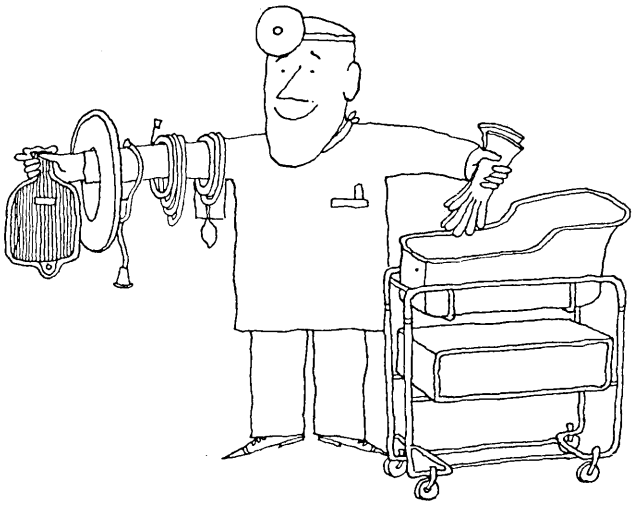
September, 1967

computers and automation

Computer Careers



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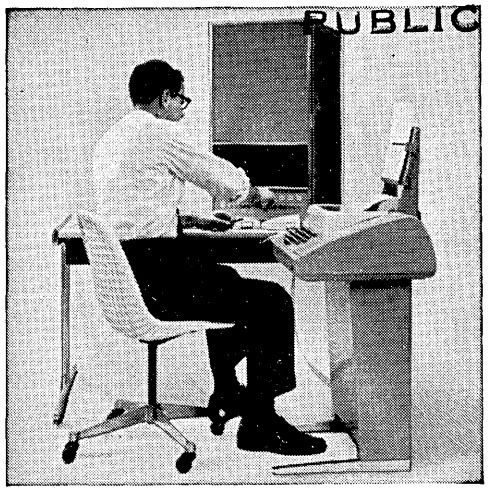

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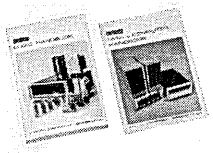

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computers and automation

SEPTEMBER, 1967 Vol. 16, No. 9

The front cover shows students in training at the Control Data Institute in Minneapolis, Minn. For more information, see "Computer Programming — The Career of the Future," beginning on page 16.

Special Feature:
Jobs and Careers in Data Processing

Multi-Access Forum

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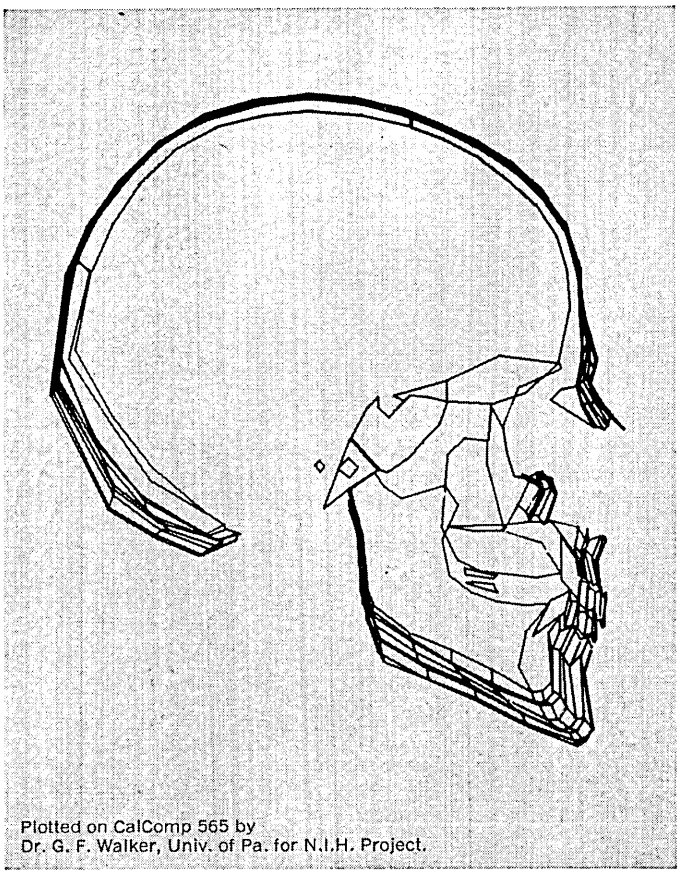

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Dr. G. F. Walker, Univ. of Pa. for N.I.H. Project.

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Professional Conduct in the Computer Field

In the July 1967 issue of the "Communications of the Association for Computing Machinery" appears a statement of "Professional Conduct in Information Processing," which begins:

> This set of guidelines was adopted by the Council of the Association for Computing Machinery . . . in the spirit of providing a guide to the members of the Association . . . for a high level of ethical conduct.

The text of this document, because of its interest and importance, is published in full on page 8 of this issue.

Several aspects of this statement of professional conduct seem particularly significant to persons working in the field of computers and data processing, and to those readers of *Computers and Automation* who have followed the discussion of "Computers and Moral Questions" appearing in *C&A*.

In the first place, here is a clear statement by a leading professional organization in the computer field that emphasizes that:

- Persons in the computer field should have professional standards of conduct;
- These standards should be stated, instead of being left unsaid or implied;
- Computer persons should try to live up to these standards.

Thus, in effect, the Council of the ACM has recognized that a computer person has a special "social responsibility" deriving from his profession, in addition to the regular social responsibility that any member of society has. (The phrase "social responsibility," however, nowhere appears in the document.) So here is a big step forward for the "profession" of "information engineering."

Second, there is a clear statement of responsibility for providing education:

- A computer person should try "to provide opportunity and encouragement for the professional advancement and development of . . . those aspiring to become professionals with whom he comes in contact."

This is all to the good too: a person who has learned something about computers should help other people learn something about computers. But it hardly seems reasonable that this should be restricted to only those persons "with whom he comes in contact."

In addition, there is a statement of responsibility for informing the "public" about computers:

- A computer person should try "to extend public knowledge, understanding and appreciation of computing machines and information processing and achievements in their application. . . ."

In other words, a computer person should try to help society (though the word "society" nowhere appears in the guidelines) understand the implications of computers for society.

Also, there is expectation of change and development in the guidelines:

- A computer person should "assist in the evolution of the set of guidelines."

Here is an invitation for considering, discussing, and improving the standards of conduct.

But the only parties referred to in the guidelines are these:

— ACM members
— the Council of the ACM
— ACM authorities
— the professional person
— his employer
— his clients
— other professionals
— the public

There is no mention of any broader parties: no mention of country or nation; no mention of the International Computation Centre, the International Federation for Information Processing, the United Nations, or any other international bodies, by name or implication; no mention of society or the human race as a whole, except as "the public" — certainly an amorphous, faceless word in this context; no mention of the underdeveloped countries; no mention of minority groups; no recognition of the fact that the Association for Computing Machinery has, from its beginning in 1947, been an international society with members from many countries, including those where the only employer or client in the computer field is a branch of the government. No mention of any of these parties or their interests is truly extraordinary.

These glaring omissions make one think of a survey of crime without mentioning homicide, or a description of the planet earth without mentioning the oceans, or a summary of geometry without mentioning the circle.

It would be good if the Council of the Association for Computing Machinery could give some thought to removing from the guidelines this narrowness, this ivory-towerness, this antisepticness — so as to make them more fit for use in today's tumultuous world of issues and conflicts.

Edmund C. Berkeley

Editor

Professional Conduct in Information Processing

INTRODUCTION

This set of guidelines was adopted by the Council of the Association for Computing Machinery on November 11, 1966 in the spirit of providing a guide to the members of the Association. In the years to come this set of guidelines is expected to evolve into an effective means of preserving a high level of ethical conduct. In the meantime, it is planned that ACM members will use these guidelines in their own professional lives. They are urged to refer ethical problems to the proper ACM authorities as specified in the Constitution and Bylaws to receive further guidance and in turn assist in the evolution of the set of guidelines.

PREAMBLE

The professional person, to uphold and advance the honor, dignity and effectiveness of the profession in the arts and sciences of information processing, and in keeping with high standards of competence and ethical conduct: Will be honest, forthright and impartial; will serve with loyalty his employer, clients and the public; will strive to increase the competence and prestige of the profession; will use his special knowledge and skill for the advancement of human welfare.

1. *Relations with the Public*

1.1 An ACM member will have proper regard for the health, privacy, safety and general welfare of the public in the performance of his professional duties.

1.2 He will endeavor to extend public knowledge, understanding and appreciation of computing machines and information processing and achievements in their application, and will oppose any untrue, inaccurate or exaggerated statement or claims.

1.3 He will express an opinion on a subject within his competence only when it is founded on adequate knowledge and honest conviction, and will properly qualify himself when expressing an opinion outside of his professional field.

1.4 He will preface any partisan statement, criticisms or arguments that he may issue concerning information processing by clearly indicating on whose behalf they are made.

2. *Relations with Employers and Clients*

2.1 An ACM member will act in professional matters as a faithful agent or trustee for each employer or client and will not disclose private information belonging to any present or former employer or client without his consent.

2.2 He will indicate to his employer or client the consequences to be expected if his professional judgment is over-ruled.

2.3 He will undertake only those professional assignments for which he is qualified and which the state of the art supports.

2.4 He is responsible to his employer or client to meet specifications to which he is committed in tasks he performs and products he produces, and to design and develop systems that adequately perform their function and satisfy his employer's or client's operational needs.

3. *Relations with Other Professionals*

3.1 An ACM member will take care that credit for work is given to those to whom credit is properly due.

3.2 He will endeavor to provide opportunity and encouragement for the professional development and advancement of professionals or those aspiring to become professionals with whom he comes in contact.

3.3 He will not injure maliciously the professional reputation or practice of another person and will conduct professional competition on a high plane. If he has proof that another person has been unethical, illegal or unfair in his professional practice concerning information processing, he should so advise the proper authority.

3.4 He will cooperate in advancing information processing by interchanging information and experience with other professionals and students and by contributing to public communications media and to the efforts of professional and scientific societies and schools.

MULTI-ACCESS FORUM

WHAT IS COMPUTER SCIENCE?

(An unsigned memorandum handed to the Editor when he was in Washington, D.C. in July.)

Professors of computer science are often asked: "Is there such a thing as computer science, and if there is, what is it?" The questions have a simple answer: Wherever there are phenomena, there can be a science to describe and explain those phenomena. Thus, the simplest (and correct) answer to "What is botany?" is, "Botany is the study of plants." And zoology is the study of animals, astronomy the study of stars, and so on. Phenomena breed sciences.

There are computers. Ergo, *computer science is the study of computers.* It remains only to answer the objections to this statement.

Objection 1. Only natural phenomena breed sciences, but computers are artificial, hence are whatever they are made to be, hence obey no invariable laws, hence cannot be described and explained.

Answer. 1. The objection is patently false, since computers and computer programs are being described and explained daily. 2. The objection would equally rule out of science large portions of organic chemistry (substitute "silicones" for "computers"), physics (substitute "superconductivity" for "computers") and even zoology (substitute "hybrid corn" for "computers"). The objection would certainly rule out mathematics, but in any event its status as a natural science is idiosyncratic.

Objection 2. The term "computer" is not well defined, and its meaning will change with new developments, hence computer science does not have a well-defined subject matter.

Answer. The phenomena of all sciences change over time; the process of understanding assures that this will be the case. Astronomy did not originally include the study of interstellar gases; physics did not include radioactivity; psychology did not include the study of animal behavior. Mathematics was once defined as the "science of quantity."

Objection 3. Computer science is the study of algorithms (or programs), not computers.

Answer. 1. Showing deeper insight than they are sometimes credited with, the founders of the chief professional organization for computer science named it the Association for Computing Machinery. 2. In the definition, "computers" means "living computers" — i.e., the hardware, their programs or algorithms, and all that goes with them. Computer science is the study of the phenomena surrounding computers. "Computers plus algorithms," "living computers," or simply "computers" all come to the same thing — the same phenomena.

Objection 4. Computers, like thermometers, are instruments, not phenomena. Instruments lead away to their user sciences; the behavior of instruments are subsumed as special topics in other sciences (not always the user sciences — electron microscopy belongs to physics, not biology).

Answer. The computer is such a novel and complex instrument that its behavior is subsumed under no other science; its study does not lead away to user sciences, but to further study of computers. Hence, the computer is not *just* an instrument but a phenomenon as well, requiring description and explanation.

Objection 5. Computer science is a branch of electronics (or mathematics, psychology, etc.).

