail | 4.09 | 792 | 1/2,000 | 1/400 |
| Mining | .88 | 170 | 1/100 | 1/50 |
| Contracting | .51 | 98 | 1/2,500 | 1/700 |
| Agriculture, Forestry & Fisheries | .29 | 56 | 1/400 | 1/200 |

NA = Not Available

TABLE III

PENETRATION RATIOS IN MAJOR CLASSIFICATIONS
(1 Computer Per X in Universe)
ARRAYED IN DESCENDING ORDER

Of the 10 major classes of employers reported here, the penetration ratio (of the universe) runs from 1/40 to 1/2,500 ... as follows:

| | Penetration of Universe | Penetration of Upper Net Worth Group ($20,000 and over) |
|---|---|---|
| Manufacturing | 1/40 | 1/20 |
| Transportation, Communica- tions & Utilites | 1/40 | 1/20 |
| Services - Business | 1/100 | 1/25 |
| Finance | 1/100 | 1/30 |
| Mining | 1/100 | 1/50 |
| Services - Social | 1/100 | NA |
| Wholesaling | 1/200 | 1/100 |
| Agriculture, Forestry & Fisheries | 1/400 | 1/200 |
| Retailing | 1/1,000 | 1/400 |
| Contracting | 1/2,500 | 1/700 |

NA = not available

### Special Notes on Manufacturing

As noted in Table IV, almost all of the current penetration ratios of 1 in 10 or better are in selected 4-digit classes in manufacturing.

Food manufacture splits rather neatly into eight distinct 3-digit groupings. When these are arrayed by penetration they spread as follows:

| SIC | Classification | No. of Computers | Universe | Penetration |
|---|---|---|---|---|
| 206 | Sugars | 13 | 150 | 1/10 |
| 209 | Miscellaneous Foods | 106 | 1,700 | 1/20 |
| 207 | Confectionery | 47 | 1,300 | 1/25 |
| 203 | Prepared Food Products | 80 | 2,700 | 1/30 |
| 201 | Meat Products | 88 | 3,200 | 1/40 |
| 208 | Beverage Industries | 104 | 4,000 | 1/40 |
| 202 | Dairy Products | 96 | 4,000 | 1/40 |
| 204 | Grain Mill Products | 63 | 3,400 | 1/60 |
| 205 | Bakery Products | 32 | 3,300 | 1/100 |

Detailed figures indicate that a brewer or a distiller is some 50 times more likely to have a computer than a soft drink bottler.

In Apparel (SIC 2300) while the actual number of computers found for Men's and Boys', and Women's is equal (89/91), the penetration in Men's wear is considerably higher (1 in 35 for men vs. 1 in 55 for women).

One small segment in Furniture and Fixtures (SIC 2500) namely Metal Office Furniture, shows a penetration ratio of 1 in 20 while the classification as a whole is in the 1 in 200 range.

In Paper and Allied Products (SIC 2600) over half of the computers located are in Paper Mills. The mill operator is five to eight times as likely to install a computer as is a converter of paper.

In like manner, in Printing and Publishing (SIC 2700) a magazine publisher, or a book publisher or a producer of business forms is 20 times as likely to install a computer as a conventional printer. (It is likely that Daily Newspapers more closely approximate specialty publishing than printers in general, on a penetration basis. But the SIC system uses code 2711 for all newspapers, daily and weekly alike . . . with the likelihood of computers for country weeklies, as yet, being pretty close to nil.)

The entire field of Chemicals and Allied Products (SIC 2800) shows a remarkable similarity in penetration, with Industrial Chemicals at 1 in 10 the highest ratio, followed by Pharmaceuticals (1/15) and Perfumes and Cosmetics (1/20). Agricultural Chemicals, with the lowest ratio, is a respectable 1 to 60.

Rubber and Plastics (SIC 3000) averages out at one computer per 35 plants. This average is, however, a bit like the one-to-one relationship in an animal stew made of one cow and one rabbit. For part of rubber and rubber products are obviously among the most computerized segments of manufacturing (average ratio 1 in 10) while production of articles from plastic materials indicates a ratio of 1 in 200. (Production of plastic materials is found primarily in SIC's 2821 through 2824 – where the average penetration is roughly 1 in 35.)

In the major metalworking[1] classifications the penetration ratios are as follows:

| SIC | Classifications | No. of Computers | Universe | Penetration |
|---|---|---|---|---|
| 3300 | Primary Metal Industry | 854 | 6,500 | 1/20 |
| 3400 | Fabricated Metal Industry | 301 | 22,700 | 1/80 |
| 3500 | Machinery, except electrical | 977 | 32,900 | 1/30 |
| 3600 | Machinery, Electrical | 948 | 8,700 | 1/10 |
| 3700 | Transportation Equipment | 432 | 5,900 | 1/10 |
| 3800 | Prof. Scien., & Control Instru. | 244 | 4,800 | 1/20 |

In the Primary Metal Industry (SIC 3300), actual primary production of steel and aluminum (Blast Furnaces, Primary Aluminum) show penetration ratios 10 to 20 times that indicated for such secondary operations as Casting and Forging. Primary Copper, Lead, Zinc show a computer penetration well behind that of the two basic production metals of our economy.

Metal Cans, produced almost exclusively in huge factories, shows the highest penetration ratio in the Fabricated Metal Industry (SIC 3400).

Machinery, except Electrical (SIC 3500) is a peculiar

**[1]There are minor segments of Metalworking found in classification 2700 (Electrotyping), 2500 (Metal Furniture) and 3900 (Silver, Jewelry, Caskets, Musical Instruments, Pens). However, the great bulk of all firms classified as Metalworking are in codes 3300 through 3800.**

TABLE IV

Penetration by 2-digit and 4-digit SIC - (1 in 10 or better)
Descending Array - from 1 computer per 1 in universe to 1 computer in 10 in universe

(Top 70 or so Computer Penetrated Classifications out of some 600)

| Ratio Against Universe | SIC | Classification | No. of Computers Located |
|---|---|---|---|
| 1/1 | 3573-4 | Comp. & Acc't Machines | 193 |
| | 3572 | Typewriters | 38 |
| | 3579 | Office Machines | 187 |
| 1/2 | 3021 | Rubber Footwear | 22 |
| | 3661 | Tel. & Tel. Apparatus | 93 |
| | 3711 | Motor Vehicles | 132 |
| | 3721 | Aircraft | 63 |
| 1/3 | 3011 | Tires & Tubes | 50 |
| | 3334 | Aluminum Prim. Production | 20 |
| | 3673 | Special Transmission Tubes | 13 |
| 1/4 | 3519 | Internal Combustion Engines | 32 |
| | *7399 | Computer Services | 1,768 |
| 1/5 | 2082 | Malt Liquors (Mfg.) | 36 |
| | 2911 | Petroleum Refining | 123 |
| | 3312 | Blast Furnaces | 123 |
| 1/6 | 19 | Ordnance | 32 |
| | 29 | Petroleum | 227 |
| | 2085 | Distilled Liquors | 160 |
| | 3562 | Ball & Roller Bearings | 25 |
| | 3632&5 | Household Refrig. & Vacuum | 12 |
| | 3662 | Radio & TV Apparatus | 185 |
| 1/7 | 2025 | Special Dairy | 21 |
| | 3611 | Electric Measuring & Testing Equip. | 85 |
| | 3621 | Motors & Generators | 46 |
| | 3639 | Household Appliances, other | 18 |
| | 3671-2 | Radio & TV Tubes | 20 |
| 1/8 | 2044 | Rice Milling | 13 |
| | 3651 | Radio & TV Receivers | 40 |
| | *4011 | Railroads (Transport) | 128 |
| 1/10 | 21 | Tobacco | 35 |
| | 36 | Machinery, Electrical | 948 |
| | 37 | Transportation Equipment | 432 |
| | 2043 | Cereal Preparations | 6 |
| | 2061-3 | Sugars | 13 |
| | 2072-3 | Cocoa | 11 |
| | 2095 | Animal Fats & Oils | 6 |
| | 2611-31 | Paper Mills | 107 |
| | 2731-41 | Books & publishing | 184 |
| | 2761 | Business Forms | 47 |
| | 2818-19 | Chemicals, Indl. (Mfg.) | 113 |
| | 2951-99 | Petroleum, other than refining (Mfg.) | 104 |
| | 3211-29 | Glass Products | 55 |
| | 3411 | Metal Cans | 20 |
| | 3613 | Switchgear & Boards | 38 |
| | 3694 | Elec. Equip. for Gas Engines | 19 |
| | 3811 | Eng. Lab & Scientific Equipment | 43 |
| | 3822 | Automatic Temperature Controls | 21 |
| | 3861 | Photographic Equipment | 53 |
| | 3871 | Watches, Clocks & Parts | 18 |
| | 3955 | Carbon Paper & Inked Ribbons | 11 |
| | *4511-83 | Air Transportation (Trans.) | 144 |
| | *4911 | Utilities, Electric (Trans.) | 150 |
| 1/15 | 2031 | Canned Sea Food (Mfg.) | 18 |
| | 2032 | Canned Specialties (Mfg.) | 7 |
| | 2099 | Food, Not elsewhere classified (Mfg.) | 88 |
| | 2834 | Pharmaceuticals | 89 |
| | 3331-57 | Non Ferrous Metals | 89 |
| | 3612-99 | Machinery, Electrical, Other | 379 |
| | 3722-29 | Aircraft Parts | 51 |
| 1/20 | 33 | Primary Metals (Mfg.) | 354 |
| | 38 | Prof. & Scien. & Control Instru. (Mfg.) | 244 |
| | 2026 | Fluid Milk (Mfg.) | 51 |
| | 2087 | Flavorings (Mfg.) | 21 |
| | 2522 | Metal Office Furniture (Mfg.) | 11 |
| | 2831-33 | Medicinals & Biologicals (Mfg.) | 20 |
| | 2844 | Perfumes & Cosmetics | 41 |
| | 3261-64 | Fired Cermaics | 10 |
| | 3443 | Fabricated Plate Work | 47 |
| | 3712-15 | Automotives, Other than vehicles | 138 |
| | 3731 | Ship Building & Repair | 21 |
| | 3951 | Pens, Pencils, Art Materials | 6 |

* All but marked classes come from Manufacturing.

TABLE V

PENETRATION RATIOS
By 2-digit SIC in Manufacturing
Arrayed in Descending Order (average 1/40)

Column (1) - Quantity
Column (2) - Penetration of Universe
Column (3) - Penetration of Firms Rated $20,000 and over

| SIC | Classification | (1) | (2) | (3) |
|---|---|---|---|---|
| 19 | Ordnance | 32 | 1/6 | 1/3 |
| 29 | Petroleum Refining & Allied | 227 | 1/6 | 1/4 |
| 21 | Tobacco | 35 | 1/10 | 1/3 |
| 36 | Machinery, Electrical | 948 | 1/10 | 1/5 |
| 37 | Transport. Equip. | 432 | 1/10 | 1/10 |
| 33 | Primary Metal Industries | 354 | 1/20 | 1/15 |
| 38 | Prof. & Scien. & Control Instru. | 244 | 1/20 | 1/10 |
| 28 | Chemicals & Allied | 524 | 1/25 | 1/15 |
| 22 | Textile Mill Products | 201 | 1/30 | 1/20 |
| 26 | Paper & Allied | 187 | 1/30 | 1/25 |
| 35 | Machinery, Except Elect. | 977 | 1/30 | 1/20 |
| 30 | Rubber & Plastics | 141 | 1/35 | 1/20 |
| 20 | Food | 639 | 1/40 | 1/20 |
| 31 | Leather & Leather Products | 72 | 1/50 | 1/15 |
| 27 | Printing & Publishing | 521 | 1/60 | 1/20 |
| 23 | Apparel | 249 | 1/70 | 1/30 |
| 34 | Fabricated Metal Ind. | 301 | 1/80 | 1/40 |
| 32 | Stone, Clay, & Glass | 144 | 1/100 | 1/50 |
| 39 | Misc. Mfg. Industries | 138 | 1/100 | 1/30 |
| 25 | Furniture & Fixtures | 68 | 1/200 | 1/60 |
| 24 | Lumber & Wood Products | 64 | 1/300 | 1/100 |

TABLE VI

THE RELATIONSHIP BETWEEN NET WORTH RATING AND COMPUTER INSTALLATIONS

| Establishments | | | Computers | |
|---|---|---|---|---|
| All Establishments | 3,600,000 | | 19,357 | |
| Less non-rated Services | 430,000 | | 4,206 | |
| | 3,170,000 | 100% | 15,151 | 100% |
| Establishments rated $20,000 net worth and over | 855,000 | 27% | | |
| Establishments rated under $20,000 net worth including Listed But Not Rated | 2,315,000 | 73% | | |

form of metal stew. One exceptionally large classification (3591 — Machine Shops) over one third of all plants here — shows up without one computer . . . while production of all forms of office machines show at least one computer for every plant. Engines and ball bearings, as might be expected, also show a high penetration.

Machinery, Electrical (SIC 3600) while equal in overall penetration to Transportation (1 computer per 10 plants) shows a much more even spread of computers. Of the 17 4-digit classes noted in SIC 3600, 10 show virtually the same penetration factor (1 in 6, to 1 in 10).

Transportation Equipment (SIC 3700) includes two of the highest penetration classifications — Motor Vehicles, and Aircraft. It is interesting to note that Motor Vehicle Parts and Aircraft Parts fall off to 1 in 20 and 1 in 15, respectively.

Professional, Scientific, and Control Instruments (SIC 3800) splits into two segments so far as penetration is concerned. Scientific equipment, automatic controls, photo equipment, and watches and clocks all show 1 in 10; all medical classes (medical, dental, ortho, ophthalmic) and surprisingly, optical, show 1/3 to 1/5 this penetration.

Miscellaneous Manufacturers (SIC 3900) show a penetration of about 1 in 100 . . . with two modest exceptions, Pens and Pencils (1 in 20) and Carbon Paper and Inked Ribbons (1 in 10). Of the 27 4-digit classes in code 3900, computers are found in 17.

Those with "none", include Jewelers Findings, Diamond Polishing, Feathers and Plumes, Buttons, Candles, Lampshades, Morticians Goods, Umbrellas, and Miscellany.