Answer. To study computers, one may need to study some or all of these. Phenomena define the focus of a science, not its boundaries. Many of the phenomena of computers are also phenomena of some other science. The existence of biochemistry denies neither the existence of biology nor of chemistry. But it is not true that all of the phenomena of computers are subsumed under any one existing science.

Objection 6. Computers belong to engineering, not science.

Answer. They belong to both, like electricity (physics and electrical engineering) or plants (botany and agriculture). Time will tell what professional specialization is desirable between analysis and synthesis, and between the pure study of computers and their application.

Computer scientists will often join hands with colleagues from other disciplines in common endeavor. Mostly, computer scientists will study living computers with the same passion that others have studied plants, stars, glaciers, dyestuffs, and magnetism; and with the same confidence that intelligent, persistent curiosity will yield interesting and perhaps useful knowledge.

COMPUTERS AND SOME MORAL QUESTIONS — ROUNDUP 2

COMPUTER PEOPLE OPPOSING WAR MIGHT CONVERT THEIR FEELINGS INTO ACTION BY SELECTING NON-WAR FIELDS IN WHICH TO WORK

Edward Webster
Roxbury, Mass.

Your discussion of "Computers and Some Moral Questions" was of intense interest to me. First, if I may vote informally, let mine by YNNN.

The landslide results of your initial tally of votes raises some questions. One might be the wording of question No. 2, which makes an honest yes-no answer difficult for someone like myself. Is there a "right" and a "wrong" side in our present war (or any other)?

The less rhetorical question concerns the political potential of computer professionals in the context of the American "liberal" ethic which dominates our current domestic and foreign policies. Typically, the liberal will pay lip service or take only token action in support of professed ideals. He refuses to accept risk — financial or otherwise — and this lies at the heart of the powerlessness of the opposition to the cold war consensus.

My concern is with the 114 people who voted "N" on question No. 2 (they would not accept employment in a company producing weapons for the "wrong" side). To see if computer people tend to be token liberals or not, C&A should try to find out if they are against the Vietnam war and if so, in what industry they are employed. If they want to avoid involvement in a war they don't think we should be fighting, they don't have much choice.

Your own market reports indicate that the most heavy computerization is in defense-oriented industries such as electronics, aerospace, and research. In the Federal Government, 80% of computer capacity is in defense or in defense-related agencies (DOD, AEC, NASA). All major computer manufacturers are deeply involved in producing equipments for the Vietnam war. Most universities do military research, many in the area of germ warfare. Few of us are able to feel smugly non-involved. The only major fields of computer application which seem not to be fairly directly involved in the Vietnam war are finance and insurance.

It would be an extremely significant development if computer people opposing war were to convert their feelings into action by selecting non-war fields in which to work. Actually, this would mean many would temporarily have to leave their jobs, or at least stop producing. The impact of this, of course, lies in the fact that computer skills are critical right now. And they lie at the heart of the United States military establishment. Here is the political significance of bringing moral questions before computer people.

If this group could rise above token liberalism and accept risk for professed beliefs by refusing to work for firms supporting the war, then, for the first time in many years, there would be an effective (and democratic) check upon the policies of the Administration. They would be making up for the default of Congressional check.

Perhaps these 114 people are the nucleus of a kind of movement. This does not necessarily mean they are idealists.

Abstract thinking is supposed to be the forte of programmers. They would be expected to be especially gifted in envisioning the real risks of military brinkmanship in today's age of nuclear proliferation. Those that do, and who act to check our present policies, will be doing so not out of idealism, but in hard-headed realization that by so doing they increase the chances that their children might be able to grow and live in an undevastated world.

You are certainly to be congratulated on your bold and stimulating editorial policy.

COMPUTER MAGAZINES MUST DISCUSS SOCIAL, POLITICAL, AND MORAL PROBLEMS RELATED TO COMPUTERS

L. Mezei
Associate Professor of Computer Science
University of Toronto
Toronto, Ontario, Canada

Magazines such as yours must discuss social, political and moral problems of importance. This stems from the function of magazines — and of professional societies — not only to pass on individual bits of information, but to help integrate and summarize it and thus assist the reader in arriving at an overall view of the relevant areas. Surveys are one of the important contributions of your publications; why limit these to counting gadgets and their users? Let us begin to count the uses! This is the type of information the individual cannot gather for himself to help him make ethical and moral decisions. How many computers are involved with the Vietnam war? With disarmament efforts? With the space program? With crime fighting and prevention? Antipollution? Chemical and bacteriological warfare? War on poverty? Civil liberties? Cigarette advertizing? Education? Political campaigns? Public Health?

We need this information to help us decide the type of action we may wish to take:

1. Individual action, e.g., refusing a job we believe is not in the best interests of society.
2. Action through our professional bodies, e.g., enforcement of a code of professional ethics by the Association for Computing Machinery.
3. Drawing certain trends to the attention of our colleagues, the administrators of our institutions, our legislators and the public, so that they can take appropriate action **if they decide to do so.**

We need these matters discussed in our publications to help us discern the trends.

By curselves we may see the green trees near us, without being aware that the forest may be burning.

LEAVE POLITICAL OPINIONS OUT OF YOUR MAGAZINE

Jack H. Hazlehurst
Programmer
Kenilworth, Ill.

Please leave political opinions to the likes of "The New Republic" and the "National Review." What's wrong with an all-technical publication? Our field needs something to fill in the gap between "Datamation" and the "Journal of the ACM," and, at least so far, C&A has been doing this.

And *please again* — no more of those "polls." You'll have statisticians who try to design valid sampling methods blowing their brains out.

HUMAN BEHAVIOR COULD LIMIT DATA BANKS — AN ENLIGHTENING EXAMPLE

Martin Edgeton
White Plains, N.Y.

Among all the current discussion of the "pros and cons," work continues on developing techniques for establishing and operating large, comprehensive Data Banks. Good will and foresight will be two major attributes required of those who find themselves in charge of such operations. If Data Banks are to come close to the power and scope projected for them in current discussions, some real problems related to the natural shortcomings of the human beings responsible for the care and feeding of Data Banks must be faced and overcome.

An example taken from a subject area of great interest, although not yet covered by a computerized Data Bank, will illustrate this fundamental problem of dependence on human beings. (Whether this is considered a strength or weakness of the proposed systems depends on one's viewpoint and objectives.)

The data file rooms (commonly called "morgues") of large metropolitan newspapers are outstanding examples of continually updated Data Banks, providing large mass storage and rapid access. The facts held in these files are, practically speaking, countless in number. The file organization is presumably arranged to optimize the types of rapid retrieval necessary in newspaper work, by name or subject. As with any library, research-type requests requiring extensive cross-referencing probably take somewhat longer, and may have lower priority. But, short of complete text-scanning, the systems depend on some indexing schemes, human or automatic, to make the material accessible.

It might be imagined that on a subject of great interest to millions of people, and of vital concern to newspapers themselves, all of the power and resources of these existing Data Banks would be brought to bear to help resolve the issue. Yet, as the following example will illustrate, a very simple and key factor in a situation can be completely overlooked because nobody thought of setting up the correct indexing; or because those for whom the fact might be damaging or embarrassing did not fulfil their responsibility to get the facts into the system properly.

The question chosen as an interesting and practical example of what might be requested from a comprehensive Data Bank is: "What human action, in connection with the power systems involved, could have triggered the great power blackout on the east coast of the United States at 5:15 p.m. on Nov. 9, 1965?"

The reply which would probably be obtained (although not necessarily the reply with the highest probability of being true) on the basis of the amount of news coverage in the period immediately following the event, is that Jay Hounsell, age 11, of Conway, New Hampshire, had struck a telephone pole with a stick at the instant that the lights went out in Conway, although this was, of course, purely coincidental. (*N.Y. Times,* Nov. 12, 1965, p. 36.)

Another specific reply, which would seem to be much more meaningful, apparently never found its way into the *Times'* files. That story was carried by a suburban paper, well down in an Associated Press item, almost a year after the blackout: "Harold Smith, chief engineer of Ontario Hydro, said the blackout occurred after a minor adjustment to a transformer at the Sir Adam Beck power plant caused an alteration of the character of the current flowing through the plant. The change tripped a relay which shut down one line, overloading others and leading to the blackout." (*The Reporter Dispatch,* White Plains, N.Y., Nov. 3, 1966, p. 5.)

Most of this information had already been publicized, but the primary cause of the relay tripping (a transformer adjustment error made at 5:15 p.m. at the Sir Adam Beck Plant) had not previously been disclosed, even though it obviously should have been known to the Beck plant operations people as soon as it happened. The Ontario Hydro employees were undoubtedly not in as free a position to admit their blame as was the actually blameless boy in Conway, New Hampshire. The boy's prompt admission of his supposed responsibility was quickly put into the newspaper Data Banks as a light touch to this potentially grim story, but the very pertinent information from the Beck plant did not enter the Data Banks for a year, and may not even now be accessible by any easy index access route.

From this example, one may conclude, not surprisingly, that a supposedly universal Data Bank will suffer from serious data lapses if one expects individuals (or organizations) to voluntarily submit to it data which might embarrass them or their organization, or reveal their blame or guilt, or their failure to produce or perform as expected. Even in the context of corporate Data Banks, one may expect a significant amount of natural human "cover-up" at various points up and down the line in the data flow toward the Data Bank. The suggested depth of indexing of "troublesome" facts may well be less than adequate, if the indexing is done by the submitter of the facts.

There may of course be resistance to compulsory disclosure of formerly private facts to a Data Bank. Not only do individuals like to keep their personal privacy, but corporations will suffer if their private files become known to the government through the Data Bank operations. Entirely apart from any question of honesty or legality, certain affairs of a business must be preserved as business confidences, or else the business operations may suffer. Since knowledge is power, one gives up to the Data Bank controllers some power over oneself, whether one is a person or a corporation. It is only human, then, to try to keep "bad news" out. Those who have been thinking that future Data Banks would deliver complete information conveniently, may need to make some changes in their thinking.

COMPUTER ANALYSIS — AND INEQUALITIES IN VOTING POWER

Neil Macdonald
Assistant Editor
Computers and Automation

The results of research which utilized mathematical-computer analysis to measure effective voting power under various systems for electing the President of the United States were presented in testimony before the Senate Subcommittee on Constitutional Amendments on July 14, 1967. A summary of that testimony follows:

(1) The existing Electoral College system discriminates against voters of the small and middle sized states by giving citizens of the more populous states an excessive amount of voting power. Citizens of states like New York and California have over two-and-one-half times as much chance to affect the election of the president as residents of some of the smaller states and more than three times as much chance as citizens of the District of Columbia. Disparities in voting power of over 200% have been demonstrated and disparities of over 100% are not uncommon. Citizens of 32 states and the District of Columbia have less than average voting power.

(2) Proportional plans under which the electoral votes of each state would be divided in proportion to the candidates' state-wide vote discriminate against residents of the large and middle sized states by giving citizens in the smaller states a greatly excessive voting power. Under such proposed plans citizens of states like Nevada and Alaska would have more than four times as much chance to affect the election of the president as residents of New York or California. Disparities of over 300% have been demonstrated. Moreover, under such plans 170,080,480 citizens of 35 states and the District of Columbia — over 90% of the total population — would have less than average voting power.

(3) District plans under which each state would elect two electors at large and one from each congressional district also discriminate against the large and middle sized states by placing excessive voting power in the hands of citizens of the smaller states. Even under an ideal system in which congressional districts within each state would be equal in population, citizens of less populous states would have over two-and-one-half times the voting power of citizens in some of the larger states. Disparities of over 100% are common. 168,014,360 citizens of 34 states — again over 90% of the total population — would have less than average voting power. Moreover, because the election would be based upon congressional districts which may not be uniform in population, even citizens of the same state would not all have the same voting power and the disparities already demonstrated would be increased. Gerrymandering, which would be possible under this plan, is beyond the scope of this analysis.

(4) In a direct presidential election all citizens would have equal voting power and an equal chance to affect the outcome of the election. No other existing or proposed plan can even come close to yielding such equality.

(5) There is evidence to suggest, as many people have long suspected, that the inequalities in voting power under the present Electoral College may be reflected in such practical matters as the allocation of campaign finances and other resources, the selection of candidates, and the effectiveness of third parties.

The relationship between computers and the law is becoming increasingly important, as evidenced by the above testimony.

An even more impressive example of the legal acceptance of computers was recently demonstrated in a decision by the New York Court of Appeals. In passing judgment on various plans presented in two reapportionment cases, the Court struck down the proposed plans, stating as follows: "In the case before us, a *considered* judgment is impossible without computer analyses (of the various voting situations), and, accordingly, there is no alternative but to require the Boards (presenting the voting plans) to come forward with such analyses and demonstrate the validity of the plans which they have submitted to the Court."