## EVALUATION OF THIS ANALYSIS

These data were derived from an analysis of the file of "Companies and Institutions with Computers" compiled for and with the help of ***Computers and Automation.*** In compiling this mailing list, every effort has been made to keep only one record per address. Thus, these data understate the ***number*** of computers accounted for. These addresses probably account for 27,000 to 28,000 of the nation's current inventory of 40,000 (plus) computers in operation.

### Bias

For two classifications Federal Government (SIC's 9100 and 9155) and Colleges (SIC 8220 within 8200-8299) . . . data was obtained covering every installation.

To the best of our knowledge, no other bias is involved in the collection, compiling, analysis, coding, converting, and machine handling of this file. However, it is clear that Data Processing Services, with an outlet for publicity through the magazines such as ***Computers and Automation*** have been much more likely than any other classification to send in data about their new computer installations.

These data are indicative, however, at best. The entire SIC coding structure commercially available[2] has an error factor estimated by major users in the 10% to 15% range. All codes for rated business come from some 2,000 enumerators working for the primary credit reporting service in the United States. Codes for the last few years have been established by a central coding office . . . which provides a measure of control. However, most codes in this service still reflect field created codes. About 30,000 entities, primarily plants in manufacturing, report multiple SIC's. For reasons of simplicity and cost, only the primary reported SIC has been utilized in this analysis. A third avenue for error has been on the conventional "read-post-tag" operation of coding what is essentially a mailing list. This has been done by experts in both list compilation and in list conversion, and unique identification numbers used for every record touched — but a small number of human errors naturally have intruded.

In this light, data between one major class and another are reasonably significant. The breakdowns of penetration within 2-digit manufacturing are obviously meaningful. But differences, unless considerable, between 4-digit groupings must be considered highly tentative.

The data, by size (net worth), are valid only as gross indicators. They understate, by a considerable proportion, the correlation of penetration of computers to company size (as measured by net worth rating assessed by the credit reporting company). This is so for a number of technical reasons. In the first place, the ratings are estimates — and based, primarily, except at the upper 1% of the range, on data provided to the credit service by each reporting company. Secondly, branch operations which should bear the same rating as the home office are, for all practical purposes, reported as "listed but not rated." Thirdly, many companies refuse to volunteer any data. Fourthly, the credit service, while listing all manufacturers and most wholesalers, covers only the top portion of such classes as retail and services.

Data is now available in manufacturing to relate penetration and use of computers by number of employees per plant. This data is now in preparation. Data by employee strength is a far more reliable indicator of business size than is net worth rating.

**[2]The chief publisher of SIC information in the United States is Dun & Bradstreet which includes such data in its credit reporting service.**

### Universes

The concept of "Penetration of a given Universe" is not utilized conventionally in management science . . . primarily because so little is known (usually) about the actual parameters of the universes under study.

In the business world three companies now publish a considerable volume of data on companies (and institutions) which function as employers. These three are Dun and Bradstreet, National Business Lists, and Computer List Marketing, a subsidiary of Ed Burnett, Inc. The data here on the employing universe as a whole come from all three — with some subjective decisions by the author. (For example, Dun and Bradstreet rated and/or lists about 1,400,000 retailers, the figure selected here. By merging this list with classified listings, a number approaching 1,800,000 is probable, and the U.S. Census of Business shows even more. The penetration in retail using the more modest 1,400,000 is less than 1 computer per 2,000 stores. Little would be gained by including every unrated "mom and pop" store.)

The figures for business companies rated $20,000 net worth and over come from a 1968 analysis of names (without addresses) published by net worth rating by Dun and Bradstreet. At the time this analysis was made Dun and Bradstreet itself could not furnish such data. Dun and Bradstreet shortly will be able to corroborate a fair amount of the data given here from their own record count programs. At the time this was produced, this was considered the best approximation, based on statistical counts, then available. The data is reasonably adequate for the rough penetration proportions published here.

As noted in the text, there are a number of "universes" to consider.

From a size point of view they range as follows:

a. Companies (Home offices only) rated $1,000,000 and over . . . . . . . . . . . . . . . . . . . . . . . . 36,000
b. Companies (Home offices primarily) rated $20,000 and over . . . . . . . . . . . . . . . . . . . . . . . 855,000
c. Establishments (employers) rated and non-rated considered as potential business and institutional market for computers . . . . . . . . . . . . 3,500,000
d. Census reported employers (non-farm) . . . including professionals and one-man businesses . . 6,600,000

The penetration data presented here — one computer for so many establishments — basically is applied to "c" and "b" above.

In credit reporting, non-buying branches (as branch units of a chain) are omitted. Branch plants in manufacturing are virtually all included as each plant is a buying entity. Overall, branch plants represent about 10% of all plants reported. But this proportion can be very misleading insofar as concentration of production is concerned. For example, about half of all such branch and subsidiary operations (some 14,000) are controlled by the 1,000 largest manufacturers — the so-termed "Fortune 1,000." These 1,000 companies (with their branches and subsidiaries) account for over 70% of all employment in manufacturing and over 75% of all value added to manufacture.

### SIC

For those who wish to complete information on this valuable classification system, the purchase of the "Standard Industrial Classification Manual" published by the United States Department of Commerce ($2.50) is strongly recommended.

For a brief review of the way SIC works and some of the pitfalls involved, see the article "OF SIC" by Ed Burnett, published in the March 1968 issue of ***Reporter of Direct Mail*** (now ***Direct Marketing***) Garden City, New York. □

WORLDWIDE

# REPORT FROM GREAT BRITAIN

### LEASCO'S Time Sharing

LEASCO is launching a major time-sharing action in Europe to take place this autumn in Britain, Holland, Sweden and West Germany.

A total of 12 systems will be set up, two each in the first three countries and four in the latter, with two to be held in reserve. Of the 12, eight are intended to be built around Modular I compact machines from Computer Technology Company, a venture closely connected with the Pergamon publishing group which Leasco is in process of acquiring. The small Modular I machines will not be immediately available and the first four time-share centres – in London, Birmingham, Munich and Stockholm – will rely on Hewlett-Packard 2000A units.

This is only the first stage of a three-phase expansion, or rather "sophistication" plan. Leasco is well aware that what it can offer on an HP 2000A or a Modular I is just not comparable with the variety of options IBM, UCC, GEIS (the General Electric time-sharing service based on 265's), ICSL and several other large bureaux are already selling heavily in Britain and Europe. Therefore, either it intends to give the service virtually for free – which would not be in keeping – or it will shorten Phase 1 very considerably.

This would present no problems since HP 2000A was the basis for a similar operation in the U.S. and all the spade-work presumably has been carried out. Leasco also already has the expertise of Inbucon, a British software house which it took over about a year ago for a purchase price of £4m.

It is doubtful whether, in Europe, the next step can be the same as in the U.S., where Sigma-5 centres with 70 terminals are to replace the 16-terminal HP set-ups, to be superseded in 1975 by very large-scale networks to be based on IBM 85's or 65's, or possibly on CDC 6600's or Univac 1108's if these prove better for the time-sharing job than the IBM equipment. It is likely that outside the U.S. there will be a direct jump from Phase 1 to the large-scale centres of Phase 3, about 1972, giving the Leasco time-sharing operation a handicap of two years at best and four to five years by comparison with market leaders here.

### Computer Technology Will Benefit

Computer Technology stands to make something out of this job over and above the eight relatively small systems (say about $100,000 each) it will be building. It will make known its product, which has so far been an unknown quantity even on the UK market. One of the reasons for this lack of fame is the cold-shouldering the company got from the Ministry of Technology when it was seeking money to start building its hardware almost two years ago.

The Ministry attitude was understandable since Computer Technology began to be active just at a time when the main plan for rationalisation of the small computer industry in Britain was taking shape. Obviously company enthusiastics were not going to take kindly to the Ministry attitude that "one small computer is very like another and what counts is a market large enough to warrant the economies of mass production by one or two manufacturers rather than the six now operating". Yet the Ministry reasoning was based on a close look at that most successful operation – Digital Equipment Corporation which serves a good part of the market at which Modular I is aimed.

### Equipment

Modular I as it will be used by Leasco will have a large memory, ability to handle 32 terminals, universal disc capability and be three times as fast on retrieval at half the price of competing equipment. But, and it is no small "but", the machine is not a proven system and it has no software. Leasco's software house acquisition, called "Leasco Systems and Research", is given that task and not much time to complete it in. Should the machine fall down on the job, Leasco would have its Hewlett-Packard experience to draw on.

Leasco is to use peripherals built by other European organizations in which it has acquired an interest. They include Detloff low-speed terminals built in Germany by the company of the same name, in which Leasco has a 25 percent holding.

### Market Projections

We have all learned to disregard market projections, particularly those brandished by salesmen. However, for what it is worth, the current time-sharing bureau turnover in the U.S. is put at $180m rising to $1,500m in 1973 – according to Leasco. The pattern in Europe should follow the same curve some two to four years behind the U.S. What the current European figure could be is a matter for conjecture. I would estimate that for 1968 Europe's computer bureau turnover was about $300m, of which perhaps $10m to $18m went on time-share jobs.

It will interest U.S. readers to hear that while most, if not all, American computer companies accept the doctrine that they have only one competitor to beat – IBM – the Europeans would contest this even as a theory and are much further from acting on it than their U.S. counterparts. Britain's International Computers, by and large, finds it easier to collaborate with U.S. companies, other than IBM, than with what remains of the European com-

*(Please turn to page 67)*

# CALENDAR OF COMING EVENTS

Sept. 8-12, 1969: International Symposium on Man-Machine Systems, St. John's College, Cambridge, England; contact Robert C. McLane, G-MMS Meetings Chairman, Honeywell Inc., 2345 Walnut St., St. Paul, Minn. 55113

Sept. 15-17, 1969: First International Conference on Programming Languages for Numerically Controlled Machine Tools, IFIP-IFAC, Rome, Italy; contact Dr. E. L. Harder, R & D Center, Westinghouse Electric Corp., Beulah Rd., Pittsburgh, Pa. 15235

Sept. 28-Oct. 1, 1969: Association for Systems Management International (formerly Systems and Procedures Association) International Systems Meeting, New York Hilton Hotel, New York City, N.Y.; contact Richard L. Irwin, Association for Systems Management, 24587 Bagley Rd., Cleveland, Ohio 44138.

Sept. 30-Oct. 2, 1969: Computers and Communications Conference (sponsored by the Mohawk Valley Section of the IEEE), The Beeches, Rome, N.Y.; contact John M. Harrington, Conference Chairman, 304 E. Chestnut St., Rome, N.Y. 13440

Oct. 1-5, 1969: American Society for Information Science, 32nd Annual Meeting, San Francisco Hilton Hotel, San Francisco, Calif.; contact Charles P. Bourne, Programming Services, Inc., 999 Commercial St., Palo Alto, Calif. 94303.

Oct. 6-10, 1969: Second International Congress on Project Planning by Network Analysis, INTERNET 1969, International Congress Centre RAI, Amsterdam, the Netherlands; contact Local Secretariat, c/o Holland Organizing Centre, 16 Lange Voorhout, The Hague, the Netherlands

Oct. 9-11, 1969: DPMA Div. 3 Conference, Lafayette Hotel, Little Rock, Ark.; contact Robert Redus, 6901 Murray St., Little Rock, Ark.

Oct. 13-16, 1969: Association for Computing Machinery (ACM) Symposium on Data Communications, Calloway Gardens, Pine Mountain, Ga.; contact Edward Fuchs, Room 2C-518, Bell Telephone Laboratories, Inc., Holmdel, N. J. 07735; Walter J. Kosinski, Interactive Computing Corp., P.O. Box 447, Santa Ana, Calif. 92702

Oct. 13-16, 1969: 1969 International Visual Communications Congress, International Amphitheatre, Chicago, Ill.; contact Internat'l Assoc. of Visual Communications Management, Suite 610, 305 S. Andrews Ave., Fort Lauderdale, Fla. 33301

Oct. 14-15, 1969: Symposium on Optical Character Recognition, sponsored by the National Archives and Records Service of the General Services Admn. and the National Bureau of Standards, at Dept. of State West Auditorium, Washington, D.C.; contact Mr. John DeMasi, International Business Forms Industries, 5223 River Rd., Washington, D.C. 20016

Oct. 14-16, 1969: American Society for Cybernetics, Third Annual Symposium, National Bureau of Standards, Gaithersburg, Md.; contact Dr. Carl Hammer, UNIVAC Div., Sperry Rand Corp., 2121 Wisconsin Ave., N.W., Washington, D.C. 20007

Oct. 15-17, 1969: IEEE Tenth Annual Symposium on Switching and Automata Theory, University of Waterloo, Waterloo, Ontario, Canada; contact Prof. J. A. Brzozowski, Dept. of Applied Analysis and Computer Science, University of Waterloo, Waterloo, Ontario, Canada

Oct. 16-17, 1969: American Institute of Industrial Engineers (AIIE), Huntsville Chapter, 7th Annual Conference, Huntsville, Alabama; contact R. Trenkle, 2226 Matthews St., S.E., Huntsville, Alabama 35801

Oct. 17-18, 1969: Northeastern Regional Conference of the Association for Computing Machinery, State Univ. of New York, Albany; contact Dr. E. D. Reilly, Jr., Computer Science Dept., State Univ. of New York at Albany, Albany, N.Y. 12203

Oct. 22-24, 1969: IEEE 1969 Systems Science and Cybernetics Conference, Philadelphia, Pa.; contact C. Nelson Dorny, Moore School of Electrical Engineering, Univ. of Pa., Philadelphia, Pa. 19104.

Oct. 24, 1969: Fourth Annual Symposium on the Application of Computers to the Problems of Urban Society, sponsored by the Assoc. for Computing Machinery, Metropolitan N.Y. Chapters, New York Hilton Hotel, New York, N.Y.; contact Mrs. Jessica Hellwig, Computer Center, Columbia Univ., New York, N.Y. 10027

Oct. 26-30, 1969: ACM/SIAM/IEEE Joint Conference on Mathematics and Computer Aided Design, Disneyland Hotel, Anaheim, Calif.; contact J. F. Traub, Program Chairman, Computing Science Research Center, Bell Telephone Laboratories, Inc., Murray Hill, N.J. 07974.

Oct. 27-29, 1969: Electronics and Aerospace Systems Convention and Exposition (EASCON '69), Sheraton Park Hotel, Washington, D.C.; contact Howard P. Gates, Jr., EASCON '69 Technical Program Chairman, P.O. Box 2347, Falls Church, Va. 22042.

Oct. 27-29, 1969: Data Processing Supplies Assoc. Fall General Meeting, New York, N.Y.; contact Data Processing Supplies Assoc., 1116 Summer St., P.O. Box 1333, Stamford, Conn. 06904

Oct. 27-30, 1969: 24th Annual ISA Conference & Exhibit, Astrohall, Houston, Texas; contact H. Buntzel, Jr., Program Chairman, Bonner & Moore Assocs., Inc., Suite 1124, 500 Jefferson Bldg., Houston, Texas 77002.

Oct. 27-31, 1969: Business Equipment Manufacturers Assoc. (BEMA) Annual Business Equipment Exposition and Management Conference, New York Coliseum, Columbus Circle, New York, N.Y. 10023; contact Laurance C. Messick, Business Equipment Manufacturers Assoc., 235 East 42nd St., New York, N.Y. 10017

Oct. 30-31, 1969: Assoc. of Data Processing Service Organizations Management Conference, Regency Hyatt Hotel, Atlanta, Ga.; contact Jerome L. Dreyer, Assoc. of Data Processing Service Organizations, Inc., 420 Lexington Ave., New York, N.Y. 10017.

Nov. 3-5, 1969: 5th Annual IEEE Symposium on Automatic Support Systems for Advanced Maintainability, Chase-Park Plaza Hotel, St. Louis, Mo.; contact Matthew F. Mayer, Program Chairman, P.O. Box 4124 Jennings Station, St. Louis, Mo. 63136

Nov. 3-7, 1969: GUIDE International, Denver Hilton Hotel, Denver, Colorado; contact Jack Eggleston, GUIDE Secretary, Mgr., Programming R&D, Mutual of Omaha Insurance Co., P.O. Box 1298, Omaha, Nebraska 68101

Nov. 5-7, 1969: IEEE Northeast Electronics Research and Engineering Meeting (NEREM), War Memorial Auditorium and Sheraton Boston Hotel, Boston, Mass.; contact NEREM, 31 Channing St., Newton, Mass. 02158.

Nov. 6-7, 1969: First National Symposium on Industrial Robots, IIT Research Institute, Chicago, Ill.; contact Mr. Dennis W. Hanify, IIT Research Institute, 10 West 35 St., Chicago, Ill. 60616

Nov. 10-11, 1969: Digitronics Users Assoc. (DUA), 4th Annual Conference, Barbizon-Plaza Hotel, New York City; contact Secretary, DUA, Box 113, Albertson, Long Island, New York, 11507

Nov. 13-14, 1969: Conference on the Legal Protection of Computer Programs (sponsored by the Law Group of the British Computer Society), Bedford Hotel, Brighton, England; contact Conference Dept. of The British Computer Society, 21 Lamb's Conduit St., London, W.C.1, England

*(Please turn to page 67)*

c.a

## PROBLEM CORNER

**Walter Penney, CDP**
**Problem Editor**
**Computers and Automation**

### PROBLEM 699: UNCHANGING TIME

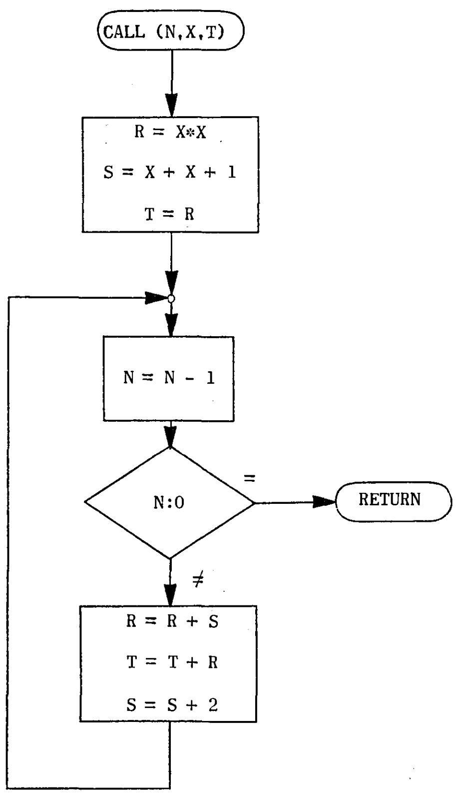
*(Contributed by Carl M. Wright)*

In a statistical program, the subroutine shown in flowchart no. 1 is used. To shorten the running time, the subroutine shown in flowchart no. 2 is substituted. However, the average running time is unchanged.

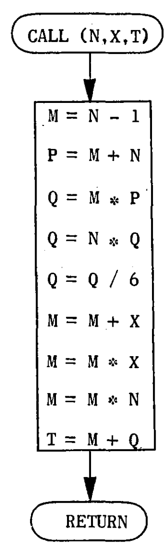
What do the subroutines compute?

What is the average value of N?

(Note: All variables are integers. Disregard call and link times. All instructions require eight microseconds execution time except multiply and divide, each of which requires 64 microseconds. All steps are performed in the order shown.)




FLOWCHART NO. 1




FLOWCHART NO. 2

### Solution to Problem 698: From Binary to BCD

$$N = n - 6\left\lfloor\frac{n}{16}\right\rfloor - 60\left\lfloor\frac{n}{256}\right\rfloor - 600\left\lfloor\frac{n}{4096}\right\rfloor - 6000\left\lfloor\frac{n}{65536}\right\rfloor,$$

where n is the number with the bits interpreted as binary and N is the equivalent in BCD.

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

c.a

## NUMBLES

### Number Puzzles for Nimble Minds — and Computers

**Neil Macdonald**
**Assistant Editor**

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

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

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

### NUMBLE 699

```
      A M A N
    X     O F
    U F G C U
  U R N M O
= U A M A M U
+ C O U R A G E
= C N F A C A R
                    P S T = M O N
                      U = V = W

79291    24775    29435    75
```

### Solution to Numble 698

In Numble 698 in the August issue, the digits 0 through 9 are represented by letters as follows:

| | |
|---|---|
| K,X = 0 | D,N,O = 5 |
| S = 1 | E = 6 |
| L,P = 2 | A = 7 |
| T,U = 3 | H = 8 |
| I = 4 | W = 9 |

The full message is: People with wax heads should not walk in the sun.

Our thanks to the following individuals for submitting their solutions to Numble 697:
A. Sanford Brown, Dallas, Tex.; Jack Byk, Dresher, Pa.; T. P. Finn, Indianapolis, Ind.; R. D. Gee, Victoria, British Columbia; Nathan Krumholz, New York, N.Y.; D. F. Stevens, Berkeley, Calif.; A. O. Varma, New York, N.Y.; and Robert R. Weden, Edina, Minn. — and to Carroll Johnson, Walpole, N.H., and Thomas M. Kaeji, Toronto, Ontario, Can., for their solutions to Numble 696.

# ACROSS THE EDITOR'S DESK

## Computing and Data Processing Newsletter

Table of Contents

## APPLICATIONS

### LUNAR SAMPLE EXPERIMENTS TO BE CONTROLLED BY PDP-8/L

A suitcase-sized PDP-8/L computer, manufactured by Digital Equipment Corporation, controlling a mass spectrometer, will determine, in part, the age and history of lunar samples brought back by the Apollo astronauts. The spectrometer, controlled by the PDP-8/L, makes two types of tests: one to find the total amount of a particular element in the lunar sample, and the other to determine how often an element occurs compared to other elements. The latter test yields the ratios that help determine the age and history of the samples. The spectrometer was built by the National Bureau of Standards in Gaithersburg, Md., to specifications set by the National Aeronautics and Space Administration.

The computer will do two things: it will control the instrument, and it will do the calculations needed to analyze the results of the tests. If there was no computer, an investigator would have to sit at the spectrometer to control the tests while they were being run. The results would be plotted on graph paper, and the scientist would have to measure and record the readings manually. The computer takes the readings automatically and records them instantly on magnetic tape. The data is statistically analyzed and the computations punched out on paper tape and a teletypewriter. The information on the paper tape will be analyzed in detail on a larger computer, while investigators can do preliminary work from the printed figures.

### SECURITIES BROKERAGE FIRM AUTOMATES BACKOFFICE HANDLING OF STOCK CERTIFICATES

The "Cage," a major Wall Street backoffice operation, has at last yielded to the computer. Goodbody & Co. (New York), one of the nation's largest securities brokerage firms, has developed a unique program for automating the "Cage," the area where large numbers of stock certificates are received and dispatched. Goodbody expects the new automated system, called Auto-Cage, to go far toward reducing the problem of "fails" — the inability to deliver certificates on time.

The system at Goodbody utilizes a battery of 50 Bunker-Ramo Series 2200 video terminals manned by specially-trained operators. Information about each incoming certificate is transmitted via the terminals to the firm's RCA third generation central computer. The computer immediately types out detailed instructions as to what must be done. The computer then watches every step of the certificate's movement through the firm's "cage", making all necessary bookkeeping entries along the way. If a certificate is improperly routed or if an error is made, the computer gives an immediate alarm signal to a supervisor, who can then take corrective action.

Another important benefit of "AutoCage", according to the sponsors, is that it greatly lessens chances for misplacement or theft of securities. The system is compatible with the various forms of stock certificates now being proposed within the industry.

So great is the potential seen in the development that the decision has been made to offer AutoCage, on a commercial basis, to other brokerage firms. A new firm, Goodbody Systems, Inc., was established on the premise that other securities firms, even small ones, can utilize AutoCage in conjunction with their own computers or through the shared-computer concept. The new computer service organization for the securities industry is owned jointly by Goodbody & Co. and a New York based computer consultant company which has worked with Goodbody for two years in the creation of AutoCage.
(For more information, circle #41 on the Reader Service Card.)

### NEW ENGLAND SEAFOOD PROCESSOR FORECASTS DEMAND FOR FISH WITH AID OF IBM COMPUTER

The Gorton Corporation (Gloucester, Mass.), one of the major producers in the seafood industry, is using an IBM System/360 Model 30 computer to help solve the logistics of shipping fish from all over the world to processing plants, warehouses and retail outlets throughout the United States. The 130 year old firm is using the computer in several ways novel to an American industry that predates the Pilgrims.

A major problem for the industry is that fish processors never can be certain how much fish they can expect from any one source. A lot depends on how the fish are running. Gorton is using its computer to arrange for the purchase of fish from a variety of sources ranging from the rice paddies of India to the frozen seas off Iceland. If South African lobsters aren't available, Gorton's occasionally are supplied from Australia.

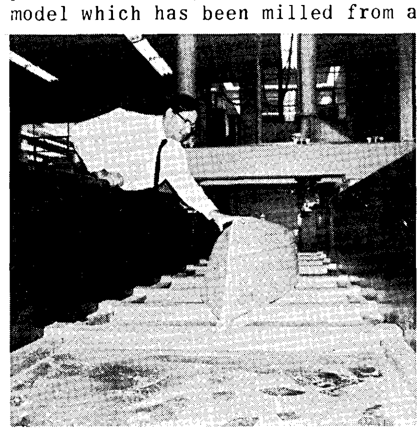
The IBM computer also is used to forecast demand and to plan processing of nearly 125 million tons of seafood the company cans or "fresh-lock" freezes each year. Marketing nearly 500 separate items to both retail and institutional outlets, Gorton nevertheless is able to keep electronic track of its clams from New Jersey, shrimp from Miami, crabs from Mobile and salmon from Westport, Wash., so that the company's "frozen assets" are not piled high in warehouses waiting for seasonal or sectional demands. Jonathan Bayliss, director of management services, said, "By forecasting sales a year, or a month ahead, we can be reasonably sure of a predictable demand for a particular frozen seafood in a trading area." The computer also helps the firm distribute available products to the right markets at the right time.

The Gorton Corporation, which operates processing plants in Alabama, Alaska, California, Connecticut, Florida and Washington, produces such well-known fish products as Blue Water, 4-Fishermen and Red L.

### SHIP MODELS MADE BY COMPUTER

Researcher Dr. D. Gospodnetic at the Ship Section of the Division of Mechanical Engineering at the National Research Council in Ottawa, Ontario, Canada, uses a Digital Equipment Corporation PDP-8/I computer to build test models of ships that may someday ply the waterways of the world. These boats, unlike the small plastic models familiar to children, are wooden test models up to 25 feet long used for studying such things as hull design, propulsion, maneuvering, and motion simulation.

Dr. Gospodnetic is shown in the picture checking the keel of a boat model which has been milled from a



large block of wood. Once the model is properly shaped, it is sanded smooth and coated with shellac — ready for test runs in the tank to acquire the necessary design data for later analysis.

The small PDP-8/I computer is equipped with a disk, an extended arithmetic element, a real-time clock, 8192 words of core memory, an X-Y plotter and a tape recorder. The computer takes data stored on magnetic tape and feeds it into the numerical control system that oversees the milling operation by which the models are made. "The job of cutting away the blocks of wood is thus totally automated," said Dr. Gospodnetic.

### HEBREW UNIVERSITY GEOGRAPHERS USE COMPUTER TO MAP DEVELOPMENT OF JERUSALEM AREA

A survey, by Hebrew University geographers, of East and West Jerusalem has recently been completed using the University's CDC 6400 computer as a new means for preparing an urban atlas. Dr. Arie Shahar, specialist in urban geography, said that he believes this to be one of the first times the computer technique has been adapted to map a city. The computer mapping technique, originally begun in the United States but now adapted to an urban geographical survey, means that the physical characteristics found during the field survey are no longer drawn on maps but written on cards which are punched and computerized.

Dr. Shahar lists the following objectives in making the new maps:

1. The atlas should point out patterns of activities in a city with a long history of development.
2. It should compare the urban structure of a city which has an old part reflecting a Middle Eastern way of life and a modern section built on a planning principle..
3. It should show what happens to a divided city without any connection between its two parts — how each entity develops a nucleus comprising business district, public buildings, service facilities, etc.
4. It should allow surveyors to see the effects of the reunification of the city and how the two populations maintain contact with each other economically and physically.