Thus the Court held that for these particular cases, computer analysis is not only admissible and significant, but absolutely necessary.

COMPUTER RESEARCH INFORMATION AVAILABLE FROM NASA

National Aeronautics and Space Administration
Washington, D.C. 20546

The National Aeronautics and Space Administration publishes short technical summaries, "Tech Briefs," which summarize specific innovations derived from the U.S. space program. Copies of these briefs are available to the public, and may be obtained from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. Additional information may be obtained from the addresses listed below. All inquiries should include the reference number.

The following is a listing of recent NASA "Tech Briefs" of some interest to computer people:

- Translator Program Converts Computer Printout into Braille Language /Ref. B67-10087 / COSMIC, Univ. of Ga., Athens, Ga. 30601
- Computer Program Calculates Monotonic Maximum Likelihood Estimates Using Method of Reversals / Ref. B67-10136 / COSMIC, Univ. of Ga., Athens, Ga. 30601
- A Power-Spectral-Density Computer Program / Ref. B67-10160 / COSMIC, Univ. of Ga., Athens, Ga. 30601
- Data Retrieval System Provides Unlimited Hardware Design Information / Ref. B67-10170 / Technology Utilization Officer, Manned Spacecraft Center, Houston, Tex. 77058
- Structural Analysis and Matrix Interpretive System (SAMIS) / Ref. B67-10171 / COSMIC, Univ. of Ga., Athens, Ga. 30601

STANDARD OPERATING-SYSTEMS INPUT LANGUAGE

M. H. Perstein, Member
USASI X3.4.2
System Development Corp.
2500 Colorado Ave.
Santa Monica, Calif. 90406

The USASI Working Group X3.4.2 on Programming Language Specifications is seeking opinions on the need for and feasibility of specifying a standard operating-systems input language. The request stems from a proposal that the Group undertake preliminary activity in this area.

If a need exists, it is most probably in the area of time-sharing systems, but a standard may reasonably include top-level communication with batch-processing systems as well. A standard might begin with the methods for "logging on" and "off", and go as far as seems reasonable.

The computing industry is urged to comment on the proposed standard. Should top-level input language to operating systems be standardized? Is it possible? What are the difficulties? How far should it go? etc.
culties? How far should it go, etc?

Please send all responses, suggestions and comments to me at the above address.

ISA INSTRUMENTATION INDEX — A NEW QUARTERLY

Instrument Society of America
530 William Penn Place
Pittsburgh, Pa. 15219

The Instrument Society of America (ISA) has commenced publication of a new quarterly, the *ISA Instrumentation Index*. The reference covers ISA-published literature including proceedings of its annual conferences and symposia; articles appearing in its monthly journal, *Instrumentation Technology,* and in the quarterly *ISA Transactions;* special purpose monographs and standards; and journals translated from Russian and Chinese.

The Index is divided into three sections. In the first section, key terms extracted from the indexed literature are arranged in alphabetical sequence and are associated with accession numbers assigned to each indexed article. The section utilizes terms from the *Thesaurus of Engineering Terms* published by the Engineers Joint Council. Sections two and three comprise a title index with source data, and an author index.

1968 SPRING JOINT COMPUTER CONFERENCE — CALL FOR PAPERS

Professor T. R. Bashkow
Technical Program Committee Chairman, 1968 SJCC
Department of Electrical Engineering
1312 S. W. Mudd
Columbia University
New York, N.Y. 10027

The 1968 Spring Joint Computer Conference will be held April 30 to May 2, in Atlantic City, New Jersey. Papers are invited on any aspect of the computer or information processing field, from hardware to software, and from theory to practice.

Suggested topics of current interest include: computer utilities, time sharing, the man-machine interface, computers and communications, computers and control, and design automation. Survey, tutorial, and interdisciplinary papers are also welcome.

Papers should include an abstract of 100 to 150 words and original drawings and photographs, and should not exceed 6,000 words. Manuscripts (5 copies) should be submitted to me by October 30, 1967.

NUMERICAL CONTROL SOCIETY'S ANNUAL MEETING — CALL FOR PAPERS

Marvin Kreithen
Program Chairman
P.O. Box 6611
Philadelphia, Pa. 19149

The Fifth Annual Meeting and Technical Conference of the Numerical Control Society will be held in Philadelphia, Pa., April 3 to 5, 1968. The theme of the conference will be "Numerical Control — Tomorrow's Technology Today."

Papers on all areas of numerical control are invited. Suggested topics include:

- Computer-Oriented Manufacturing Processes
- New Concepts in NC Systems
- NC Justification
- NC and Inspection
- Training in NC
- Maximum Utilization of NC Installations
- Tooling for NC

Abstracts (6 copies), accompanied by a biographical sketch, should be submitted to me by October 1, 1967. At least 3 copies of the final paper, including supporting pictures and drawings, are due November 1, 1967.

COMPUTER TIME TO SHARE

I. A. M. Calabrese, Manager
System Development Department
Standard Brands Inc.
New York, N.Y. 10022

We are expecting installation of an IBM 360/30 at our San Francisco office this coming January. We will have some excess computer time and would like to get in touch with someone who could make use of it.

I would appreciate your suggestions as to how I might locate an interested party in the San Francisco area with whom available time, rates, etc. could be discussed.

II. From the Editor

We suggest several avenues for reaching organizations interested in using excess time on your computer: (1) Check through the list of organizations in the "Computer Directory and Buyers' Guide, 1967" (the June issue of *Computers and Automation*) for computer organizations in the San Francisco area and inquire of them; (2) Check the yellow pages of the telephone directory for computer service organizations and inquire of them; (3) Run a small classified advertisement in the financial section of a San Francisco newspaper; and (4) Approach a time broker.

We wish you success with your new installation.

THE COMPUTER DIRECTORY AND BUYERS' GUIDE, JUNE, 1967: SUPPLEMENT, SEPTEMBER, 1967

The following entries are additions to or corrections of entries in the "Computer Directory and Buyers' Guide, 1967:, the June issue of "Computers and Automation".

Key to abbreviations: S - Size in number of employees; E - Year established.

We expect to mail out entry forms for the "June 1968 Computer Directory and Buyers' Guide" in February, 1968. If you wish to be certain that you receive an entry form for your organization, please send your request for an entry form, and your name, organization name, and address, to: 1968 Directory Editor, Computers and Automation, 815 Washington Street, Newtonville, Massachusetts 02160.

Roster of Organizations

Audio Instrument Co., Inc., 311 Mountain Rd., Union City, N.J. 07087 / 201-864-4542
Special purpose analog computers, data recording equipment, simulators, magnetic storage systems, and electronic function generators / S 12 / E 50

D. R. Black Associates, Seven Parkway Ctr., Pittsburgh, Pa. 15220 / 412-922-6622
Computer management consulting, systems analysis, original systems design, professional computer programming. Real-time and on-line systems, data retrieval, inventory management. Original programs include warehouse automation, insurance actuarial programs and utilities billing systems. Offer training programs for client personnel / S 4 / E 65

Compass, Inc., 311 Church St., Nashville, Tenn. 37201 / 615-244-5030
General business computer consulting and data processing, specializing in actuarial computing and actuarial computer systems for insurance companies and consulting actuaries / S 15 / E 65

Computer Research Corp., 429 Watertown St., Newton, Mass. 02158 / 617-969-4050
Computer consulting, specializing in the man-machine partnership for effective interaction and problem solving; hardware and systems development, research, engineering, educational applications, state of the art surveys; time-sharing system development / S 18 / E 65

DIAL-DATA, Inc., 429 Watertown St., Newton, Mass. 02158 / 617-244-2560
Remote access time-sharing services for scientific, engineering and commercial users with SDS 940 computer. Large number of problem solving languages including CAL, FORTRAN, SNOBOL, and QED. Additional centers under development in Washington, D.C. and New York, N.Y. / S 18 / E 66

Leeds and Northrup Co., 4901 Stenton Ave. Philadelphia, Pa. 19144 / 215-329-4900
Industrial process control and process monitoring computer systems; instruction in systems / S 3500 / E 1898

The Stanwick Corp., 1401 Wilson Blvd., Arlington, Va. 22209 / 703-524-6126
Consultants, analysts, designers, programmers, and operators of electronic information handling, command and control systems for U.S. space, defense, and civil programs. Professional support provided to computer users for software research, statistical analysis, information retrieval, data conversion, machine translation, computer-assisted instruction (public and industrial), long range systems planning, etc. / S ? / E ?

College and University Computer Centers

Eastern Iowa Community College, 1829 State St., Bettendorf, Ia. 52722
Education / Unit record equipment; G.E. 225 with card reader and punch, high speed printer, magnetic tape, and random access storage / Programming, applications, systems analysis, etc. leading to Associate Degree in computer programming / S ? / E ?

Illinois State Univ., Normal, Ill. 61761
Instruction, research for faculty and students, administration / IBM 1620, 60K: 1443 with two disk drives; IBM 1401, 16K: 1403 with three disk drives and four tape drives; unit record equipment / Data Processing, Systems Analysis, Industrial Education, Numerical Analysis / S 11 / E 65

Industridata AB, Headoffice, Albygatan 102, Solna, Sweden / 08-98 03 50
Consultants in commercial and scientific systems and applications; contract programming; computing services and time sales; complete bureau services / S 110 / E 64

Miami-Dade Junior College, 11380 N.W. 27th Ave., Miami, Fla. 33167
Education, administration and research / IBM 360/40, 360/30, 1620; IBM 1627 plotter; unit record equipment / Techniques of Data Capture, Computer and Programming Concepts, Systems Analysis and Design, etc. leading to Associate Degree in business information systems and programming / S ? / E ?

San Fernando Valley State College, 18111 Nordhoff St., Northridge, Cal. 91324
Instructional program, research, and administration / GE-225, GE-415 DAPS, Datanet-30 / Undergraduate and graduate courses through Masters degree / No separate computer science curriculum / S 32 / E 64

Saskatchewan, Univ. of, Saskatoon, Sask., Canada
Education and research / IBM 7040, 16K memory, 6 #729 tape drives, disk storage / Programming, numerical analysis, computer design, data processing / S 40 / E 57

from varian data machines

new... small... fast! data 620/i systems computer

The DATA/620-I integrated circuit computer is the newest member of the DATA/620 family of system computers. DATA/620-I fills the gap between general purpose and special purpose computers. It belongs in a system, and solves problems previously considered too difficult or expensive for computer solution.

Designed for faster problem solution the DATA/620-I has a bigger instruction set, integrated circuit reliability, is smaller, has one-half the components, and costs less than any computer in its class.

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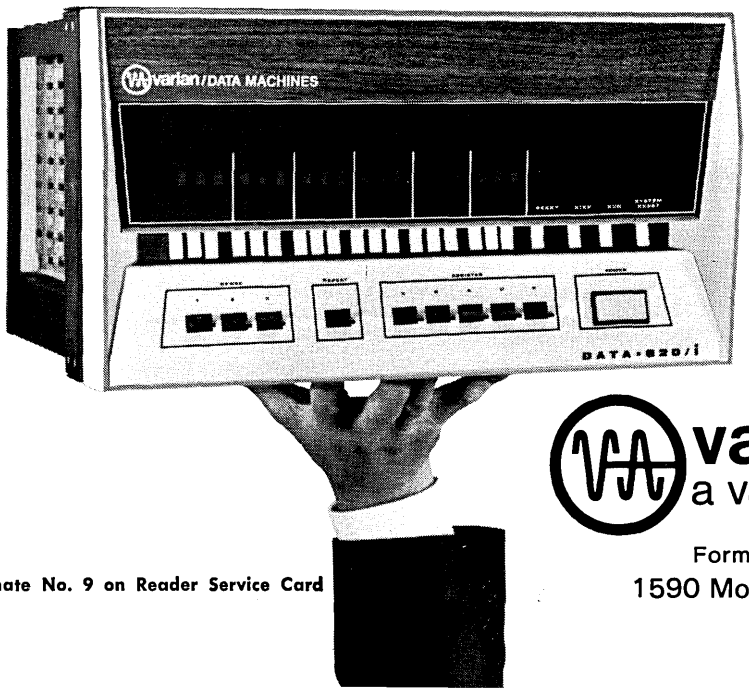

Extremely compact, the DATA/620-I requires only 10″ of 19″ rack space. It's available with memory modules from 1024 to 32,768 words of 16 or 18 bits, and with a selection of control, arithmetic and I/O facilities, including our unique Micro-Exec.

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COMPUTER PROGRAMMING — THE CAREER OF THE FUTURE

Perry C. Smith, Director
Control Data Institutes
Waltham, Mass.

"Fifty thousand programmers are needed right now . . . and it is estimated that by 1970 there will be a need for 250,000 programmers!"

How do you program a computer to guide the first manned spaceship to Mars? To estimate the sales potential of a new three-dimensional color television set? To teach algebra to eager high school students? To calculate a 5,000 man payroll in several international currencies?

These are the types of questions that may be by-passed during the next decade unless many more qualified men and women are trained as computer programmers. Fifty thousand programmers are needed right now to help write programs for the 35,000 computers already in operation. By 1970 it is estimated that 100,000 computers will be installed throughout the world, and more than 1,000,000 persons will be required — including 250,000 programmers — to build, sell, design, install, maintain, and program these computer systems.

The Impact of the Computer

Little question remains about the impact of the computer. According to a recent memorandum from the president of the United States, "The electronic computer is having a greater impact on what the government does and how it does it, than any other product of modern technology."

The phenomenal growth of this highly skilled industry places a serious demand for excellence on today's men and women. One recognized authority in data processing sees the situation this way: "The computer age will go as far as people will take it. An acute shortage of trained personnel is the only limitation."

Just 16 years ago, in 1951, one of the founders of the computer industry had estimated that only six major computer installations would be needed to handle the world's data processing requirements. But the explosive growth in computer sales during the late 1950's and early 60's soon proved this prediction false, and the original group of programmers who had grown up alongside the first-generation and early second-generation machines was exhausted.

Why a Personnel Shortage?

There were several reasons for the shortage of trained personnel. Initially, the sharply rising volume of computers manufactured and installed automatically boosted the demands for trained personnel to program them. At first, this demand centered around the writing of what is now called the more standard types of computer programs, such as payroll and billing in business accounting departments. But then, as users became more sophisticated in their knowledge of computers, they discovered new and more valuable ways in which to utilize the untapped power of their data processing systems. Thus, computers began to analyze consumer and industrial product markets and sales statistics, simulate national economies, perform legal searches for law firms, and record and study masses of scientific data acquired in nuclear, geophysical and aerospace environments. At the same time, the scope of programming technology was also being sharply expanded.

In addition, the nation's computer manufacturers realized that the computers they were designing would be simpler to use (even while they were becoming more complex in design and operation), if they were to provide the greatest possible assistance to business, science and industrial users. So they began to devote extensive time, funds and available manpower to the enormous task of developing more comprehensive, more powerful, operating system and application

programs. This resulted in the creation of the "built-in" and "off-the-shelf" type of software that any successful manufacturer today must supply to his customer.

The demands of this two-fold activity soon outstripped the small pool of available, qualified programmers. And the recent advent of the new third-generation systems has pushed this demand far beyond the capability of industry or education to meet it.

One Approach to the Problem

Where will these people come from? Here's how Swen Larsen, President of Control Data Institutes, describes how this firm met the problem:

"Initially, the training of technical personnel for the company was handled internally. But as the scope and complexity of computer technology grew by leaps and bounds, the Control Data Institutes were established to train company personnel. The Institutes were given the responsibility to follow new products from the drawing board through prototype testing to production, so that when the company was ready to place a product in the hands of the user, it would already have trained people to install it, maintain it, adjust it, operate it, and program it.

"Several years ago, it became apparent to us that the skills that we were seeking simply were not being developed in sufficient numbers in the public or private schools of the country. At the same time we were experiencing this shortage of people, we were also hearing the query: 'How do I get a job in the computer industry? All the ads say: Experienced only need apply.'

"At this point the decision was made to open some of our training facilities to the public on a tuition basis. The first course offered in this manner in Minneapolis was oversubscribed. We expected an enrollment of 70 students on opening day; we had 94.

"That course was one that we had taught regularly to our employees, and it prepared the student for a position as a customer engineer. Since opening the institutes to the public, we have encouraged other employers tc interview our graduates and make job offers to those students that meet their requirements. It is not uncommon for a graduate of this customer engineering course, for example, to receive up to 10 job offers at salaries in excess of seven thousand dollars."

Today there are Control Data Institutes operating in Washington, Los Angeles, Minneapolis, Boston, and Frankfurt, Germany, and several others are being planned here and overseas. "Control Data is moving aggressively to help alleviate today's acute shortage of Computer Programmers," says William C. Norris, President of Control Data. "As a manufacturer we feel a responsibility to our customers by establishing computer schools for training people to help operate computers and write programs. There is no question but that opportunity beckons for men and women who train themselves as computer programmers."

Range of Jobs Available

Computer programming offers stimulating challenge and virtually unlimited opportunities. The range of jobs open to qualified individuals includes coding specialists and assistant programmers who help to develop the programs marketed by the manufacturer. In the applications area, programmers assist the applications analyst in defining particular customer problems and writing the programs to solve the problems. The exceptionally well-qualified programmer may even begin work immediately as an applications analyst. All these positions are offered at top starting pay and working conditions.

Training Required

How can interested people acquire the necessary background and training for computer programming? The most practical way is to take an approved course offered by a recognized university, technical school, or educational institute.

Control Data Institutes provide a unique benefit, since it is the only nation-wide public training facility established by a computer manufacturer. Even more important is the type and amount of equipment available at the school for hands-on training. Students get hands-on experience using modern systems such as the Control Data 3100, 3200 and 3600 systems, plus a full array of peripheral equipment and the equipment of other manufacturers.

The 500-hour course covers the basic scope of computer programming: instruction formats, assembly and compiler (Cobol, Fortran) languages, debugging techniques, card-tape-peripheral systems programming, operating systems, real-time and disk system programming, on both fixed and variable length word computers.

General Qualifications

What are the general qualifications for computer programming? Basically, they are a high school diploma and an aptitude for logical thinking. In the case of C.D.I., graduates range from those with high school diplomas through those with master's degrees and range in age from 18 to 55 years. Almost half have been women. The average graduate has completed one or two years of college. Institute graduates generally receive better than four job offers from computer manufacturers, business firms, industrial firms and scientific organizations.

Computer programming seems to be the career of the future, in the industry of the future, for those who prepare for it.

MONTHLY COMPUTER CENSUS — NOTE

Because of certain complications, the "Monthly Computer Census" is not published in this issue of "Computers and Automation". We hope to publish a Computer Census in the next issue, October.

For the latest Monthly Computer Census which we have published, please see page 52 of the August, 1967 issue.

LAST MINUTE FLASH — AS WE GO TO PRESS

CONTROL DATA AND C-E-I-R MAY MERGE

William C. Norris, Chairman of the Board and President of Control Data Corp., a major computer manufacturer, and Dr. Herbert W. Robinson, Chairman of the Board and President of C-E-I-R, Inc., jointly announced on August 15 that preliminary negotiations are underway regarding the merger of their two firms. C-E-I-R, Inc. is the largest company in the United States providing independent computer services.

The heads of the two companies emphasized that talks are in the preliminary stage, but did say that agreement had been reached in principle involving the exchange of one share of Control Data common stock for each six shares of C-E-I-R common stock. All negotiations are, of course, subject to approval of the Boards of Directors and stockholders of both companies.

CAREER BUILDING: FROM EDP SPECIALIST TO TOP MANAGEMENT

William F. Breitmayer, Pres.
Executive Register, Inc.
New York, N.Y. 10020

"All too frequently, the EDP specialist finds that after a new system has been installed, the company no longer has a place for him at his salary level. Then he must move on. The salary he commands is certainly comfortable, but the time comes when he begins to wonder how long he will have to move back and forth across the country before he finds a slot where he can settle down."

There is no particular need here to discuss today's "job market" for analysts, programmers, and other EDP specialists, since many readers of *Computers and Automation* are well aware that the demand for computer specialists has ballooned over the past few years.

What does concern me is the future. Can the EDP expert move beyond the confines of his specialty and become a top executive with management responsibility in his corporation?

The thoughtful EDP man might well learn a lesson here from the engineers. After World War II — and particularly during the 1950's — our exploding economy created an intense demand for engineers, and beginning salaries for new college graduates increased rapidly. It is not unusual now for an employer to bring a young engineer in at a salary bracket several steps above other employees who have greater seniority. The young engineer is understandably pleased with himself and confident that a great future lies ahead for him. All too often, however, after a few years have passed, he realizes that he is not moving ahead as rapidly as he had expected, and that his compensation and responsibilities are not much different from when he first started. It may then dawn on him that continued progress requires more than advanced degrees and technical proficiency, and that he has missed opportunities by remaining a narrow specialist.

The Roving Specialist

We are entering an era now where the data processing/systems man has even greater opportunities than engineers have had. The growth in size and complexity of both business and non-business organizations means that effective management will depend more and more on effective information systems. Men who have established reputations as specialists in installing or upgrading EDP systems are in great demand; and they can command substantial salaries from operating companies, consulting firms, service groups, and so forth. But all too frequently they find that, after a new system has been installed, the company no longer has a place for them at their salary level, and they must move on.

One Executive Register subscriber, for example, has installed systems in four different major corporations during the last few years. The $30,000 to 40,000 salary bracket he commands is certainly comfortable; but he and his family are beginning to wonder how long he is going to have to move back and forth across the country until he finds a slot where he can settle in. A significant point here is that this man welcomes the challenge of new problems and enjoys solving them on a theoretical and mathematical level; but he is uncomfortable with "people" situations and with a day-to-day routine of management responsibility. Unless he can change his attitudes dramatically, he seems destined to the life of an itinerant problem solver.

The Road to Management

Now, for many men a career as a well regarded, well compensated specialist will be highly satisfying. This is the route they should follow. Others may find that, as they mature, they can only find satisfaction through gaining broader responsibilities in management. The central question for such a man is: What can he do to achieve this kind of breadth?

The Expanding Role of Data Processing in a Corporation

At present, the EDP function is usually incorporated into the controller's department and reports functionally either to a Controller or to a Vice President, Finance. In an increasing number of companies, however, data processing is being combined with systems and procedures in an overall corporate information department, reporting to the President or occasionally an Executive Vice President. The point is that data processing is becoming increasingly important in a corporation and is spreading into every phase of the organization: finance, sales and marketing, manufacturing, engineering, research and development, personnel and industrial relations, and international operations.

This gives the data processing man an unparalleled opportunity to see every part of his company's operations at close range. If he applies himself, and has the interest, he can

learn what role each man in the company plays in the overall structure, from the field salesman or factory worker to the vice president, and even the president himself. If he shows that he can understand and cope with the problems of each position, that he has a sensitivity to people and the ability to lead and motivate them, then the data processing man will be well on his way to becoming a candidate himself for top management. He will also find out that this kind of attitude will help in his own job of establishing data systems and procedures throughout the corporation, and in enlisting the support of everybody concerned.

In short, don't close yourself off or limit yourself by the vocabulary and attitudes of the narrow specialist. Open up, be positive and optimistic, and develop a real interest in other people's jobs and personalities.

What You Can Do

If you have a thirst for management responsibility, here are a few things you can do to broaden yourself out.

- Attend night graduate courses in business and business administration, to learn as much as you can about manufacturing, marketing, finance, management techniques and so forth.
- Join associations or informal discussion groups where you can trade ideas with people from other branches of management. You should be able to converse with and ask intelligent questions of a banker, marketing manager, European area manager, and so forth. In other words, try to make yourself as broad and flexible a problem solver as a good management consultant would be.
- Develop your understanding of finance by working in and around your financial department as much as possible, and by exchanging information at luncheons or meetings with financial executives. Read all you can about finance. Purchase or follow a few selected stocks and read annual or quarterly reports closely so that you become familiar with the terminology of stocks, bonds, long range debt, mergers, acquisitions, and so forth. Become familiar with financial control techniques and with the criteria and ratios for evaluating performance in various parts of a corporation.
- Try to persuade your superiors to let you get on the "outside" occasionally, calling with a salesman on clients or customers of your company. There is a good deal of truth in the old saw that "there is no substitute for knocking on doors". Direct contact of this sort with clients and customers can give you the kind of "feel" for a company's business which you could not acquire in any other way. Work also with the staff marketing groups so that you will begin to see how marketing strategy goes hand-in-hand with field selling.
- Try to get your company to assign you to one of the plants for a while, so that you can see at first hand what workers on the machines do, what their attitudes are, what part labor unions play and how a good plant manager tackles the problems of production scheduling, cost control, hiring, training, and management of his personnel.