Dr. Shahar, together with Professor David Amiran, Head of the University's Geography Department, who initiated the project, conducted a 12 months study of the formerly divided city, assisted by a team of 30 students who made the actual field survey. The survey started in September 1967, a few months after the Six-Day War, and lasted until October 1968. The geographers now are processing the material which in six months will be published as urban maps by the National Survey of Israel, with text and legend in English as well as Hebrew. When the new atlas is published, the whole material obtained during the survey will be handed to the Master Planning Team of the Municipality of Jerusalem for use in the development projects of the city.

## EDUCATION NEWS

### UNIVERSITY PROJECT USES CAI TECHNIQUES FOR "SHORT CUT" TO ADULT EDUCATION

Some 30 institutions through the country have been granted U.S. Office of Education funds to develop new education techniques, each in a different specialty. North Carolina State University is believed to be the only USOE-sponsored project exploring the use of computer-assisted instruction (CAI) and programmed instruction for adults with little or no prior schooling. The NCSU pilot group will test the effectiveness of course materials developed by the Adult Learning Resources Project. According to Dr. J. B. Adair, director of the NCSU Learning Resources Project, under ideal conditions, four to six months of study might enable a student to gain the equivalent of three school years in reading comprehension, writing and mathematical abilities.

A key element of the federally funded research and development project is an IBM 1500 instruction system, which controls a network of 10 TV-like terminals. This special computer system is leased or sold on a limited basis by IBM to organizations conducting experimental programs in computer assisted instruction.

Because there has never been a concerted effort in this country to create materials for under-educated adults, some of the course material has been adapted from existing primary-grade math tables and materials originally prepared to teach English to the foreign born. Based on evaluation of the learning experiences in the pilot program, future emphasis will be on developing original materials. Reading lessons deal with subjects of interest to adults, e.g., the home and family living, child care, civic participation and consumer education. Each lesson has been prepared at several levels of difficulty, to match the backgrounds and capabilities of the student.

The computer-based instructional system can be used even by a completely illiterate person, by means of an audio attachment. Using earphones, the student is given an oral lesson which describes letters and numbers that appear on a terminal or an adjacent slide screen. After the student advances to the point where he recognizes numbers, letters and simple words, he is phased into more advanced reading, writing and arithmetic.

Many of the students are being recruited with the aid of federal, state and local social service organizations in the Raleigh area. Others are being drawn from the maintenance staff of the university. The initial "class" of about 75 students is expected to be expanded this month to about 150 adults, some with no previous formal education, others with minimal schooling — up through the eighth grade. Students spend 1½ hours a day, five days a week at the center. Their progress is logged by the computer and observed and analyzed by researchers. The ultimate goal of the program is to take an uneducated adult to the point where he can pass a high-school equivalency examination.

### COMPUTER TRAINING PROGRAM FOR INNER-CITY YOUTHS IN SOUTHERN CALIFORNIA

The University of Southern California, under a grant from the National Science Foundation, is training 100 inner-city youths in computer science in an effort to help close the competition gap that may confront them in the future. Students in the program receive a $25 per week stipend, range in age from 15 to 18, and are representatives of 17 Southern California area high schools.

Participants in the program are in two major categories: (1) 80 students who have some background in mathematics and science, and who will most likely get into college; (2) 20 students who have no background in mathematics and science, most of whom will be looking for jobs when they leave high school; or in a few cases, may be potential high school dropouts.

The 80 participants who are college-bound are divided into two groups of 40 students each. Both group receives intensive training in FORTRAN IV programming based on the IBM System 360, and its usefulness. The remaining 20 of the total group of 100 are getting a less technical but extremely practical course in data processing. These students will have sufficient background to apply for trainee positions in the many computer-allied fields such as computer operators, data processors, and keypunch operators.

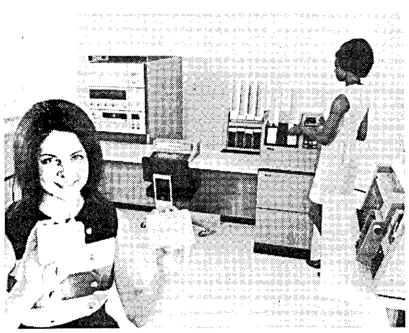
The man who created the program a year ago, Dr. Richard E. Bellman, USC professor of mathematics, medicine, and electrical engineering, said he hopes other colleges and universities across the nation will adopt the same kind of program. He feels that, if placed on a national scale, such a program might help solve the major problems faced by unskilled high school dropouts and potential dropouts.

## NEW PRODUCTS

## Digital

### IBM SYSTEM/3 / IBM Corporation

IBM's newest computer, called IBM System/3, is a low-cost system designed especially for small business. It is also expected to find application in large firms that wish to decentralize data processing capabilities. System/3 uses a new punched card that is about 1/3 the size of a traditional 80-column card, yet holds 20 percent more information; the new card accommodates up to four lines of printing, with 32 characters per line.



— System/3 uses the new small punched cards shown above

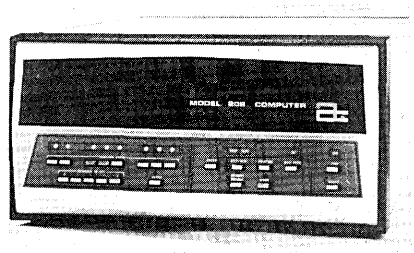
Two models of the System/3 are available: a punched card system or one with direct access disk storage. The card version starts with an 8192 character (byte) main core memory, a 100 lpm printer, and a multi-function card unit (combining five card-handling operations — sorting, collating, punching, printing and reading — in the single, automatic device). The disk system starts with a 12,288 character main memory, 2.45 million character disk and a 100 lpm printer. The built-in disk file has storage capacity up to 9.80 million characters.

Main core storage for both card and disk versions can be expanded to 32,768 characters. Printer speeds can be increased to 200 lines per minute. System/3's programming language, RPG II, is an English-like language based on the IBM System/360 RPG. RPG II contains many improvements and additions to the currently available version.

A number of related products and services, including data processing education, program products and systems engineering assistance also are being offered to System/3 users as options by IBM.
(For more information, circle #42 on the Reader Service Card.)

### MODEL 208 CONTROL COMPUTER / Computer Automation, Inc.

The new addition to Computer Automation's family of compatible mini-computers, Model 208, is an 8-bit, stored-program, parallel computer. It has a new high speed memory with 2.6 micro-seconds full




cycle time. Memory is byte-organized, requiring only one word to execute Shifts, Register Change, Control and Skips. Two words are used for Memory and I/O instructions.

Standard I/O features of the 208 include three hardware priority interrupts expandable in groups of eight, as well as high speed block transfer into and out of memory. The parallel I/O bus simultaneously presents data, peripheral address, control codes and function codes, which simplifies system integration and interface with other equipment.

In addition to its usefulness as a communications controller, the 208 is also expected to find wide application in data acquisition and process control systems where high speed, reliability, I/O flexibility and programming convenience are important.
(For more information, circle #43 on the Reader Service Card.)

### MODEL 216 CONTROL COMPUTER / Computer Automation, Inc.

The Model 216 increases Computer Automation's family of economical mini-computers to four compatible units with a full line of interchangeable peripherals and system interface modules. The 216 is a 2.6 microsecond, 16-bit machine, designed for process monitoring and control, automatic test and inspection systems, numeric control systems and on-line data acquisition.

The high speed Model 216 computer has a large repertoire of 122 basic instructions as well as extensive micro-programming instructions such as memory scan, three way compare, memory load and dump, and automatic input/output.

For control applications the Model 216 (like its slower companion, the Model 816 control computer) has sich I/O features as block I/O, direct memory access, hardware priority interrupt, and core memory field expandable from 4096 to 16,384 words.
(For more information, circle #44 on the Reader Service Card.)

### GE-105 RTS COMPUTER / General Electric Company

GE's new remote terminal system — the GE-105 RTS — can communicate with all computers in the GE-100, GE-400, and GE-600 lines as well as with computers of other manufacturers. The system allows low-cost local data processing while providing remote use of a large central computer when needed.

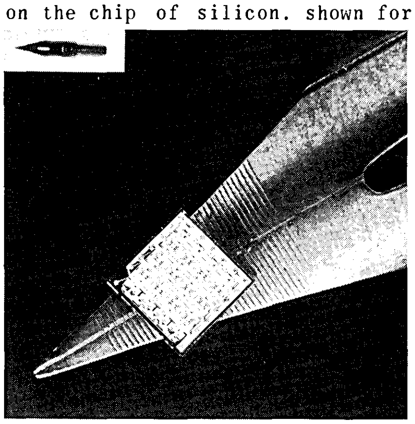
Serving as a free standing system, data to be transmitted to a larger central computer can first be reduced, validated and edited by the GE-105 RTS, prior to transmission. Data transmission rate is 2000-bits per second over public telephone lines; 2400-bits per second over leased common carrier voice-grade lines.

A basic GE-105 RTS system includes a 4,096-byte-memory, a 300-card-per-minute reader, a 250-line-per-minute printer with 120 print positions and a half-duplex synchronous single-line communication controller. Options include an additional 4,096-byte-memory, 16 additional print positions, and a 60-200 card-per-minute card punch.
(For more information, circle #45 on the Reader Service Card.)

### IBM SYSTEM/360 MODEL 195/ IBM Corporation

The most powerful computer ever developed by IBM, called System/360 Model 195, is designed to help solve the most complex commercial and scientific problems, from nationwide airline reservations handling to global weather forecasting. The Model 195 has an internal processing speed about twice as fast as IBM's next most powerful System/360 — the Model 85. It is so fast that it can process an instruction in just 54-billionths of a second. Light — which travels 186,281 miles in a second — can move only 53 feet in that time.

Model 195 uses monolithic integrated circuits for the arithmetic and logic operations in the central processor, and as the storage medium in the 32,768-byte buffer memory. In the picture below there are 64 complete electronic memory circuits on the chip of silicon. shown for



size comparison on the nib of a pen. The monolithic circuits can transmit signals in three to five nanoseconds.

Within the Model 195 CPU, there are five functionally separate units: processor storage; storage bus control; instruction processor; fixed-point processor and floating-point processor. This internal organization allows the computer to overlap and process up to seven different operations at the same time.

System/360 Model 195 can run most programs from other large models of System/360 without modification. In addition, most input/output devices used with other System/360 models may be attached to the new computer.
(For more information, circle #48 on the Reader Service Card.)

## Special Purpose Systems

### DPI-500 DATA PROCESSING SYSTEM / DPI, Inc.

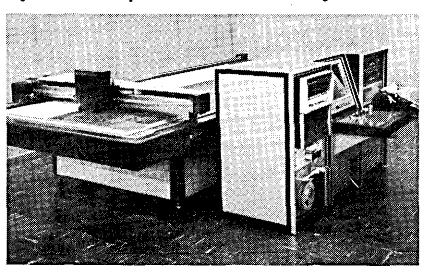
A low-cost computer system is now available from DPI, Inc., that automates the complete accounting and record keeping operations of any small business. The DPI-500 data processing system operates in a conversational manner through a standard typewriter keyboard. No prior experience is required; any secretary can operate the DPI-500 with minimum training. Basic information is compiled and stored on magnetic tapes. The secretary keeps the information current simply by feeding new data through the familiar typewriter.

The system includes a Digital Electronics Corp. computer processor, an IBM Selectric typewriter for input and output, complete programming, and a library of program tapes with easy to understand instructions for the operator.

DPI will provide programs for sales order entry; invoicing; sales analysis; accounts receivable; accounts payable; payroll, job costs and related reports; inventory; production control; and mailing lists.
(For more information, circle #46 on the Reader Service Card.)

### ALTAPE (AUTOMATIC LINE TRACING AND PROGRAMMING EQUIPMENT) / Tridea Electronics

The costs of preparing numerical control tapes to program the operation of N/C machine tools may be reduced by more than 50% with the ALTAPE (Automatic Line Tracing and Programming Equipment) System, according to Tridea Electronics, (a subsidiary of Conductron Corp.), El Monte, Calif. Tridea's new ALTAPE system comprises a tracing table



(5 ft. wide by as long as 24 ft.) with a vacuum hold-down surface, a moving tracer head including a TV camera, a two-axis linear measuring system, a Varian Data 620/i digital computer, and an operator's console with TV monitor and all essential controls.

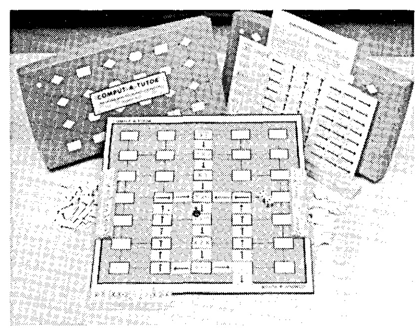
The Varian Data 620/i, with 8K memory, is programmed to produce a complete N/C control tape embodying measured part-description information and including other functional tool commands such as acceleration, deceleration, coolant, feed rate, etc., for both two-dimensional and three-dimensional machining. Tridea has prepared basic programming software compatible with any standard N/C control system specified by the customer.

The 620/i computer processes all the data "on-line", while tracing is under way, and eliminates the multiple processing and post-processing steps required in other programming systems. The computer may be given supplementary instructions by the operator, who need not have any specialized computer programming or parts programming skills. Tracing accuracy is to within ±.001 inch, and automatic tracing speed is 50 inches per minute.
(For more information, circle #47 on the Reader Service Card.)

## Teaching Devices

### COMPUT-A-TUTOR / Worldwide Computer Services, Inc.

Programmers spend a large proportion of their time in preparing flow charts. COMPUT-A-TUTOR© is a two-game kit designed to introduce novices to the fundamentals of computer flow charting. As players of COMPUT-A-TUTOR© learn to win against opponents, important concepts and good flow chart habits are developed automatically.



The first game, an introductory version, can be taught to an average-to-bright 10 year old in 15 minutes. This version also is a very good screening device for programmer trainee applicants. The advanced game is more competitive in a way that accelerates the learning process. It is aimed at teenagers and adults. COMPUT-A-TUTOR© (which sells for $5.99 including postage and handling) provides a painless and entertaining introduction to programming.
(For more information, circle #49 on the Reader Service Card.)

## Memories

### EXPANDACORE-18 MEMORY SYSTEM / Cambridge Memories, Inc.

The field-expandable memory system, called ExpandaCore-18, available in a basic 4096 18-bit version packaged on two plug-in circuit boards, may be expanded in 4096-word increments by plugging in an additional storage board containing a core stack and associated drive and sense circuitry. The low-cost core memory provides up to 16,384 18-bit words in only three inches of rack space.