(Please turn to page 21)

CAREER OPPORTUNITIES IN THE BUSINESS MACHINES INDUSTRY

Donald E. Young
Vice President
Burroughs Corp.
Detroit, Mich. 48232

"The business machines industry is in need of scientists, engineers, mathematicians, economists, salesmen, production specialists, and financial analysts — who will work together in virtually every area of information processing technology."

The business machines industry is fast-growing, exciting, and challenging. Firms in the industry are seeking the best available talents. The qualified business school graduate who is looking for this combination of elements, in addition to exceptional prospects for progress, reward, and career development, should give careful attention to the opportunities here. The business machines field is remarkable because of its rapid growth, diversification of activities, and vigorous competition.

Business machines were being made and sold in the United States long before automobiles came on the scene. The concept of the punched card, you may remember, goes back two centuries to Jacquard's first automatic loom. Its possibilities for speeding mechanical tabulation were demonstrated by the Hollerith machine as early as the 1890 census. W. S. Burroughs' adding machine was put into mass production at about the same time. The potential that high speed calculation holds for science and business began to be explored most seriously following World War II as mechanical techniques were augmented or supplanted by electronics. The growth of the business machines industry since that time has been phenomenal. From a 1959 level of $\$1/8$ billion, the industry delivered $6 billion worth of equipment, ranging from adding machines to computers, in 1965. It is estimated that by 1970, gross sales will hit an annual level of over $12 billion.

Areas of Activity

The visible stream of new products and services generated by the business machines industry provides some idea of the crosscurrent of disciplines and interests that underly that stream. We can, however, categorize these into four principal areas of activity common to companies within the industry. They are: 1) research and development; 2) manufacturing and engineering; 3) marketing; and, 4) finance. We can view these as being vertically oriented, with representation in each case from top management down to basic supervisory levels, and with opportunities at each of the many levels involved.

Let's consider some specific disciplines represented within each of these four areas. A large manufacturer of business machines is typically a diversified, growing firm where scientists, engineers, mathematicians, economists, salesmen, production specialists, and financial analysts work together in virtually every area of information processing technology.

Training for R & D

Research and development activities within the business machines industry call for people trained in:

electrical engineering
mathematics
physics
chemistry
metallurgy
mechanical engineering
engineering sciences
computer sciences
graphic arts.

Most companies conduct continuing programs of research and development. The size of these programs is obviously related to the breadth and scope of each company's product/service line, as well as to its aspirations. Company size is no indicator of the intensity with which programs are conducted, however. Small firms with limited lines and market shares can be just as dedicated to progress through research as their giant brothers.

Backgrounds Required in Information Processing

In the broad field of information processing, academic backgrounds relate to technical or managerial responsibilities in some of the following ways:

For engineering sciences — either electronic or mechanical backgrounds in circuits, systems, mechanisms, or packaging.

For physical sciences — magnetics, optics, solid state, physical chemistry and materials.

For mathematical sciences — information processing applications, numerical analysis, statistics, programming, and mathematical logic.

For business sciences — economics, information processing applications, and management sciences.

Manufacturing and Engineering

Manufacturing and engineering activities require people trained in:

Mechanical engineering
electrical engineering
mathematics
physics
chemistry
engineering physics
industrial engineering
economics
industrial management
computer sciences
graphic arts.

This training is put to work in such areas as product development, product and tool design, manufacturing, quality control, and industrial engineering. Burroughs products include precision office machines, electronic computers and data processing systems, a wide variety of business forms and supplies, equipment for check printing, protection and control, and a number of special electronic components, devices and systems.

The divisions producing these products are responsible for their design, development, testing, and manufacturing. Each division conducts programs aimed at improving existing techniques and at creating new production techniques as new products are developed. Each develops those new products as well as new ways to improve current products. Each is responsible for time and cost studies, manufacturing layout, production scheduling, and cost-pricing of each new product.

The challenging area of **marketing** attracts men and women whose academic training may have centered around:

economics
liberal arts
business administration
engineering
mathematics
accounting
industrial management
graphic arts and printing management
marketing
finance
computer sciences.

The Challenge of Marketing

Selling technologically-advanced business machines demands a lot more than salesmanship. The sales representative for a business machines firm, and for other companies with specialized products, is required to become a systems analyst, a professional problem-solver. His customers will include top echelon members of management in industry, banking, government, and commerce. The potential rewards of a marketing career are high. Traditionally, earnings are closely tied to performance. Managerial ability, developed through formal training and job experience, leads to positions of increasing responsibility within the marketing activity and, often, within the corporate structure as well. Marketing, perhaps more than any other area, is quick to recognize professionalism and to reward the man with initiative, imagination, and ambition.

There are diverse challenges in all areas of corporation **finance** which employ the disciplines of:

economics
mathematics
business administration
industrial management
industrial engineering
accounting
marketing
finance
computer sciences.

Opportunities in Finance

Excellent opportunities exist in the business machines industry for business management graduates, economists, statisticians, and others in related professions. As companies grow, increasing demands are placed upon the corporate financial activity. Firms such as Burroughs continually seek men whose skills can be profitably employed in general accounting, internal auditing, corporate taxation, systems and procedures, manufacturing cost accounting, financial analysis, and financial planning and control.

Most new employees receive job training that goes beyond specific job assignments into other related phases. The purpose of this, of course, is to provide a broad base of experience and understanding. This experience, coupled with a resulting sharpening of analytical judgment, is essential in preparing for positions of high responsibility and great reward.

CAREER BUILDING — Breitmayer

(Continued from page 19)

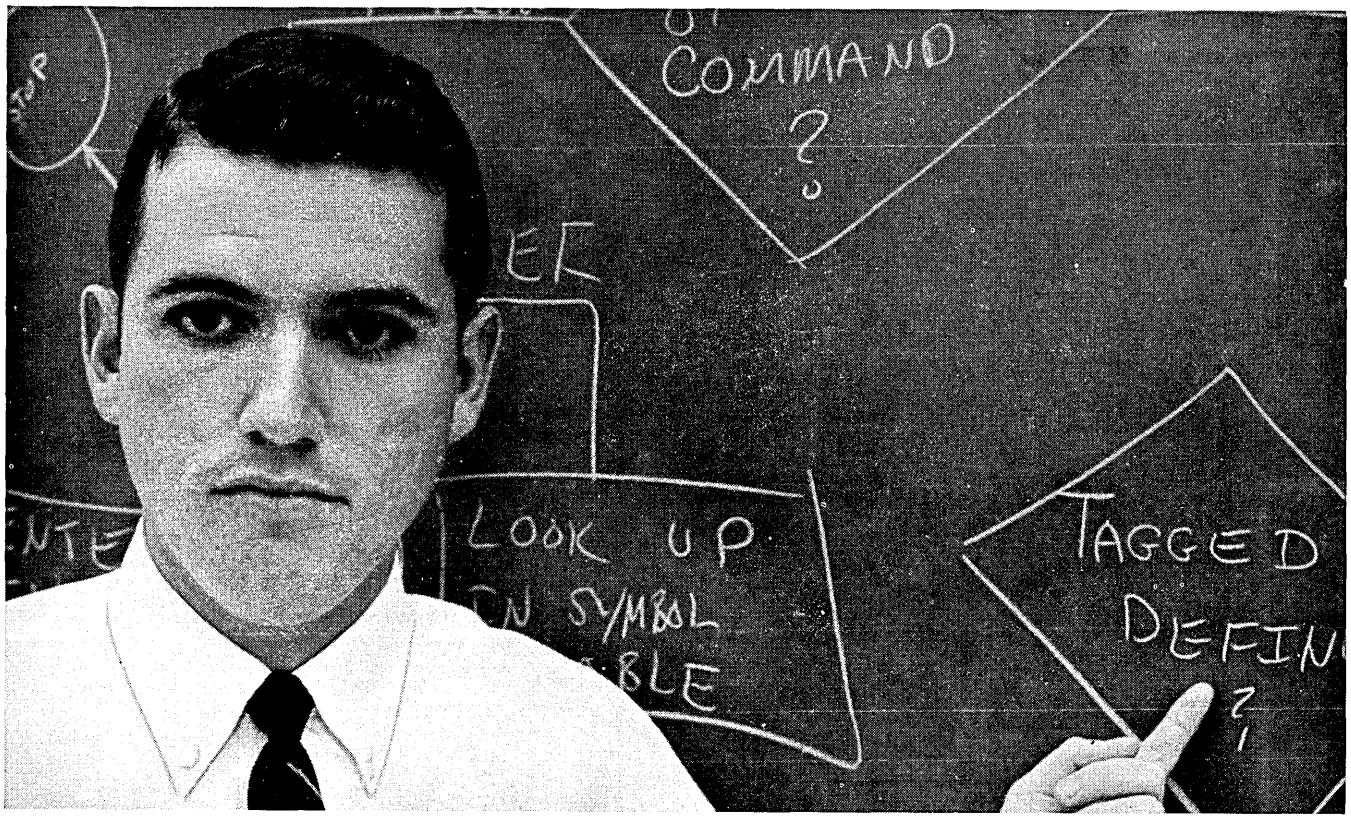
- Work also, if you can, with the personnel department. You may be able to assist them by developing information systems which will make the personnel department more effective in manpower development, training, and planning.

Case Histories

You, as an EDP man, are in as good a position as anyone else in the company to broaden your horizons — perhaps even better. Some data specialists have already broadened their horizons and are beginning to move up into top management positions. One early subscriber to the Executive Register joined a major consumer products manufacturer a few years ago, and now has top corporate responsibility for development and acquisitions. As such, he works closely with the president and the board of directors, and is himself a member of the board. His possibilities of succeeding the president seem to be at least as good as those of any of the other vice presidents in the corporation! Another, who had spent over twenty years in the U.S. Government, recently joined a major chemical company as Data Processing Manager. He had spent his Government time well, however, and had prepared himself broadly through graduate courses and participation in outside activities. As a result he has been promoted three times in his first year in business and is now the second ranking financial man in this major corporation!

It can be more comfortable, in the short run, to stick to your own last and to stay out of people's business. But the data processing man who has the curiosity, interest, and determination to find out what other people in his company are doing, will find that his own job becomes more stimulating and meaningful and that he is opening up many new opportunities to move his career ahead.

This committee is developing a new programming system



Ronny Morris, a programmer with IBM Rochester, is currently engaged in developing specifications for a new programming system.

That's right. A committee of one.

If you were a programmer with IBM's Systems Development Division in Rochester, Minnesota, you'd be given opportunities to work independently, too.

You'd design and develop a total programming package for a new, commercially oriented, computer system. Programmers participate in writing functional and performance specifications as they write and "de-bug" systems programs. And when you wanted to discuss your ideas with experts, you'd simply walk down the hall and chat with other members of Rochester's Development Division.

Right now IBM has openings for experienced programmers. If you qualify, you'd have the facilities of IBM Rochester at your disposal. This engineering complex includes a development laboratory—where advanced concepts are translated into new and improved technologies—and a comprehensive technical library.

Rochester is a progressive city offering unusual cultural, social, civic, recreational, medical and educational facilities. Rochester, home of the famed Mayo Clinic, is eighty miles south of Minneapolis-St. Paul. Here you can enjoy relaxed living in a city of 50,000 and reap the benefits of working with one of the top companies in the nation.

Find out more about IBM Rochester by sending your resume today to: Steve J. Aufderheide, Dept. UC6-J, IBM, Rochester, Minn., or call Steve collect: (507) 286-2704.

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EDP AND EMPLOYMENT AGENCIES: HOW ARE THEY RELATED?

James D. Haselton
Career Consultants, Inc.
Boston, Mass.

The business of employment agencies has been given new life by the explosion of electronic data processing. It has become painfully evident that tremendous need exists, and is growing, for competent personnel to create and aid the electro-technical revolution. Employment agencies serve the industry and the individual by attempting to supply the right man for the right job. Here we seek to give an overview of the relationship between EDP and employment agencies, and its effect on the industry.

Development of EDP Employment Specialists

Employment agencies have long been active in the American labor market, but never before on such a large scale. Prior to EDP, most agencies were concerned with the placement of relatively unskilled or menial workers in correspondingly low level positions. Employers were most willing to accept the services of an agency, for the employee was responsible for the agency fee. An employer, therefore, did no recruiting and had no advertising costs to bear. As a rule, professional people did not turn to agencies for assistance. Competent professionals had no difficulties in changing positions whenever they desired to do so. Mediocre professionals found positions in large, security-minded organizations and were content to sit and await retirement pensions.

In the late 1950's and early 1960's a new industry and profession began to make demands on the American labor market. Electronic engineers, mechanical engineers, production engineers, industrial engineers, and mathematicians found new challenges in the data processing industry. In addition, programmers and systems analysts became very much in demand. Many people with only a high school diploma who qualified on the aptitude tests broke into this field through promotions from within their companies. Initially, the bulk of this demand came from computer manufacturers, who needed armies of personnel to develop new applications and programs for their computers, and from the large companies who had ordered more than one computer.

Large organizations recruited from college campuses, trained the new employee, and developed him into a professional. Smaller organizations could not compete with the giants on training and development programs because of high costs and the length of time before productivity was achieved. It was found that employment agencies who were willing to take on all responsibility for advertising and personal contacts could locate experienced people who would change jobs for more money. The agency fees for an individual who was immediately productive were far less than the costs of recruiting and development.

As the computer manufacturers began to deliver their products, it was found that computer users were in desperate need of competent personnel. This increased the demand for agencies to contact personnel, with the lure of money and advancement, for positions with computer customers.

The View from Within

As the demand for people has grown, two types of agencies have emerged. The first is concerned mainly with the quick fee. This type of agency works on the principle that everybody has his price, and a slightly higher salary offer will make any employee willing to change positions. Large mailings and advertising campaigns are utilized to amass mountains of resumes from employees looking for the extra dollar. The employer is then bombarded with resumes until he has selected enough applicants to fulfill his requirements. There is no particular concern with quality on the part of this type of agency. The agency philosophy is that someone will be chosen and, as long as a fee is paid, his competence or satisfaction matters little. Often, after an employee has held a job secured by this agency for at least a year, he will again be contacted by the same agency for a possible change to still another position.

This agency functions extremely well in an atmosphere of great demand, with unsophisticated employers who are simply trying to get a job done on comparatively limited funds.

The second type of agency that has appeared in the field is one which is concerned with placing competent professionals in career positions with quality organizations. The operating philosophy of this type of agency is that people like variety and challenge. Professional people will place themselves on the "available" list for many reasons, which often do not include the desire for more "long green." This kind of agency interviews such people (there are always technical experts on the agency staff) in an attempt to determine career objectives, competence, and type of personality. The agency then arranges interviews with companies

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SECOND-GENERATION COMPUTERS LIVE AGAIN — IN THE RESALE MARKET

Michel Feuche
Editor, Moody's Computer Industry Survey
Brandon Applied Systems, Inc.
New York, N.Y.

"Indications are that by early 1968 the supply of used computers will be sufficiently large and dependable to support a continuous trading market. This will pose interesting questions for the computer manufacturers, who own the largest reserves of used, fully depreciated computers. They may have to decide they can no longer remain aloof from the resale market."

With the third computer generation little more than three years old, new and sometimes unexpected consequences of its introduction are still becoming apparent. Among the latest is the great and sudden stimulus which it has given to the EDP equipment resale market, hitherto better served by trade press speculations than by its actual performance. In recent months, trading in used computers has grown rapidly, and there are indications it may reach a volume of $100 million a year before 1970. The result will not only be another EDP industry success story, but will also add a new dimension to the industry's marketing pattern.

A New Market for Old Machines

Underlying the new computer resale activity is the growing supply of used equipment displaced by third generation machines. This is a dramatic change since, until recently, the supply was so small that any investigation of the resale market had to start with a question as to whether it really existed. The demand for dependable, low-cost equipment was certainly there, but the supply consisted mainly of first-generation machines which, with the exception of the IBM 650, were largely unmarketable. The 1963 sale of a Univac I whose buyer promptly converted its processor cabinet into a fish tank was atypical only to a degree. The used equipment market, characterized by isolated transactions, was far too thin to be more than a sideline for brokers and dealers doing a limited trade in unit record equipment.

The equipment supply situation is now improving every month with the steady growth of third generation computer deliveries. Deliveries for IBM 360 systems now top 1,200 per month. As deliveries increase, so does the number of displaced older machines. Prominent among these are up to 1,500 of the 1400 series systems and 150 of the 7000 series systems. Indications are that by early 1968 the supply of used computers will be sufficiently large and dependable to support a continuous trading market. It will be similar to those which already exist for other complex and expensive capital equipment such as airplanes and machine tools.

Present Volume

As befits a market which until recently did not really exist, there is little agreement as to its present annual volume. Estimates range from a low of about $10 million to a high of about $75 million. This covers sales of both computer and unit record equipment, the latter accounting for up to 70% of transactions, but a far smaller share of the dollar value. Unit record volume is, however, likely to grow much more slowly than EDP business, which will account for most of the growth of the data processing equipment resale market.

The Advantages of Used Equipment

Buyers of used computers are seldom first-time users. Instead, they fall into two distinct categories:

(1) large companies which possess the necessary sophistication and know-how to tie in the equipment into relatively complex systems efficiently; and

(2) small firms with relatively small installations for which economy is a decisive factor.

Buyers' interests are usually restricted to widely used second generation models which they are already using. The IBM 1400 and 7000 series computers, and the Univac 1004 processor are particularly popular. So is the Honeywell 200 computer, reflecting the large number of installations of this relatively recent model. Demand for other second generation models is quite limited.

Among the major incentives leading to acquisition of used equipment are the following:

• *Quick delivery* — Delivery is far prompter than the one to two years waiting time for most third generation computers. "We can supply almost any kind of second generation machine within 120 days or less," says E. R. McDonald, head of Business Machines Corp., one of the growing number of newly-formed organizations in the EDP resale field.

• *Elimination of installation and conversion delays* — As the used equipment is usually of the same type as machines already on-site, and will frequently perform the same tasks, new software requirements are eliminated or significantly reduced. In addition, users are enabled to forego, or at least, delay conversion to a third generation system with its attendant expenses and problems. For example, an IBM 8K 1401 is suggested as an acceptable substitute for an IBM 360/30 on the basis of the machines' price/performance ratios.

• *Low cost* — Used machines sell at 50% or less of their original list price. Thus, current costs are about $35,000 to $55,000 respectively. Similarly, prices for Univac 1004's average slightly under $30,000. These prices are particularly attractive for smaller firms. Bigger firms also find bargains. "Savings on larger systems are fantastic," says John Losio, president of EBM Co., New York. He cites as an example his recent sale of an IBM 7074 to a West Coast public utility at 35% of the cost of the 360/50 configurations which, he states, would otherwise be required. Discounts of this type enable the purchaser to write off the machine within two to three years. Afterwards, he can either continue to use the old equipment or switch to a third generation system, whose software should by then be fully debugged and operational.

Other incentives have apparently been found by a small group of third generation equipment buyers who, after comparison of their needs and the cost of the new systems, have turned back to older computers. One recent transaction involved the replacement of two IBM 360/30's with an IBM 1401 8K machine. These transactions are, of course, quite rare and are not likely to start a trend. In return for delivery in three to four months, the new buyers usually pay list price, plus a premium of about 10% to the broker.

A Market in Search of an Industry

Despite its growth, the market is still too new to have brought about the creation of a formal computer resale industry. The main elements in the picture today are a multitude of local middlemen, often working (or moonlighting) out of their homes; a group of about 20 national broker/dealers; and the major computer leasing companies, now taking a closer look at this new market. Computers are too costly and outright purchasers too few, for the machines to be successfully marketed other than nationally. Consequently, local middlemen must frequently work on a finder's fee basis for the major brokers.

The major brokers work in two ways:

(1) *As brokers,* acting as go-betweens between seller and buyer. For this they receive a premium based on the selling price and paid by the buyer.

(2) *As dealers,* purchasing the equipment themselves and reselling it at a profit. In such cases, they frequently break up systems, finding separate buyers for processors and peripherals. There is a particularly good demand for second generation tape drives.

As the supply of used, heavily depreciated equipment continues to increase, prices are likely to decline and brokers may find that buying machines for resale will become more profitable than brokerage. However, these firms are usually relatively small enterprises whose main revenues may come from other activities such as time brokerage, personnel recruitment, or service bureau operations. Few have the backing of a large parent company, or substantial capitalization. Some may, therefore, find themselves at a disadvantage in competing with the better-financed leasing companies.

Attitude of Leasing Companies

The attitude of the leasing companies is reflected by James Hasset, president of Cyber-Tronics, Inc., who says, "We are always willing to sell any machine we own." Prices, of course, reflect returns from computer rentals. The leasing firms have not been too active in the resale field, largely because the market was too thin and leasing was a much more attractive proposition. As the market grows it will be easier for them to use their sizeable resources to purchase used equipment on a risk basis for later resale. In this way, they will gradually establish a trading market in which a dependable supply will be promptly available to meet normal demand. They may thus also emerge as the major factors in the resale "industry."

The Role of IBM

IBM, whose second generation computers are most in demand, is also the biggest holder of these machines, which have been released by users who have gone on to 360's. This potentially makes IBM the biggest factor in the resale market and the one whose decisions can most affect its future prospects.

The company's policy has always been to protect its rental business (and residual revenues). It is thus unlikely to welcome outside transactions in used equipment which could affect new equipment leasing. Under the anti-trust consent decree of 1956 is must both offer new computers for purchase (thus creating the bulk of the resale supply) and allow bona-fide dealers to buy equipment released by users before it is returned to reserves. Dealers, however, have frequently found better bargains elsewhere. IBM has thus retained control over the supply of its used equipment, and as long as the resale market was a small one, it could afford to ignore it. Thus, users of second-hand equipment have found little difficulty in obtaining contract maintenance services from local

IBM offices. Where there have been difficulties, they have been for older equipment which it was inconvenient and difficult for outlying offices to service. Today, however, when the resale market may reach a significant size, the question must come up as to what actions the company may take.

The First Step

IBM has already taken one step, with the introduction of the stripped-down 1401 H system, which shows its concern for its rental business. The machine is intended to lock small users into the IBM fold until they are ready to move on to a 360/20, or perhaps to the rumored, low-end 360/10. However, with a rental fee of $1,300 per month, the system is still more expensive than a more powerful 1401. The card-oriented 1401 H also suffers from a disadvantageous price/performance ratio when compared to a used 1401 tape system. It thus seems intended primarily as a stop-gap for future 360 users, rather than as a limiting factor on resale business.

Much more to the point is the question of what IBM will do with its reserve of second generation equipment depreciating in warehouses. The soundness of IBM planning has yet to be faulted. It seems possible that if the 360/10 is indeed announced, as the number of 360 installations reaches a certain level, IBM may feel that the resale market would provide a profitable outlet for at least some of its second generation machines. This, however, would not necessarily depress the resale market. The company would release this equipment solely for profit. It would therefore be likely to carefully structure the mix of released equipment models and prices.

The Future of the Resale Industry

If a formal computer resale industry comes about, it will most likely be through a gradual shake-out. This will effectively eliminate all but a few well-financed major broker/dealers and leasing companies, which will both make a market for used equipment and control it. The trend towards a well-regulated resale market is unmistakable. One indication, for instance, comes from Business Machines Corp., which is preparing a price list for major data processing equipment models and options similar to the used car and office machine "blue books." This undertaking, which would be impractical in a thin, volatile market, is designed to provide buyers with a dependable supply from an established source. As this situation develops, the differences between the surviving dealer/brokers and leasing firms may become increasingly blurred, with the former also entering the leasing field.

The future of the resale market depends on the supply of available equipment. This may be broadened through increased demand for non-IBM second generation models, such as the NCR 315 and RCA 301, whose installations are reaching respectable levels. In addition, the fast-growing number of sale-leaseback transactions is vesting ownership of a large number of IBM 360 systems in the leasing firms. They are mostly out on short-term risk leases. If any are returned, the temptation, or at least the possibility, will exist to sell this partially depreciated equipment outright.

By the early 1970's the number of available IBM and other computers (ranging up in scale to CDC 6600's) should be such as to make for a really broad resale market. This will pose interesting questions for the manufacturers. They may find that they must consider the supply and cost of used equipment while structuring prices and marketing for their new models. All the while, they will continue to own the largest reserves of used, fully depreciated computers. They may then have to decide whether they can continue to remain aloof from the resale market.

CAREER CORNER

(Continued from page 23)

which provide the opportunity for long-term, career employment, good fringe benefits, and pleasant working conditions.

This type of agency does most to aid both the applicant and the employer, because of its high standards of operation.

From the Outside Looking In

Employment agencies are seen from the outside through glass of different tints. To the technical manager of a corporation, the employment agency has information on qualified professionals who will be able to perform a function swiftly and competently. To the personnel department, an employment agency has one of two views: (1) Either it is a valuable extension of the personnel department with lines of information that no personnel department can hope to have, or: (2) The employment agency rivals the recruiting department, performing the same function but commanding a fee for its services. In fact, the employment agency works closely with both the technical and personnel departments. A quality agency not only absorbs the costs of advertising and recruiting, but often performs all the functions of screening, reference checking, and testing. This type of agency counts on the performance of employees, its reputation, and increased business for income and profit growth.