The new memory has full cycle time of one microsecond. Access time is 350 nanoseconds over a $0^{o}$ to $50^{o}$ C. temperature range. Operating modes include read/restore, clear/write, read/modify/write and byte control (which allows the system to perform as an eight- or nine-bit memory with no increase in access or cycle time).

The system is designed primarily for use as main memory in mini-computers. Other applications are expected in data terminals, digital controllers, numerical controllers, and digital communications buffers. ExpandaCore-18 is also available in 12- and 16-bit capacities.
(For more information, circle #50 on the Reader Service Card.)

### MODEL CO600 LINC TAPE SYSTEM / Computer Operations, Inc.

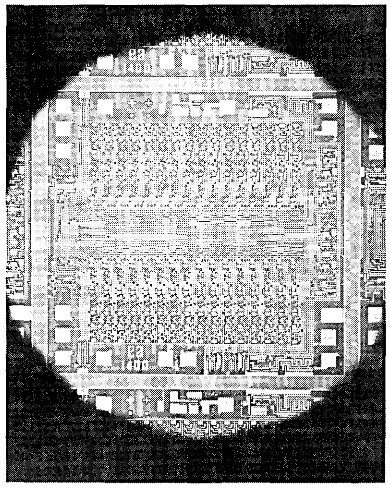
The C0600 LINC Tape System is a random address, mass storage device for the Varian Data 620/i computer. In the basic system, two identical tape transports are individually addressable from the computer. Up to eight transports may be addressed in a fully implemented system. A complete software package also is provided.

Each C0600 tape stores 102,400 16- or 18-bit words. Thus, without changing reels, 204,800 words are available. Data transfer rate is 4.2 KHz. Data is addressable in 256 word blocks. Since the reels are easily removable, there is no limit to the amount of data that can be stored.

The LINC Tape Systems are available on special order for other small and medium scale digital computers.
(For more information, circle #51 on the Reader Service Card.)

### 128-BIT READ/WRITE RANDOM ACCESS MEMORY / Electronic Arrays, Inc.

The 128-bit memory, designated EA 1400, is an off-the-shelf MOS Read/Write Random Access Memory. It is organized as 64 words, 2 bits per word, and is primarily for applications in digital computer and computer related equipments. The EA 1400 has nondestructive readout, bipolar output drive capability and low power (135 mW typical @ 1 MHz read rate). Access time is 1 microsecond or less over the temperature range of $-55^{o}$C to $+85^{o}$C.



All decoding circuitry is included on the monolithic chip to simplify its use and to keep the number of package leads to a minimum. A chip disable feature on the output permits coupling together of a number of devices to form expanded memories.
(For more information, circle #52 on the Reader Service Card.)

## Software

ACCOUNTS PAYABLE SYSTEM / Computer Processing Corp. / For use with IBM System/360 Model 25 (32K) and up. System is applicable to manufacturing, distributing and retail concerns. It is designed to be run on a weekly basis, generating both weekly and monthly reports. Weekly reports include an Edit Report, Invoice Register, Payment Checks, Cash Requirements Report and a Cash Disbursement Report. Monthly reports include a Monthly Purchase Journal and an Expense Distribution Report. Cost of the system (marketed by National Software Exchange) is $16,000 and includes a full guarantee and 4 consecutive days of on-site training and support.
(For more information, circle #53 on the Reader Service Card.)

EZPERT / Systonetics, Inc. / Automatically produces plots of PERT TIME networks by means of computer driven digital plotters. The software package was designed to be operated through the simple addition of 2 control cards to the basic PERT deck setup. The new program contains no manual phases and interfaces directly with IBM,

Control Data, Univac or any PERT TIME systems, to automatically generate PERT networks.
(For more information, circle #54 on the Reader Service Card.)

HELP© — Highly Extendable Languages Processor (Bailey's Processor) / Advanced Computer Techniques Corporation / A natural language general purpose macrogenerator; HELP simplifies the specification, implementation, maintenance and documentation of programs. It can be used to extend and/or alter conventional computer languages, create application-oriented procedural languages, or implement generative software packages of all kinds.
(For more information, circle #55 on the Reader Service Card.)

INQUIRY & REPORTING SYSTEM / Sigma Data Computing Corp. / A general purpose information management system for extracting information from computer files, performing basic data processing operations, and producing card, printer, tape and disk output. Both programmers and nonprogrammers can quickly learn the easy-to-use system. INQUIRY & REPORTING SYSTEM operates on IBM/360 equipment under Disk Operating System (DOS) or Operating System (OS) (minimum configuration — Model 25 with 32K bytes memory); and RCA Spectra 70 Series under TDOS or DOS (minimum configuration — Model 35 with 32K bytes memory.
(For more information, circle #56 on the Reader Service Card.)

Real Estate Risk Analysis Program (RERA) / Software Services, Inc. / Uses probability uncertainty techniques developed at the Harvard Business School. The user inputs all relevant variables for a real estate development analysis; conditions of uncertainty are allowed for in the input; and the output reflects the range and probability of cash requirements and discounted return on investment.
(For more information, circle #57 on the Reader Service Card.)

SYSTEM 6403 / Data Systems Analysts, Inc., Pennsauken, N.J. / Proprietary software system for the analysis and optimization of computer programs. System 6403 predicts a program's performance by determining mean value and standard deviation of running time and core or channel utilization of programs. It is available in batch mode on any computer with a minimal FORTRAN IV; also as an inter-active time-sharing program — equipped with a complete editing facility.
(For more information, circle #58 on the Reader Service Card.)

## Peripheral Equipment

### SELF-SCAN PANEL DISPLAY / Burroughs Corporation

A technical breakthrough has been achieved in Burrough's new display device. The Self-Scan Panel Display is an adaptation of the dot matrix technique, and embodies a scanning technique which eliminates up to 90 percent of the electronic gear traditionally required to operate dot matrix display devices. The new panel, only ¼" in depth, offers wide design possibilities not available with the bulkiness of cathode ray tube type displays.

Production is scheduled for early 1970. Initially, there will be two configurations available: the first is a 16-digit numerical and special symbol display for use in electronic calculators; the second, a 16-digit display with associated memory, will have application in cash registers, data communications terminals and terminal computers, and scientific instruments.
(For more information, circle #59 on the Reader Service Card.)

### 2000 SERIES PRINTER / Digitron Corporation

The new low-cost, solid-state, digital printer, designated as the 2000 series, has been designed especially for low speed print-out systems. The new printer can print from 4 up to 20 columns at 60 lines per minute. Input may be from -30 to +30 vdc with 100 K ohms input impedance and is BCD parallel entry 8421, 4221, or 2421. Options available include internal clock print-out; log index; decimal point or colon; and special print fonts.
(For more information, circle #60 on the Reader Service Card.)

### MERITAG DATA SYSTEM / Dennison Mfg. Co.

The keystone in Dennison's MERITAG© Data System is the MERITAG (magnetic encoded retail information tag) ticket. The MERITAG looks and functions like a merchandise ticket. The ticket, about one-eighth the size of a punched card, has the capacity for 48 characters of printed information on one side; the same data is magnetically encoded on two circular tracks at the center of the ticket's other side. The MERITAG Data System currently includes the MERITAG ticket, ticket coder and batch reader.

Although the MERITAG Data System has a number of potential applications, its initial use is within a computerized retail information system; it is currently in use at 50 J. C. Penney stores in the Los Angeles area. The building-block capabilities of the system permit a user to establish a free-standing batch system and expand to a completely computerized point-of-sale system. The MERITAG Ticket Reader serves as an alternate data collection device to point-of-sale terminals, providing the means to batch-process ticket data on-line or off-line to magnetic tape for later processing.
(For more information, circle #61 on the Reader Service Card.)

### DCT TYPEWRITER / Microdyne, Inc.

The Microdyne DCT typewriter is a low-cost input/output defice for use as a remote message transmitter and/or receiver, an automatic data collector and distributor, or as a general office typewriter. Data is transmitted and received in coded form. All standard codes can be furnished through electronic interfacing to meet any requirements.

The DCT has a readout speed of approximately 15 characters per second, a 15" and 11" paper capacity, upper and lower case characters, and 6-bit IBM correspondence code circuit operation. The device is available in desk top, console and portable terminal models. Options include electronic parity checking, code conversion compatibility, and a low cost incremental tapedeck.
(For more information, circle #62 on the Reader Service Card.)

### GRAPHIC RECORDER / Valtec Corporation

The Valtec Model 1024 graphic recorder, a hard-copy display device, is designed specifically to interface with computers, computer peripherals, data terminals, and a variety of other digital and analog data sources. Plug-in signal conditioning modules adapt the recorder to the type of signal to be processed. Separate modules are used for the horizontal and vertical axes, so any combination of BCD, binary, and analog signals can be combined into a single graphic record.

Data is recorded on a 10.24-inch square plot, printed on standard Z-fold computer printout paper. A magazine within the recorder holds a 100-sheet pack of paper which is advanced by mechanical linkage that can be actuated by pushbutton or by

remote program signals. Manual paper changing has been completely eliminated. The finished record is in a form familiar to data-processing personnel.
(For more information, circle #63 on the Reader Service Card.)

## Data Processing Accessories

### COMPUTER TAPE CLEANER / Wright Line

This new computer tape cleaner uses a pulsing 60 cycle per second vacuum to shake loose oxide, dust and other contaminants from the tape surface. The loosened particles are then sucked away through collector ports in the cleaning head by the vacuum source and trapped in a glass filter bowl. The principle of vibration and vacuum eliminates the need for scrapers and wipers, thereby reducing operating costs.

Speed is an important feature of the new equipment. An entire 2400 ft. reel goes through its dual pass cleaning cycle in less than four minutes.
(For more information, circle #64 on the Reader Service Card.)

### MAGNETIC TAPE ANALYZER / Controltex, Inc.

The Model 156 Magnetic Tape Analyzer, suitable for research, developmental or quality assurance operations, indicates position, amplitude, shape and flux polarization of magnetic bits on half-inch tape. The Analyzer also enables detection of phenomena contributing to signal errors in high-density recording.

Provisions are included for writing as well as reading tape in moving and stationary modes. Output terminals are provided for single-ended or differential connection to a chart recorder. The instrument weighs 12 pounds and is enclosed in a compact attache-type case. Models are available to handle other standard tape widths.
(For more information, circle #65 on the Reader Service Card.)

## COMPUTING/TIME-SHARING CENTERS

### ITT DATA SERVICES ST. LOUIS CENTER TO SERVE 12-STATE AREA

ITT Data Services, a division of International Telephone and Telegraph Corp., has opened a large-scale computer center in St. Louis, Mo., to supply the full range of data processing services to business, educational, government and scientific organizations in a 12-state area. The new center is headquarters for ITT's Central Region and the hub of its computer time-sharing service. It also will provide programming and systems design services, and handle batch data processing for other organizations throughout the region. The center is geared to around the clock operations.
(For more information, circle #66 on the Reader Service Card.)

### SECOND AL/COM TIME-SHARING SYSTEM NOW OPERATIONAL

Users of the AL/COM Time Sharing Service have direct access to the "Dual AL-10 Computer System" of Applied Logic Corporation located at Princeton, N.J., through telephone lines and AL/COM terminal equipment. Applied Logic recently announced that the second "Dual AL-10 System" of the coast-to-coast network is now in operation. Each Dual AL-10 System is comprised of two DEC PDP-10 Central Processors and massive core memory plus drum, disk and tape units, augmented by several satellite computers and special Applied Logic interface equipment. Each user has at his command core capacity totaling 32,000 words (36 bit) and disk files of 1,250,000 characters.

The new system includes provision for IBM 2741 terminal equipment and equivalent devices with upper/lower case printing, as well as improved file protection. A third system will be operational soon.
(For more information, circle #67 on the Reader Service Card.)

## COMPUTER-RELATED SERVICES

### "TRUTH-IN-LENDING" SERVICE NOW OFFERED BY FIRM IN CALIFORNIA

A simple way to make the complicated calculations required under the new "Truth-in-Lending" Act is available from Credit Data Corp. (Anaheim). CDC has programmed the Federal Reserve System's formula for computing Irregular Payment contracts as required by Regulation "Z". The program (run on an IBM System/360, Model 50) is on-line 12 hours a day, 7 days a week. Subscribers call in through a toll free telephone network.

A credit grantor dials his assigned CDC telephone number and gives the operator the information necessary to calculate the Annual Percentage Rate. The operator, equipped with a 2260 video terminal, enters the input and, in seconds, retrieves the Annual Percentage Rate, along with an authorization number. Every evening hard copy verification of the complete transaction is sent to subscribers. Six states, including California, are now part of the network; others will be added as demand increases.
(For more information, circle #68 on the Reader Service Card.)

## NEW LITERATURE

### OPERATIONAL ANALYSIS REPORTS

The scope and coverage offered by SOFTWARE PACKAGES: AN ENCYCLOPEDIC GUIDE (see Computers and Automation, December, 1968, page 62) has been increased with the announcement by System Interaction Corp. (New York, N.Y.) of the availability of Operational Analysis Reports. A complete service may now include the ENCYCLOPEDIC GUIDE and Operational Analysis Reports — in three volumes. Individual Operational Analysis Reports are available to subscribers of SOFTWARE PACKAGES: AN ENCYCLOPEDIC GUIDE.

Operational Analysis Reports will enable Data Processing Management to evaluate alternatives offered by the "unbundled" market. Software packages marketed by main-frame manufacturers and independent vendors are now described in thorough systems summaries, in addition to machine-oriented specification sheets. Update services are available on an annual basis.
(For more information, circle #69 on the Reader Service Card.)