Seeking a Different Job

For the individual looking for a different position, the employment agency provides a vast source of confidential information. If the individual is working but feels unchallenged or not in an atmosphere of opportunity or advancement, he has a willing listener in the personnel counselor who is trained to tackle the task of placing a qualified professional. The applicant, by writing one resume for the employment agency, immediately establishes contact with many firms and organizations in all parts of the country. The conscientious personnel counselor will carefully weigh the applicant's qualifications and expectations and will introduce him to firms who can meet his job requirements.

It would be unrealistic to ignore the applicant who is primarily interested in "quick" money and who changes positions several times to obtain rapid, better-than-average increases in salary. He is interested only in working for the highest bidder, and only until a higher offer comes along. This pattern will be continued until the "jumper" reaches a state of maturity and realizes there are other considerations besides money, or until he overprices his qualities and finds that he is no longer in great demand. Employers realize this and are willing to hire such a person only to get a particular job done.

For the Unemployed

Last, but not least, comes the case of the applicant who finds himself out of a job. Here, the personnel counselor can perform an extremely valuable function by forming a realistic evaluation of the applicant and discussing it with him. Constructive criticism, in a friendly vein, can help an individual realize his potential and establish career objectives. Although the applicant might not receive the highest paying position offered, he will be given the opportunity to build a solid and fruitful career.

Thus a personnel agency is a valuable organization in today's EDP labor market, and both employers and applicants can efficiently use it.

WORLD REPORT — GREAT BRITAIN

English Electric Sells First Third-Generation Computer to the USSR

The first of the western world's third generation computers has been sold to the Soviet Union by Britain. English Electric has contracted with Mashpriborintorg, the Soviet foreign trade corporation, to install 12 months from now a System 4-50 worth $1.4 million at the headquarters of GOSNAB in Moscow.

GOSNAB is probably the most important state organization in the USSR, since it is the State Committee of Supply for the whole nation, which runs the allocation of orders for factories and warehouses. Its chairman is a Deputy Premier, V. E. Dymshits.

A pilot scheme will involve the allocation of orders in the entire steel industry of the USSR; and the importance attached to the project is underlined by the fact that all the system's work is to be undertaken by the Institute of Automation and Telemechanics of the Academy of Sciences in Moscow.

This is the third 4-50 to go to the east — the other two are in Czechoslovakia and Yugoslavia. Total UK sales of new-design computers in the eastern bloc countries are now around the $40 million mark, with many more to come. At the same time, UK salesmen coming back from eastern Europe say that the big effort being deployed there by a number of American companies is not paying off. For what it is worth — and allowing for professional jealousy — they say the U.S. company representatives always make the mistake of hard selling and forget that invariably the men to whom they are talking probably know more about data processing than themselves. Does this mean that traditional British diffidence is paying off at last?

Last Processor in Atlas Series Finds Home

After many months of negotiations, the sixth and last central processor built in the Atlas Series by Ferranti (before it became part of International Computers and Tabulators) has found a home. This may sound a little disparaging but it is not meant to be. The home in question is Cambridge University, where the Atlas will serve as the main equipment in the Ministry of Technology's $6 million plus Computer-Assisted Design (CAD) project. It is intended that industry all over Britain shall be given access to the centre over broadband links and through local light-pen and display units. The CAD organization at the Ministry has had a fair amount of computer time at its disposal on such large beasts as the Stretch at Aldermaston nuclear weapons centre, the 1108 working on APT at the National Engineering Laboratory, and the Imperial College's 7094. But these machines are distant, different, and under the control of unconnected groups. The new centre with its very powerful processor will coordinate all these activities.

It is ironical that Atlas — a relatively old machine (which six years ago pushed existing circuit technology to the limit and taught computer engineers in the U.S. many new tricks) — should now be used to provide the mainstay for Britain's most advanced engineering project.

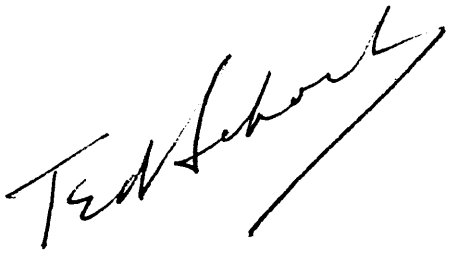
This bears out a contention by Dr. Grace Hopper of Univac that it matters less to have ultra-fast circuits than to have maximum exploitation of computer power by well-designed software. Software developed in Britain for Atlas 1 and 2 (and the smaller, but comparable Orion 1 and 2) may have no parallel, even in the U.S.

Atlas Software May Influence Government Purchase

The existence of this wealth of software for Atlas-type machines, totally different from the 360 concept followed in the UK by English Electric, may determine the Government's choice as to which type of number-cruncher it is going to support. The choice must lie between ICT's 1908 computers (various arrays of multi-processor) and whatever emerges from the link-up between English Electric and Elliott-Automation. The latter's design ideas are for a flexible, powerful processor acting as a supervisor for a very big crunching unit. Prices would start around $1.7 million, stretching up to some $10 million. English Electric has been most reticent about its own big machine project; little is known beyond that it will include two or more processors.

Ministry of Technology Has Little Success on Small Machine Front

While there has been some rationalisation in general purpose machines by reducing the number of makers to two, the Ministry of Technology is having little success on the small machine front. It had planned to split the market into process control on the one hand and message switching and traffic control on the other, with somewhat similar arrangements in military equipment. But the manufacturers generally are not prepared to play ball, and the Ministry is not yet in a position to use contract coercion, except perhaps on the military side. Just to complicate the issue, the most successful company in steel automation with the most advanced projects to its credit — including the most important one of cold mill control at Steel Company of Wales — has no machine of its own but makes a General Electric computer under license. Some politically-minded administrators in the Ministry of Technology find this very hard to swallow; and they are trying many expedients to get rid of this "need to use American technology."



Ted Schoeters
Stanmore
Middlesex
England

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The one on the right, a Chestnut Hunter.

Generations of careful and selective breeding made them what they are: paragons of unusual style, gallantry, and brilliance of carriage. Both are strong and full of stamina. Both are extremely reliable. Yet, they are not identical.

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Generations of experimental tapes brought them to what they are: the most durable and reliable in the industry.

It took endless testing and modification to perfect the right combination of backing, binder, and coating. No wonder the two great tapes make pass after pass without a dropout.

Like the two great horses, the two great tapes aren't exactly alike. Some tape-users even insist the other great tape can't match what ours can do.

We wouldn't argue.

(Instead, we'll send you brochures and specs, if you'll write us at 243 Memorex Park, Santa Clara, California 95050.)

MEMOREX

CAPITAL REPORT

From Unemployed to EDP Professional

The Institute of Computer Technology (ICT), a Washington non-profit corporation, is taking economically deprived adults in the 22-35 age range and successfully training them in programming and computer operations. ICT has a better than 90% placement rate for its high school graduates and dropouts who go through the 1,200 hours of instruction.

The United States Employment Service gives unemployed registrants its General Aptitude Test Battery, and refers students to ICT. ICT then tests further with programming and skills measures, and puts them either in the programming or operations classes. About 210 students are scheduled to go through "Project Repair" courses under a $250,000 contract from the Department of Labor.

About 1 out of 3 referrals from the United States Employment Service make it into the program, which includes remedial courses in math, English, and other subjects the qualified student needs for his new profession. Applicants must have a 1-year record of having been employed in any kind of work to become eligible.

The Institute was organized in 1964 by Hugh Donaghue of the Datatrol Corp., now merged with Control Data. Datatrol developed curriculum and provided teachers, and IBM supplied space, machine time, and other support. As the Institute expanded, a decision was made to organize a separate non-profit corporation and seek funding independently of IBM and Datatrol, who had carried a large share of the increasing costs. ICT is now headed by Albert Kreger, its president, and a board of directors including Donaghue, Herbert Halbrecht, Bernard Manheimer, Dr. Jack Moshman, Jack Roseman, and Dr. Robert Williamson.

Students receive living allowances of $35-55 per week, free tuition, books, transportation, and machine time. Hands-on training is included for operations courses students, and ICT develops on-the-job training slots where possible, and also negotiates with employers on behalf of the students.

Some of the program's success is undoubtedly due to the stiff selection and aptitude criteria, but Kreger places most of the graduates in jobs at the $5,300 to $6,500 starting salary range, and has some graduates earning $11-12K within 24 months after they graduate.

The Department of Labor has also funded $785,000 for a new program which will use some of the techniques ICT developed during its EDP work. This contract involves non-EDP training in literacy, skills, and math in basic education, and pre-vocational training in how to get along on the job, deal with your supervisors, etc. ICT also has had to write some of its own texts, and is developing training manuals for the Office of Education in the Dept. of Health, Education & Welfare. They deal with how to train programmers and operations personnel.

Air Force Procurement in Limbo

The unprecedented withdrawal of the $114 million contract award which the Air Force gave IBM for 135 base-level computers has created a large vacuum in Washington EDP circles. The Air Force doesn't want to talk about it, and refers inquirers to the Comptroller's decision, a hefty, 38-page book. Air Force sources say that no date has been set for resuming the selection process, and they are going strictly by the book.

According to these sources, "The Air Force received the Comptroller's decision, B 161483, concerning the Base Level Data Automation plan. The selection process was developed in the belief that it conformed fully with applicable statutes. However, it is the policy of the Air Force to comply fully with the decision of the Comptroller in such matters. Accordingly, the Air Force engaged in further oral and written discussion with the 4 manufacturers who submitted proposals, Burroughs, Honeywell, RCA and IBM. No procurement orders have been issued. Specific plans for the resumption of the Phase II source selection competition in compliance with the decision will be developed promptly. The 4 firms have been notified that these plans will be known to them as soon as they are complete."

IBM came under heavy fire during a Senate Investigations subcommittee preliminary probe by John L. McClellan, (D-Ark.). He said his investigators found that RCA, Honeywell, or Burroughs could have made equipment changes required by specs and still saved the government more than $50 million over the IBM proposal. It was very "disturbing" that the Air Force refused to give the unsuccessful bidders specific reasons for rejecting their equipment, he said.

During the controversy and subsequent cancellation of the award, some of the political implications became touchy. It is alleged that Thomas J. Watson, Jr., IBM Board Chairman, gave $37,000 to the 1964 campaign of Lyndon B. Johnson through various campaign committees, and that Arthur K. Watson, his brother, gave $13,000 the same year. T. J. Watson, Jr., is listed as the fourth largest contributor in the country to the 1964 Democratic campaign by those who dig up and tally such contributions. Of the 37K, 6K is alleged to have been used to help elect Robert F. Kennedy to the Senate.

5 Million Records and 4,000 Variables

The National Institute of Neurological Diseases and Blindness at the National Institutes of Health is doing a massive study on causes of neurological problems in infants. Its Office of Biometry in Bethesda, Maryland, near Washington, has 31 reels of magnetic tape holding 4.5 million records of hospital data on mothers and babies. Thirteen cooperating organizations all over the country are taking part in the study, which started in 1959. The last child included was born in September, 1966.

Not only is the mother examined, tested, and followed through her pregnancy, but the baby's data recording begins shortly after birth. Some data is from trained observation of delivery. The child is subsequently examined and periodically tested through age 7, with a very large battery of tests given at that time. The project's magnitude is evident in a partial

list of types of data recorded with many different devices in a variety of codes, structures, etc. Blood counts and analyses, psychological exams (some at 8 months of age with the Apgar test), probable disease diagnoses, Stanford-Binet tests, speech, language proficiency, hearing, neurological response, lab tests, motor responses, virus infections, etc. Some 14 different data forms are used to record raw data.

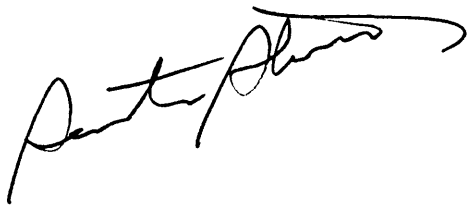
Subfiles, which deal with specific data needed by users, are created from the mammoth master file which contains about 100,000 records describing some 50,000 events. An event is data about both mother and child. William Weiss, Acting Chief of the Office of Biometry, and Bernard Kroll, Head of Systems Design and DP, are using CDC 3600's, 3200's, 160A's and IBM 360/50's and 30's and 1401's to process.

According to Kroll, some of the problems in handling such a large file with so many variables, and attempting to develop methods for correlation, are "tremendous," but they still analyze a statistical requirement, come up with a package, and usually deliver answers to users within 30 to 50 days, "even with a very complex set of variables." They give 24-hour turnaround from the smaller subfiles and programs which correlate, summarize, recode, format, and print from records already taken from the big master.