# NEW CONTRACTS

| TO | FROM | FOR | AMOUNT |
|---|---|---|---|
| General Electric Co. | U.S. Army Corps of Engineers | Installation of GE information systems at 42 sites in 37 cities throughout the U. S.; it is intended to establish on-line communications between the nine Corp of Engineers' centers, creating a nationwide ADP network; a combination of business and civil engineering programs will be performed by the systems | $10.1 million |
| Varian Data Machines, Palo Alto, Calif. | Burroughs Corp. | Modified Varian 520/i digital computers and related equipment for use as controllers for remote peripherals and in data concentrators in communications networks to provide remote access to large Burroughs computers | $8 million (approximate) |
| Burroughs Defense, Space and Special Systems Group, Paoli, Calif. | U.S. Army Electronics Command, Fort Monmouth, N.J. | Nine medium-scale B3500 computer systems for installation in various locations throughout the Continental Armies and Major Overseas Commands (CARMOC) to provide increased capabilities in major command information systems | $6.1 million |
| | Martin Marietta Corp., Orlando, Fla. | Thirty-five additional D84 computer systems used with the U.S. Army's PERSHING 1A missile | $5.2 million |
| Burroughs Corp., Detroit, Mich. | U.S. Post Office Department, Bureau of Facilities, Washington, DC. | Continuing production and installation of letter sorting machines as part of the Department's program of mechanization of mail handling; contract calls for 39 sorters | $4.9 million |
| Control Data Corporation | Iben Data Systems, Los Angeles, Calif. | A CDC 6500 computer system; Iben Data Sys- is an independent computer services facility and software house | $4.5 million |
| Scientific Resources Corp., Montgomeryville, Pa. | Sonatrach, Algiers, Algeria | Establishment of a major computer center complex in Algiers, Algeria | $4.5 million |
| Federal Electric Corp., Paramus, N.J. | National Aeronautics and Space Administration (NASA) | Engineering and technical specialists to aid NASA in documenting the results of the agency's continuing R&D program in space technology | $4.1 million |
| Ampex Corp., Redwood City, Calif. | U.S. Government | Designing, building and delivering an on-line random access bulk computer memory with a storage capacity of two trillion bits of information | $4.1 million |
| Sperry Rand Corporation, Univac Div., Philadelphia, Pa. | The Bunker-Ramo Corporation | A dual UNIVAC 1108 computer system which will form the central processing facility of a nationwide third generation network at new financial data center | $4 million |
| Comcet Inc., Rockville, Md. | Information Network Corp., Phoenix, Ariz. | Ten Comcet 40 systems, ten Comcet 20 systems, and twenty Comcet 10 systems to serve as the communications systems for IBM 360 computers | $2,642,000 |
| Electronic Laboratories, Inc., Houston, Texas | Federal Aviation Administration | The manufacture of 21 maintenance monitors for the computerized air traffic control system now being installed by FAA | $2,535,779 |
| Compunet Ltd., Sydney, Australia | Sperry Rand Corporation, Univac Div., Philadelphia, Pa. | A UNIVAC 1108 computer system which will be used to process scientific, engineering and business data for firm's clients | $2.3 million |
| Computer Knowledge Corp., San Antonio, Texas | Scientific Control Corp., Carollton, Texas | One hundred DCT-132 remote data communications terminals to be used to expand firm's remote batch processing network of service bureaus throughout southern Texas | $2.27 million |
| The Bunker-Ramo Corp., Business & Industry Div., Stamford, Conn. | Pan American World Airways | 190 desk-top console data display systems for use in extending computerized check-in to seven major terminals | $1.7 million |
| RYDACOM, Miami, Fla. | Micro Systems Inc., Santa Ana, Calif. | Micro 811 computer systems to be used as part of a RYDACOM Data Processing Network for on-line inventory control and order processing for a network of warehouses located throughout the United States | $1.5+ million |
| Ampex Corp., Redwood City, Calif. | Pima College, Tucson, Ariz. | The design and installation of a complete random access audio/video instructional system for the college | $1.5 million |
| Gerber Scientific Instrument Co., So. Windsor, Conn. | Compusize, Inc., Leonia, N.J. | Automatic pattern grading systems which will be used to size and produce graded patterns for the garment industry and individual customers | $1.1 million |
| Data Disc, Inc., Palo Alto, Calif. | General Computer Systems, Inc., Dallas, Texas | Data-memory systems comprising 7200-Series Disc Memories and Model 1210 Disc Memory Controllers to be incorporated in General Computer's DATA/TAPE 2100 Computer Data Input Systems | $1 million |
| Leasco Systems & Research Corp (LS&R), Bethesda, Md. | Grumman Aerospace Corp. | Redesign of the aircraft company's automated business system | $1/2+ million |

# NEW INSTALLATIONS

| OF | AT | FOR |
|---|---|---|
| Burroughs Model 220 system | University of California, Santa Cruz, Calif. (2 systems) | Student instruction in computer science as well as in independent study projects; the systems are a gift to the University from the Allstate Foundation, a non-profit organization sponsored by the Allstate Insurance Companies |
| Burroughs B300 system | Sugardale Foods, Inc., Canton, Ohio | Accounting and payroll operations and the preparation of management reports (system valued at over $200,000) |
| Burroughs B500 system | General Medical Corp., Richmond, Va. | Facilitating accounting procedures; system will be linked with 25 Burroughs L2000 desk-size billing computers (system valued at over $200,000) |
| | Nacogdoches Computer Service, Inc., Nacogdoches, Texas | Demand deposit, savings and time accounting operations to the two banks which founded the center, as well as to other area banks (system valued at over $180,000) |
| | Security National Bank of Battle Creek, Battle Creek, Mich. | Increasing its processing capabilities for charge card operations as well as for savings, demand deposit, payroll, proof and transit operations; also will handle data processing for other area banks |
| Burroughs B5500 system | Computer Network Corp., Washington, D. C. | Expanded time-sharing and remote computing services to its customers in a six-state area (system valued at $1,590,000) |
| Control Data 6600 system | Combustion Engineering, Inc., Windsor, Conn. | Research and development of nuclear steam supply systems, components and fuels, as well as for design and engineering of chemical process plants and petroleum refineries |
| Digital Equipment PDP-8/L | MTS Systems Corp., Minneapolis, Minn. | Automating procedures in MTS Systems Corp. equipment that previously required subjective interpretation |
| Digital Equipment PDP-12 | Massachusetts Institute of Technology, Communications Biophysics Group, Cambridge, Mass. | Auditory research experiments, for on-line control of stimuli and analysis of responses |
| EMR ADVANCE 6070 system | Gulf Oil Canada Ltd., Calgary Alberta, Canada | Seismic applications |
| GE-105 system | Metropolitan College, Milwaukee, Wis. | Computer operations, programming and systems study classes conducted by the business and technical college; system is used strictly for classroom work |
| GE-115 system | Merchandise National Bank, Chicago, Ill. | Further increasing bank's automated services |
| GE-265 system | Graphic Controls Corp., Buffalo, N. Y. | Increasing capacity of computer time-sharing services; this second system almost doubles firm's capacity |
| GE-415 system | Silver Burdett Co., a division of General Learning Corp., Morristown, N. J. | A variety of applications including processing textbook orders, inventory of textbooks stored in warehouses and depositories in several different states, sales analysis, sales estimating and general ledger and payroll applications |
| GE-635 system | General Electric Aerospace Electronics Dept., Utica, N.Y. | Centralizing data processing work and standardizing programming efforts (system valued at $2.5 million) |
| Honeywell Model 120 system | Doyle Dane Bernbach, Inc., New York, N. Y. | Replaceing a card-oriented system; the H-120 will be used for media client billing and payments, production payments, job cost accounting, partial media estimating, insertion writing and specialized media accounting |
| IBM System/360 Model 40 | State of New Jersey, Division of Motor Vehicles, Trenton, N. J. | Expansion of computer operations to stem the flood of paper work and improve service to the public |
| NCR Century 100 system | Filter Dynamics International, Inc., Cleveland, Ohio | Processing, payroll, payables and inventory |
| | J. George Fisher and Sons, Flint, Mich. | Inventory control and invoicing |
| | Pioneer Corn Company, Tipton, Ind. | Keeping track of about 80 varieties of grain in many different kernal sizes; also producing sales analysis and shipping orders |
| SDS Sigma 5 system | Miami Heart Institute, Miami, Fla. (2 systems, one scheduled for later delivery in October 1970) | Development of a total hospital management system dedicated to the diagnosis and treatment of heart disease and research into its causes |
| | Newport News Shipbuilding and Dry Dock Co. | Aiding in an experiment that will attempt to get a 100,000-ton tanker through the polar ice cap and establish a Northwest passage for transporting Alaskan oil to east coast refineries |
| UNIVAC 494 system | Beamtenheimstaettenwerk GmbH., (BHW) Hemeln, North Germany | Administering various projects under the organizations's authority: BHW is a building and loan association for employees of the W. German Government (system valued at $1.8 million) |
| UNIVAC 9200 system | Computek Corp., Tulsa, Okla. | General accounting operations for small businesses |
| | Kitt Peak National Observatory, Tucson, Ariz. | Payroll processing, accounts payable and budget preparation |
| UNIVAC 9400 system | Inter-Community Hospital, Covina, Calif. | A pilot project for a complete medical information system at the community hospital level in the U.S. |

# MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
Computers and Automation

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. Please note the variation in dates and reliability of the information. Several important manufacturers refuse to give out, confirm, or comment on any figures.

Our census seeks to include all digital computers manufactured anywhere. We invite all manufacturers located anywhere to submit information for this census. We invite all our readers to submit information that would help make these figures as accurate and complete as possible.

Part I of the Monthly Computer Census contains reports for United States manufacturers. Part II contains reports for manufacturers outside of the United States. The two parts are published in alternate months.

The following abbreviations apply:

- (A) — authoritative figures, derived essentially from information sent by the manufacturer directly to Computers and Automation
- C — figure is combined in a total
- (D) — acknowledgment is given to DP Focus, Marlboro, Mass., for their help in estimating many of these figures
- E — figure estimated by Computers and Automation
- (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
- (R) — figures derived all or in part from information released indirectly by the manufacturer, or from reports by other sources likely to be informed
- (S) — sale only, and sale (not rental) price is stated
- X — no longer in production
- \- — information not obtained at press time

SUMMARY AS OF AUGUST 15, 1969

| NAME OF MANUFACTURER | NAME OF COMPUTER | DATE OF FIRST INSTALLATION | AVERAGE OR RANGE OF MONTHLY RENTAL $(000) | NUMBER OF INSTALLATIONS In U.S.A. | Outside U.S.A. | In World | NUMBER OF UNFILLED ORDERS |
|---|---|---|---|---|---|---|---|
| Part I. United States Manufacturers | | | | | | | |
| Autonetics | RECOMP II | 11/58 | 2.5 | 30 | 0 | 30 | X |
| Anaheim, Calif. | RECOMP III | 6/61 | 1.5 | 6 | 0 | 6 | X |
| (R) (Jan. 1969) | | | | | | | |
| Bailey Meter Co. | Bailey 756 | 2/65 | 60-400 (S) | 17 | - | - | 3 |
| Wickliffe, Ohio | Bailey 855 | 4/68 | 100 (S) | 0 | - | - | 15 |
| (R) (Jan. 1969) | | | | | | | |
| Bunker-Ramo Corp. | BR-130 | 10/61 | 2.0 | 160 | - | - | X |
| Canoga Park, Calif. | BR-133 | 5/64 | 2.4 | 79 | - | - | X |
| (R) | BR-230 | 8/63 | 2.7 | 15 | - | - | X |
| (Aug. 1969) | BR-300 | 3/59 | 3.0 | 18 | - | - | X |
| | BR-330 | 12/60 | 4.0 | 29 | - | - | X |
| | BR-340 | 12/63 | 7.0 | 19 | - | - | X |
| Burroughs | 205 | 1/54 | 4.6 | 25-38 | 2 | 27-40 | X |
| Detroit, Mich. | 220 | 10/58 | 14.0 | 28-31 | 2 | 30-33 | X |
| (N) | B100 | 8/64 | 2.8 | 90 | 13 | 103 | X |
| (Jan.-May 1969) | B200 | 11/61 | 5.4 | 370-800 | 70 | 440-870 | 31 |
| | B300 | 7/65 | 9.0 | 180-370 | 40 | 220-410 | 150 |
| | B500 | 10/68 | 3.8 | 0 | 0 | 0 | 70 |
| | B2500 | 2/67 | 5.0 | 52-57 | 12 | 64-69 | 117 |
| | B3500 | 5/67 | 14.0 | 44 | 18 | 62 | 190 |
| | B5500 | 3/63 | 23.5 | 65-74 | 7 | 72-81 | 8 |
| | B6500 | 2/68 | 33.0 | 4 | 0 | 4 | 31 |
| | B7500 | 4/69 | 44.0 | 0 | 0 | 0 | 13 |
| | B8500 | 8/67 | 200.0 | 1 | 0 | 1 | 5 |
| Control Data Corp. | G15 | 7/55 | 1.6 | - | - | 295 | X |
| Minneapolis, Minn. | G20 | 4/61 | 15.5 | - | - | 20 | X |
| (N) | LGP-21 | 12/62 | 0.7 | - | - | 165 | X |
| (Feb.-Apr. 1969) | LGP-30 | 9/56 | 1.3 | - | - | 322 | X |
| | RPC4000 | 1/61 | 1.9 | - | - | 75 | X |
| | 636/136/046 Series | - | - | - | - | 29 | - |
| | 160/8090 Series | 5/60 | 2.1-14.0 | - | - | 610 | X |
| | 924/924A | 8/61 | 11.0 | - | - | 29 | X |
| | 1604/A/B | 1/60 | 45.0 | - | - | 59 | X |
| | 1700 | 5/66 | 3.8 | 65-130 | 41-50 | 106-180 | C |
| | 3100/3150 | 5/64 | 10-16 | 68-90 | 15-20 | 83-110 | C |
| | 3200 | 5/64 | 13.0 | 40-45 | 15 | 55-60 | C |
| | 3300 | 9/65 | 20-28 | 38-100 | 17-25 | 55-125 | C |
| | 3400 | 11/64 | 18.0 | 12 | 4 | 16 | C |
| | 3500 | 8/68 | 25.0 | 1 | 0 | 1 | C |
| | 3600 | 6/63 | 52.0 | 30 | 9 | 39 | C |
| | 3800 | 2/66 | 53.0 | 18 | 2 | 20 | C |
| | 6400/6500 | 8/64 | 58.0 | 23-50 | 14-17 | 37-67 | C |
| | 6600 | 8/64 | 115.0 | 32-40 | 11 | 43-51 | C |
| | 6800 | 6/67 | 130.0 | 1 | 0 | 1 | C |
| | 7600 | 12/68 | 235.0 | 1 | 0 | 1 | C |
| | | | | | | | Total: 160 E |
| Data General Corp. | NOVA | 2/69 | 8.0 (S) | 71 | 6 | 77 | 800 |
| Boston, Mass. | | | | | | | |
| (A) (Aug. 1969) | | | | | | | |
| Datacraft Corp. | DC6024 | 5/69 | 30-200 (S) | 1 | 0 | 1 | 3 |
| Ft. Lauderdale, Fla. | | | | | | | |
| (A) (Aug. 1969) | | | | | | | |
| Digital Equipment Corp. | PDP-1 | 11/60 | 3.4 | 53 | 1 | 54 | X |
| Maynard, Mass. | PDP-4 | 8/62 | 1.7 | 25 | 3 | 28 | X |
| (A) | PDP-5 | 9/63 | 0.9 | 76 | 17 | 93 | X |
| (July 1969) | PDP-6 | 10/64 | 10.0 | 14 | 5 | 19 | X |
| | PDP-7 | 11/64 | 1.3 | 59 | 27 | 86 | X |
| | PDP-8 | 4/65 | 0.5 | 945 | 378 | 1323 | C |
| | PDP-8/I | 3/68 | 0.4 | 802 | 243 | 1045 | C |
| | PDP-8/S | 9/66 | 0.3 | 575 | 269 | 844 | C |
| | PDP-8/L | 11/68 | ? | 463 | 159 | 622 | C |
| | PDP-9 | 12/66 | 1.1 | 214 | 114 | 328 | C |
| | PDP-9/L | 11/68 | ? | 6 | 8 | 14 | C |
| | PDP-10 | 12/67 | 8.0 | 72 | 19 | 91 | C |

| NAME OF MANUFACTURER | NAME OF COMPUTER | DATE OF FIRST INSTALLATION | AVERAGE OR RANGE OF MONTHLY RENTAL $(000) | NUMBER OF INSTALLATIONS In U.S.A. | Outside U.S.A. | In World | NUMBER OF UNFILLED ORDERS |
|---|---|---|---|---|---|---|---|
| Digital Equipment Corp. (cont.) | PDP-12 | 6/69 | ? | 10 | 2 | 12 | C |
| | LINC-8 | 9/66 | ? | 108 | 40 | 148 | C |
| | | | | | | | Total: 1200 E |
| Digiac Corp. (formerly Digital Electronics Inc.), Plainview, N.Y. (A) (May 1969) | Digiac 3080 | 12/64 | 19.5 (S) | 12 | - | - | 1 |
| | Digiac 3080C | 10/67 | 25.0 (S) | 4 | - | - | 1 |
| Electronic Associates Inc. Long Branch, N.J. (A) (May 1969) | 640 | 4/67 | 1.2 | 50 | - | - | 20 E |
| | 8400 | 7/65 | 12.0 | 21 | - | - | 5 E |
| EMR Computer Div. Minneapolis, Minn. (N) (May 1969) | ADVANCE 6020 | 4/65 | 5.4 | C | - | - | C |
| | ADVANCE 6040 | 7/65 | 6.6 | C | - | - | C |
| | ADVANCE 6050 | 2/66 | 9.0 | C | - | - | C |
| | ADVANCE 6070 | 10/66 | 15.0 | C | - | - | C |
| | ADVANCE 6130 | 8/67 | 5.0 | C | - | - | C |
| | ADVANCE 6135 | - | 2.6 | - | - | - | - |
| | ASI 210 | 4/62 | 3.9 | C | - | - | X |
| | ASI 2100 | 12/63 | 4.2 | C | - | - | X |
| | | | | Total: 90 E | | | Total: 30 E |
| General Electric Phoenix, Ariz. (N) (Feb.-Apr. 1969) | 105A | 6/69 | 1.3 | - | - | - | - |
| | 105B | 6/69 | 1.4 | - | 0 | - | - |
| | 105RTS | 7/69 | 1.2 | - | - | - | - |
| | 115 | 4/66 | 2.2 | 200-400 | 420-680 | 620-1080 | - |
| | 120 | - | 2.9 | - | - | - | - |
| | 130 | 12/68 | 4.5 | 0 | 0 | 0 | - |
| | 205 | 6/64 | 2.9 | 11 | 0 | 11 | - |
| | 210 | 7/60 | 16.0 | 35 | 0 | 35 | - |
| | 215 | 9/63 | 6.0 | 15 | 1 | 16 | - |
| | 225 | 4/61 | 8.0 | 145 | 15 | 160 | - |
| | 235 | 4/64 | 12.0 | 60-100 | 17 | 77-117 | - |
| | 245 | 11/68 | 13.0 | - | - | - | - |
| | 255 T/S | 10/67 | 17.0 | - | - | - | - |
| | 265 T/S | 10/65 | 20.0 | - | - | - | - |
| | 275 T/S | 11/68 | 23.0 | - | - | - | - |
| | 405 | 2/68 | 6.8 | 10-40 | 5 | 15-45 | - |
| | 410 T/S | 11/69 | 11.0 | - | - | - | - |
| | 415 | 5/64 | 7.3 | 170-300 | 70-100 | 240-400 | - |
| | 420 T/S | 6/67 | 23.0 | - | - | - | - |
| | 425 | 6/64 | 9.6 | 50-100 | 20-30 | 70-130 | - |
| | 430 T/S | 6/69 | 17.0 | - | - | - | - |
| | 435 | 9/65 | 14.0 | 20 | 6 | 26 | - |
| | 440 T/S | 7/69 | 25.0 | - | - | - | - |
| | 615 | 3/68 | 30.0 | - | - | - | - |
| | 625 | 4/65 | 41.0 | 23 | 3 | 26 | - |
| | 635 | 5/65 | 45.0 | 20-40 | 3 | 23-43 | - |
| | 645 | 7/66 | 90.0 | 4 | 0 | 4 | - |
| Process Control Computers: (A) (Aug 1969) | 4020 | 2/67 | 5.0 | 112 | 35 | 147 | 55 |
| | 4040 | 8/64 | 3.0 | 45 | 20 | 65 | - |
| | 4050 | 12/66 | 7.0 | 22 | 1 | 23 | - |
| | 4060 | 6/65 | 8.5 | 18 | 2 | 20 | - |
| Hewlett Packard Cupertino, Calif. (A) (Aug. 1969) | 2114A | 10/68 | 0.25 | - | - | 251 | - |
| | 2115A | 11/67 | 0.41 | - | - | 530 | - |
| | 2116A | 11/66 | 0.6 | - | - | 357 | - |
| | 2116B | 9/68 | 0.65 | - | - | 628 | - |
| | | | | | | Total: 1766 | |
| Honeywell Computer Control Div. Framingham, Mass. (N) (Jan.-Apr. 1969) | DDP-24 | 5/63 | 2.65 | - | - | 90 | X |
| | DDP-116 | 4/65 | 0.9 | - | - | 230 | - |
| | DDP-124 | 3/66 | 2.2 | - | - | 70 | - |
| | DDP-224 | 3/65 | 3.5 | - | - | 50 | - |
| | DDP-516 | 9/66 | 0.8 | - | - | 280 | - |
| | H632 | - | 3.2 | - | - | 2 | - |
| Honeywell EDP Division Wellesley Hills, Mass. (N) (Jan.-Apr. 1969) | H-110 | 8/68 | 2.5 | 10-20 | 2-5 | 12-25 | 0 |
| | H-120 | 1/66 | 4.0 | 260-600 | 140-180 | 400-780 | - |
| | H-125 | 12/67 | 5.0 | 20-90 | 10-15 | 30-105 | - |
| | H-200 | 3/64 | 8.5 | 450-800 | 210-300 | 660-1100 | - |
| | H-400 | 12/61 | 6.2 | 32-40 | 14-30 | 46-70 | X |
| | H-800 | 12/60 | 28.0 | 42-50 | 10-12 | 52-62 | X |
| | H-1200 | 2/66 | 10.0 | 65-190 | 31-50 | 76-240 | - |
| | H-1250 | 7/68 | 12.0 | 2-15 | 2-5 | 4-20 | - |
| | H-1400 | 1/64 | 14.0 | 6 | 1-2 | 7-8 | X |
| | H-1800 | 1/64 | 50.0 | 8-12 | 3 | 11-15 | X |
| | H-2200 | 1/66 | 16.0-26.0 | 32-100 | 21-25 | 53-125 | - |
| | H-3200 | 2/70 | 18.0 | 0 | 0 | 0 | - |
| | H-4200 | 8/68 | 21.0-26.0 | 1-2 | 0 | 1-2 | - |
| | H-8200 | 12/68 | 50.0 | 1 | 0 | 1 | - |
| IBM White Plains, N.Y. (N) (D) (Jan.-May 1969) | System/3 | - | 1.1 | 0 | 0 | 0 | - |
| | 305 | 12/57 | 3.6 | 40 | 15 | 55 | - |
| | 650 | 10/67 | 4.8 | 50 | 18 | 68 | - |
| | 1130 | 2/66 | 1.7 | 2580 | 1227 | 3807 | - |
| | 1401 | 9/60 | 5.4 | 2210 | 1836 | 4046 | - |
| | 1401-G | 5/64 | 2.3 | 420 | 450 | 870 | - |
| | 1401-H | 6/67 | 1.3 | 180 | 140 | 320 | - |
| | 1410 | 11/61 | 17.0 | 156 | 116 | 272 | - |
| | 1440 | 4/63 | 4.1 | 1690 | 1174 | 2864 | - |
| | 1460 | 10/63 | 10.0 | 194 | 63 | 257 | - |
| | 1620 I, II | 9/60 | 4.1 | 285 | 186 | 471 | - |
| | 1800 | 1/66 | 5.0 | 415 | 148 | 563 | - |
| | 7010 | 10/63 | 26.0 | 67 | 14 | 81 | - |
| | 7030 | 5/61 | 160.0 | 4 | 1 | 5 | - |
| | 704 | 12/55 | 32.0 | 12 | 1 | 13 | - |
| | 7040 | 6/63 | 25.0 | 35 | 27 | 2 | - |
| | 7044 | 6/63 | 36.5 | 28 | 13 | 41 | - |
| | 705 | 11/55 | 38.0 | 18 | 3 | 21 | - |

| NAME OF MANUFACTURER | NAME OF COMPUTER | DATE OF FIRST INSTALLATION | AVERAGE OR RANGE OF MONTHLY RENTAL $(000) | NUMBER OF INSTALLATIONS In U.S.A. | Outside U.S.A. | In World | NUMBER OF UNFILLED ORDERS |
|---|---|---|---|---|---|---|---|
| IBM (cont.) | 7070, 2 | 3/60 | 27.0 | 10 | 3 | 13 | - |
| | 7074 | 3/60 | 35.0 | 44 | 26 | 70 | - |
| | 7080 | 8/61 | 60.0 | 13 | 2 | 15 | - |
| | 7090 | 11/59 | 63.5 | 4 | 2 | 6 | - |
| | 7094-I | 9/62 | 75.0 | 10 | 4 | 14 | - |
| | 7094-II | 4/64 | 83.0 | 6 | 4 | 10 | - |
| | 360/20 | 12/65 | 2.8 | 4690 | 3276 | 7966 | - |
| | 360/25 | 1/68 | 5.3 | 0 | 4 | 4 | - |
| | 360/30 | 5/65 | 9.3 | 5075 | 3144 | 8219 | - |
| | 360/40 | 4/65 | 19.0 | 1260 | 498 | 1758 | - |
| | 360/44 | 7/66 | 15.0 | 65 | 13 | 78 | - |
| | 360/50 | 8/65 | 33.0 | 480 | 109 | 589 | - |
| | 360/65 | 11/65 | 70.0 | 175 | 31 | 206 | - |
| | 360/67 | 10/66 | 138.0 | 9 | 4 | 13 | - |
| | 360/75 | 2/66 | 81.5 | 14 | 3 | 17 | - |
| | 360/85 | - | 115.0 | 0 | 0 | 0 | - |
| | 360/90 | 11/67 | 150.0 | 5 | 0 | 5 | - |
| Interdata | Model 2 | 7/68 | 0.25 | - | - | 13 | 1 |
| Oceanport, N.J. | Model 3 | 3/67 | 0.4 | - | - | 150 | 23 |
| (A) (June 1969) | Model 4 | 8/68 | 0.6 | - | - | 55 | 36 |
| NCR | 304 | 1/60 | 14.0 | 15 | 2 | 17 | X |
| Dayton, Ohio | 310 | 5/61 | 2.5 | 8 | 0 | 8 | X |
| (R) | 315 | 5/62 | 8.7 | 460 | 400 | 860 | - |
| (May 1969) | 315 RMC | 9/65 | 12.0 | 110 | 35 | 145 | - |
| | 390 | 5/61 | 1.9 | 240 | 500 | 740 | - |
| | 500 | 10/65 | 1.5 | 1800 | 950 | 2750 | - |
| | Century 100 | 9/68 | 2.7 | 110 | 12 | 122 | - |
| | Century 200 | - | 7.5 | 0 | 0 | 0 | - |
| Pacific Data Systems Inc. | PDS 1020 | 2/64 | 0.7 | 145 | - | - | 10 |
| Santa Ana, Calif. | | | | | | | |
| (N) (Jan. 1969) | | | | | | | |
| Philco | 1000 | 6/63 | 7.0 | 16 | - | - | X |
| Willow Grove, Pa. | 2000-210, 211 | 10/58 | 40.0 | 16 | - | - | X |
| (N) (Jan. 1969) | 2000-212 | 1/63 | 52.0 | 12 | - | - | X |
| Potter Instrument Co., Inc. | PC-9600 | - | 16.0 (S) | - | - | - | - |
| Plainview, N.Y. | | | | | | | |
| (A) (May 1969) | | | | | | | |
| RCA | 301 | 2/61 | 7.0 | 140-290 | 100-130 | 240-420 | - |
| Cherry Hill, N.J. | 501 | 6/59 | 14.0-18.0 | 22-50 | 1 | 23-51 | - |
| (N) | 601 | 11/62 | 14.0-35.0 | 2 | 0 | 2 | - |
| | 3301 | 7/64 | 17.0-35.0 | 24-60 | 1-5 | 25-65 | - |
| | Spectra 70/15 | 9/65 | 4.3 | 90-110 | 35-60 | 125-170 | - |
| | Spectra 70/25 | 9/65 | 6.6 | 68-70 | 18-25 | 86-95 | - |
| | Spectra 70/35 | 1/67 | 9.2 | 65-100 | 20-50 | 85-150 | - |
| | Spectra 70/45 | 11/65 | 22.5 | 84-180 | 21-55 | 105-235 | - |
| | Spectra 70/46 | - | 33.5 | 1 | 0 | 1 | - |
| | Spectra 70/55 | 11/66 | 34.0 | 11 | 1 | 12 | - |
| Raytheon | 250 | 12/60 | 1.2 | 155 | 20 | 175 | X |
| Santa Ana, Calif. | 440 | 3/64 | 3.6 | 20 | - | - | X |
| (A) | 520 | 10/65 | 3.2 | 26 | 1 | 27 | X |
| (Aug. 1969) | 703 | 10/67 | (S) | 109 | 20 | 129 | 8 |
| | 706 | 5/69 | (S) | 4 | 1 | 5 | 23 |
| Scientific Control Corp. | 650 | 5/66 | 0.5 | 23 | - | - | - |
| Dallas, Texas | 655 | 10/66 | 1.9 | 84 | - | - | - |
| (A) | 660 | 10/65 | 2.0 | 40 | - | - | - |
| (May 1969) | 670 | 5/66 | 2.7 | 1 | - | - | - |
| | 4700 | 4/69 | 2.0 | 1 | - | - | - |
| | 6700 | - | 30.0 | 0 | - | - | - |
| | | | | | | | Total: 70 E |
| Scientific Data Systems, Inc. | SDS-92 | 4/65 | 1.5 | 10-60 | 2 | 12-62 | - |
| El Segundo, Calif. | SDS-910 | 8/62 | 2.0 | 150-170 | 7-10 | 157-180 | - |
| (N) | SDS-920 | 9/62 | 2.9 | 93-120 | 5-12 | 98-132 | - |
| (Feb.-Apr. 1969) | SDS-925 | 12/64 | 3.0 | 20 | 1 | 21 | - |
| | SDS-930 | 6/64 | 3.4 | 159 | 14 | 173 | - |
| | SDS-940 | 4/66 | 14.0 | 28-35 | 0 | 28-35 | - |
| | SDS-9300 | 11/64 | 8.5 | 21-25 | 1 | 22-26 | - |
| | Sigma 2 | 12/66 | 1.8 | 60-110 | 10-15 | 70-125 | - |
| | Sigma 5 | 8/67 | 6.0 | 15-40 | 6-18 | 21-58 | - |
| | Sigma 7 | 12/66 | 12.0 | 24-35 | 5-9 | 29-44 | - |
| Standard Computer Corp. | IC 4000 | 12/68 | 9.0 | 6 | - | 6 | 8 E |
| Los Angeles, Calif. | IC 6000 | 5/67 | 16.0 | 9 | - | 9 | - |
| (N) (Aug. 1969) | IC 7000 | 6/69 | 17.0 | 3 | - | 3 | 10 E |
| Systems Engineering Laboratories | 810 | 9/65 | 1.1 | 24 | - | - | X |
| Ft. Lauderdale, Fla. | 810A | 8/66 | 0.9 | 131 | - | - | 34 E |
| (A) | 810B | 9/68 | 1.2 | 20 | - | - | 18 E |
| (May 1969) | 840 | 11/65 | 1.5 | 4 | - | - | X |
| | 840A | 8/66 | 1.5 | 33 | - | - | X |
| | 840MP | 1/68 | 2.0 | 15 | - | - | 20 E |
| UNIVAC (Div. of Sperry Rand) | I & II | 3/51 + 11/57 | 25.0 | 23 | - | - | X |
| New York, N.Y. | III | 8/62 | 21.0 | 25 | 6 | 31 | X |
| (R) | File Computers | 8/56 | 15.0 | 13 | - | - | X |
| (Jan.-May 1969) | Solid-State 80 I, II, 90, I, II, & Step | 8/58 | 8.0 | 210 | - | - | X |
| | 418 | 6/63 | 11.0 | 76 | 36 | 112 | 20 |
| | 490 Series | 12/61 | 30.0 | 75 | 11 | 86 | 35 |
| | 1004 | 2/63 | 1.9 | 1502 | 628 | 2130 | 20 |
| | 1005 | 4/66 | 2.4 | 637 | 299 | 936 | 90 |
| | 1050 | 9/63 | 8.5 | 138 | 62 | 200 | 10 |
| | 1100 Series (except 1107, 1108) | 12/50 | 35.0 | 9 | 0 | 9 | X |
| | 1107 | 10/62 | 57.0 | 8 | 3 | 11 | X |
| | 1108 | 9/65 | 68.0 | 38 | 18 | 56 | 75 |
| | 9200 | 6/67 | 1.5 | 127 | 48 | 175 | 850 |
| | 9300 | 9/67 | 3.4 | 106 | 38 | 144 | 550 |

| NAME OF MANUFACTURER | NAME OF COMPUTER | DATE OF FIRST INSTALLATION | AVERAGE OR RANGE OF MONTHLY RENTAL $(000) | NUMBER OF INSTALLATIONS In U.S.A. | Outside U.S.A. | In World | NUMBER OF UNFILLED ORDERS |
|---|---|---|---|---|---|---|---|
| UNIVAC (cont.) | 9400 | 5/69 | 7.0 | 3 E | 0 | 3 E | 60 |
| | LARC | 5/60 | 135.0 | 2 | 0 | 2 | - |
| Varian Data Machines | 620 | 11/65 | 0.9 | - | - | 75 | 0 |
| Newport Beach, Calif. | 620i | 6/67 | 0.5 | - | - | 480 | 300 |
| (A) | 520i | 10/68 | - | - | - | 20 | 175 |
| (May 1969) | | | | | | | |

## REPORT FROM GREAT BRITAIN

*(Continued from page 49)*

puter industry following the disastrous post-war policies of short-sighted non-technical European governments.

But there is no salvation for Europe in the formation of a giant "supranational" computer company with feet of clay and run by committees. Far better and probably the only way out now would be to allocate manufacture on a regional basis to groups which have proved themselves particularly good at electro-mechanical work, magnetic technology, processor assembly, software compiling and the like.

Unfortunately, every small group set up with government blessing anywhere in Europe sees itself as the saviour of national data processing honor and wants to go for the whole market, from desk-top to super-scale, taking in time-sharing and a full range of peripherals on the side. Yet how many of the U.S. computer companies make all their own peripherals and how many peripheral projects have fallen by the wayside in America?

It is amazing to me that any European businessman, looking for instance at what NCR has had to spend its $150m of "launching money" on to get two machines from the New Century range into production and on to the market, can contemplate trying to do a much bigger range of equipment on a tiny budget. No one seems to realize that the years of wild spending in America on computer project launches have gone for good and that NCR cost figures are about the most valid one could take to apply to any European projection.

Ted Schoeters

*Ted Schoeters*
*Stanmore, Middlesex*
*England*

## CALENDAR

*(Continued from page 50)*

Nov. 15-16, 1969: ACUTE (Accountants Computer Users Technical Exchange), Jack Tar, San Francisco, Calif.; contact ACUTE, 947 Old York Rd., Abington, Pa. 19001

Nov. 17-19, 1969: IEEE Eighth Symposium on Adaptive Processes, The Pennsylvania State Univ., State College, Pa.; contact Dr. George J. McMurtry, Program Chairman IEEE 1969 (8th) Symposium on Adaptive Processes, Dept. of Electrical Engineering, The Pennsylvania State Univ., University Park, Pa. 16802

Nov. 18-20, 1969: Fall Joint Computer Conference, Convention Hall, Las Vegas, Nev.; contact American Federation for Information Processing (AFIPS), 210 Summit Ave., Montvale, N.J. 07645.

Nov. 20-21, 1969: Conference '69: 1969 Data Processing Conference sponsored by the Empire Div. (13) of the Data Processing Management Association (DPMA), Statler Hilton Hotel, New York, N.Y.; contact Registrar, Conference '69, P.O. Box 1926, Grand Central Station, New York, N.Y. 10017

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

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

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

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

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

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

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

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

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

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

# BOOK REVIEWS

**Neil Macdonald**
**Assistant Editor**
**Computers and Automation**

We publish here citations and brief reviews of books and other publications which have a significant relation to computers, data processing, and automation, and which have come to our attention. We shall be glad to report other information in future lists if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, hardbound or softbound, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning *Computers and Automation.*

**Wilkes, M. V. / Time-Sharing Computer Systems / American Elsevier Publishing Company, Inc., 52 Vanderbilt Ave., New York, N.Y. 10017 / 1968, hardbound, 102 pp., $4.95**

"This book is concerned with a development that is revolutionizing our idea of what a computer system should be. 'Time Sharing' came about not as the result of a discovery of an entirely new principle, but more by the realization that the technical means existed to make a big advance possible." Time sharing makes possible remote simultaneous use of a big computer by many individuals each acting as if he had the computer to himself. This book gives a user's view of time sharing systems, and describes how such systems are designed. The seven chapters are: Introduction; A User's View of Time Sharing; Early Systems and General Principles; Design of a System; Satellite Computers and Graphical Displays; Filing Systems; Operational and Managerial Aspects of Time Sharing. References cover pp. 97-99, and an index, pp. 101-102.

The author is director of the mathematical laboratory at the University of Cambridge, Cambridge, England. He is a distinguished computer scientist.

**Minsky, Marvin, Editor, and 7 Authors / Semantic Information Processing / The M.I.T. Press, 50 Ames St., Cambridge, Mass. 02142 / 1968, hardbound, 438 pp., $?**

This book is composed of an introduction and eight more chapters. Chapters include: "SIR: A Computer Program for Semantic Information Retrieval" by Bertram Raphael; "Semantic Memory" by M. Ross Quillian; "A Deductive Question-Answering System" by Fischer Black; and "Programs with Common Sense" by John McCarthy.

Each chapter in the book represents an experiment involving computer programs which solve different kinds of "artificial intelligence" problems. These problems concern semantics. The methods used in these experiments are original, and each is a first trial of a previously untested idea. The editor likens the ability of these programs to solve problems to the potential of a certain school age level. Much of the material in the book is a slightly modified version of important and interesting Ph.D. theses at M.I.T.

**Stein, Seymour, and J. Jay Jones / Modern Communication Principles / McGraw-Hill Book Co., 330 West 42 St., New York, N. Y. 10036 / 1967, hardbound, 382 pp., $?**

This book is a comprehensive introduction to modern communication principles, with special attention to digital radio communications. The book presents advanced theoretical models involved in radio communication. The authors present the subject as a "systems engineering" approach to modern communication systems and their design. The 17 chapters include: "Frequency Spectra and Fourier Theory"; "Correlation of Deterministic Signals"; "Amplitude (Linear) Modulation"; "Binary On-Off Keying"; "Matched-Filters and Correlation Detection"; "Channel Capacity and Error-Control Coding", "Diversity Techniques". There is an index.

The book is an outgrowth of a "concise review of modern radio communications" prepared within Sylvania for Sylvania's use. The authors are (1) the Director of the Communication Systems Laboratories of Sylvania Electronic Systems and (2) a Senior Engineering Specialist in the Communication Sciences Department of Philco Western Development Laboratories. The level of the book assumes advanced calculus and its applications in Fourier series; etc.

**Hsu, Jay C., and A. U. Meyer / Modern Control Principles and Applications / McGraw-Hill Book Co., 330 West 42 St., New York, N. Y. 10036 / 1968, hardbound, 769 pp., $24.50**

This book provides a reasonably detailed working knowledge of the pertinent modern theories of control without wading through the myriad of publications in the field. It is also intended for those who wish to apply these theories to concrete problems. It is aimed at first-year graduate students and qualified undergraduates, as well as working engineers who wish to keep abreast of the development in modern control theory.

The three parts, including 17 chapters, are: Introduction and Basic Techniques; System Stability Analysis; and Optimum System Performance Analysis. There are three appendices, a bibliography, and an index. The book is typed and then photo-offset. It is full of high-level mathematics.

**Hoeschele, David F. Jr. / Analog-to-Digital/Digital-to-Analog Conversion Techniques / John Wiley & Son, Inc., Publishers, One Wiley Dr., Somerset, N. J. 08873 / 1968, hardbound, 455 pp., $15.95**

The purpose of this book is to help engineers, scientists and technicians to design and use Analog-to-Digital and Digital-to-Analog conversion equipment, and to promote the use of such equipment and techniques. The author has spent over 12 years designing and developing new circuit techniques for A/D and D/A conversion equipment at Burroughs and General Electric. At present Mr. Hoeschele is an electronic consultant in the missile and space division of G.E.

Contents include: "Conversion Systems", "Error Allocation/Analysis", "Conversion Logic", "Switching Analog Voltages", "Reference Voltages", "Analog Voltage Comparators", "Shaft-Position-to-Digital Encoding", etc. There are 4 appendices, a glossary and an index.

**Kuhn, Thomas S. / The Structure of Scientific Revolutions / The University of Chicago Press / 11030 S. Langley Ave., Chicago, Ill. 60628 / 1962, hardbound, 172 pp., $6.00**

This book analyzes the nature, causes, and consequences of revolutions in basic scientific concepts. The author holds that every large revolution in science is complemented by several smaller revolutions and that the revolutionary process is fundamental to scientific advance — the normal framework within which "normal science" works must be broken down in order to explore the unknown.

There are thirteen chapters among which are these: The Nature of Normal Science; Anomaly and the Emergence of Scientific Discoveries; The Response to Crisis; The Nature and Necessity of Scientific Revolutions; Progress Through Revolutions. There is no index.

**Woodgate, H. S. / Planning by Network / Brandon Systems Press, 30 East 42 St., New York, N.Y. 10017 (printed in Great Britain) / 1967, hardbound, 363 pp., $?**

This book was written specifically for those who wish to know and understand network planning and how to make use of it. It deals with fundamental principles involved in the various systems, including PERT (Program Evaluation and Review Techniques) and CPM (Critical Path Method) and examines in detail the managerial implications of network planning methods. The book uses the language of operational management and not the theoretician. Its sixteen chapters include: Basic Techniques of Network Construction; Multi-Level and Sectionalized Networks; Analysis of the Network; Project Progress Control; Cost-Planning and Cost Control; Project Profitability; Production Planning and Control. There are illustrations, an appendix and an index.

# CLASSIFIED ADVERTISEMENTS

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# ADVERTISING INDEX

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