They are still trying new and better information retrieval approaches. They expect to have 6 million records before the study is complete, and have hopes of eventually using the file to do research which compares machine-produced diagnoses with those of medical doctors.

One hundred fifty people in 5 or 6 different disciplines gather and record data from the 13 hospitals and clinics, and they have access to Biometry's staff of 17 as well as to the range of statistical programs which have been developed during the past 8 years.

A special study is also underway in infants in a special electroencephalogram (EEG) file. EEG's are recorded simultaneously with a TV camera having a clock in the background for synchronization. Researchers can watch a display of the EEG digitized waves and the expression of the child at the same time on a split TV screen.



Senter Stuart

c & a

PROBLEM CORNER

Walter Penney, C.D.P.
Problem Editor
Computers and Automation

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

Problem 679: Are Two Heads Better Than One?

"I wonder whether they could finish it today," Art said, half to himself, but just loud enough so that John Lawthorne, who was passing by, overheard him.

"Do you have a problem?," John asked since Art's forehead wore more of a frown than usual.

"Oh!" Art turned around quickly. "I was just trying to figure out how long it would take tc get this program written." He made a few calculations on a sheet of paper. "Bob is one of my best programmers. I would estimate that he could get this written in about four hours. Charlie is a good man too; it might take him five hours."

"Would it be possible to have both of them working on it simultaneously?"

"Yes, and in fact I've segmented it so that they can do just that. I'm in a hurry for it so I guess I'll put them both on the job."

"How much loss efficiency do you figure there is when two people work on the same program — putting the parts together, and such?"

"Well, I've found that in a situation like this it would amount to about a 10% loss." Art crumpled the sheet he had been writing on and threw it into the waste paper basket. "I can't figure this out. My guess is that it will take two and a half hours."

His companion had been making a few mental calculations. "That's very close. Actually it would take a little less."

Exactly how long would it take Bob and Charlie to finish the program?

Solution to Problem 678: A Fascinating Flow Chart That Doesn't Work

After y is changed to y + 1, x must be reset to 0. Otherwise x retains the value 9 and the correct solution (x = 6, y = 6) will be missed.

COMPUTER-ASSISTED EXPLANATION

Edmund C. Berkeley
Senior Scientist
Information International Inc.
Cambridge, Mass. 02139

"A new field for the application of computers is assistance in explaining. Computer-assisted explanation is closely related to — but is not the same as — computer-assisted instruction (CAI). As is the case with CAI, the potential practical benefits of computer-assisted explanation are enormous. Some estimates of the possible value of improvements in explanation are given below."

What is Explanation?

To explain is to make plain or clear, to change something that is not understood into something that is understood. To explain a strange idea means to define it and make it clear, using familiar or previously explained ideas put together in a familiar or previously explained relation. Explanation, therefore, is the activity or the result of explaining.

Explaining involves something to be explained (a topic), a person who does the explaining (the explainer or lecturer), persons to whom the explanation is given (the audience), and many more elements and factors besides. To explain well is an art, and the capacity to explain well can be learned.

Assistance from a Computer

The advent of the automatic computer makes it possible to apply to the art of explaining a vast power to handle information. The programmed computer, for example, can easily provide a great deal of control over many factors such as vocabulary, sentence length, and number of syllables. The result is that better explanations can be produced with less human labor. In addition, in the next few years, the programmed computer should become able to deal efficiently not only with words but also with ideas. The computer should be able to deal intelligently with terms and relations, statements and questions, and thus provide explanation ideally suited to each individual member of an audience. Many other interesting and important possibilities for computer-assisted explanation[1] clearly cast their shadows before.

[1]The work reported here was done under contract N00014-66-C0281 from the Office of Naval Research of the U.S. Navy Dept., to Information International Inc.

This article has two purposes. The first is to discuss what is good explaining and to present a short guide to improving explanation. The second purpose is to demonstrate a beginning in using an automatic computer to help produce good explanation. Several working computer programs are here described.

Outline

Two Examples of Explanation

Let's begin by considering two examples of explanation. Following is a notice that I read in a New York taxicab in 1949:

> **AVOID** INJURY ACCIDENTS
>
> SIT BACK — RELAX — ENJOY YOUR RIDE

This is excellent explanation. The words are good, direct words, with clear meaning to almost everybody who rides in a taxicab. The entire explanation is short: nine words in all. The reason for the directions is given first: "avoid injury and accidents." Then the directions are stated, "sit back and relax." Then one more encouraging reason is given, "enjoy your ride."

The following is part of the third paragraph from an article "The Significance of Meiosis in Allomyces" by Ralph Emerson and Charles M. Wilson in *Science,* July 22, 1949, vol. 110, pp. 86-88:

> Resistant sporangia formed by sporophytic thalli grown on slants of yeast starch agar ordinarily become capable of germination three to six weeks after their formation. At this time each sporangium contains about a dozen expanded, diploid nuclei in an advanced prophase stage. These sporangia are fully mature and, if air dried, they will remain viable and their nuclei will remain in prophase without any further detectable change for periods up to at least ten years. When mature resistant sporangia are taken directly from moist agar cultures and placed in water at 20° to 25°C., they form and release spores in 100 to 130 minutes. During this short interval the two meiotic nuclear divisions occur, and are immediately followed by cleavage of the cytoplasm and organization of the zoospores. Each of the zoospores is haploid and normally uninucleate.

This is straightforward technical writing of the ordinary technical journal variety. Also, the writers have pointed out something remarkable — here is a form of life which has a resting period ten years long, and then in two hours' time under the right conditions it lives actively again and makes spores. But the words shown in Table 1, the special terms, all have to be understood in order that the paragraph have full meaning. In fact, out of 99 different words in this paragraph, 24 are special terms. This is undoubtedly much too heavy a load for at least some readers and probably a great many.

The Differences between Instruction and Explanation

Instruction and explanation grade smoothly into each other in some ways but in many ways they are quite different.

Instruction regularly implies that there is a deliberately arranged situation in which some persons are students, and another person is the teacher, and explanation is taking place in a deliberately educational environment such as a classroom, a seminar, a lecture, etc. In this environment there exist several kinds of compulsion. Basically, the student is under some kind of pressure to try to learn.

The instructional environment is, however, missing on many occasions when explanation is needed. For example, a subordinate may be presenting some proposals to a busy supervisor, and he has to rely on the interest and convincingness of his first few explanatory statements to persuade his supervisor to listen to the rest of what he has to say. Or the manager of a project may have to explain to a committee that holds the purse strings why the project continues to be important, how this year's results have been significant, and why a larger budget than last year is reasonable; and he knows he has to rely on some ten pages of explanation which the committee will read in his absence. Or a department of a corporation is interested in increasing the skills and understanding of men working for it, and desires to make instructional material, manuals, etc., as clear, interesting, and inviting as possible so as to persuade these men to use some of their spare time to learn more and thus become more useful. In each of these cases, the audience for the explanation is under no compulsion to listen.

As a result, explanation must be more interesting, more attractive and more "explanatory" than much instruction. But many of the principles of good instruction apply to explanation also.

Table 1

A SPECIAL VOCABULARY

agar	germination	sporangia
centigrade	haploid	sporangium
cleavage	meiotic	spores
cultures	nuclear	sporophytic
cytoplasm	nuclei	thalli
diploid	prophase	uninucleate
divisions	resistant	yeast starch
expanded	slants	zoospores

Factors Affecting Explanation

The quality or effectiveness of an explanation depends on a large number of factors, such as:

— the nature of the audience;
— the importance of the subject to the audience;
— the explainer's knowledge of the subject matter;
— the choice of words by the explainer (his vocabulary); and so on.

More than fifty factors and variables can be inventoried that influence the effectiveness of an explanation (see Table 2). For a discussion of these factors, see Reference 1, pp. 23-53.

Edmund C. Berkeley has been Senior Scientist at Information International Inc., Cambridge, Mass., since 1963. He is also Editorial Director of the Library of Computer and Information Sciences, Crowell-Collier, New York; and Editor and Publisher of *Computers and Automation,* Berkeley Enterprises Inc., Newtonville, Mass. He graduated from Harvard College A.B. 1930 summa cum laude, having concentrated in mathematics. He is a Fellow of the Society of Actuaries; was first secretary of the Association for Computing Machinery (1947-53); and is the author of eleven books including *Giant Brains or Machines That Think,* Wiley, 1949, and *The Computer Revolution,* Doubleday, 1962.

Table 2

FACTORS AFFECTING THE QUALITY OF EXPLANATION

A. Factors Related to Subject Matter

1. Context
2. Ideas Assumed Known
3. Common Properties and Relations
4. Theses
5. Repetition
6. Examples
7. Development
8. Relations of Ideas to People
9. Self-Protection

B. Factors Related to Words

10. Spelling
11. Pronunciation
12. Wrong Words
13. Ambiguous Words
14. Fuzzy Words
15. Familiar or Strange Words
16. Frequency of Words
17. Length of Words
18. Connotation of Words
19. Vividness of Words
20. Word or Phrase

C. Factors Related to Sentences

21. Punctuation
22. Grammar
23. References of Words
24. Modifiers
25. Length of Sentences
26. Variety of Sentence Structure

D. Factors Related to Paragraphs

27. Paragraph Length
28. Unity within Paragraphs
29. Coherence within Paragraphs
30. Emphasis within Paragraphs

E. Factors Related to the Whole Explanation

31. Unity
32. Coherence
33. Emphasis
34. Brevity
35. Tempo
36. Accuracy
37. Simplicity
38. Style

F. Factors Related to the Audience

39. The Nature of the Audience
40. Importance
41. Interest
42. Entertainment
43. Motivation
44. Feedback
45. Effectiveness

G. Factors Related to the Explainer

46. Knowledge of the Subject Matter
47. Emotional Attitude
48. Sincerity
49. Skill
50. Time Available
51. Clerical Assistance
52. Assistance by Computer

Computer Programs to Assist in Explanation

In the work so far done, a number of computer programs have been worked out for tasks associated with improving explanations. These programs include:

- a computer program for classifying the words used in an explanation into special terms, allusions, words of one syllable, and other words (there are appropriate definitions; for more information, see below);
- a computer program for placing all the words of a class into alphabetical sequence and counting the number of occurrences of each word;
- a computer program for determining the average number of words per sentence in an explanation;
- a computer program which determines the number of syllables in a word;
- a computer program which selects words of one syllable (after dropping the endings "-s, -es, -d, -ed, -ing");
- a computer program which classifies words according to tags attached to them;
- a computer program that determines the ratio of the number of syllables in a passage to the number of words;
- a computer program that determines the presence or absence of key words and phrases in an explanation;
- a computer program which determines word by word the differences between the actual vocabulary used in an explanation and the assumed vocabulary of an audience.

Most of these programs have been expressed, in order to demonstrate feasibility, in the computer programming language LISP. Some, for producing output quickly, have been expressed in assembly language for the PDP-7 computer made by Digital Equipment Corporation, and have been assembled into swiftly operating binary programs in machine language.[2]

Analyzing Explanations with a Computerized Vocabulary Analysis Program

Over a dozen examples of explanation (sample passages) were analyzed using the computer program called the Vocabulary Analysis Program. This program, applied to an explanation (a passage of up to 800 words):

[2]For more information about these programs, see Appendix 1 and Appendix 2 in Reference 1.

— classifies the words occurring into four classes;
— places each word in its class;
— lists the words in each class in alphabetical sequence;
— counts how often each word occurs and states the frequency;
— states the total number of different words and the total frequency of all occurrences (for each class).

The four classes of words have been given names as follows:

— Class 3, the Special Vocabulary;
— Class 4, the Allusion Vocabulary;
— Class 1, the One-Syllable Vocabulary; and
— Class 2, the Key Vocabulary.

The definitions of these classes of words are as follows:

Class 3, The Special Vocabulary (the "special terms"):

Words that are used for explaining, that most readers certainly do not know or probably do not know, and that are or ought to be explained in the course of the explanation.

Each such word is tagged by placing the number 3 after an occurrence of the word. (It is not necessary to tag more than one occurrence.)

Class 4, The Allusion Vocabulary:

Words that most readers may not know, and do not need to know, and that are not used in later explanation.

Each such word is tagged by placing the number 4 after an occurrence of the word.

Class 1, The One-Syllable Vocabulary:

One-syllable words; words which become one syllable after dropping the endings "-s, -es, -d, -ed, -ing," as in "faces, bunches, graded, raided, looking" — since these endings do not make the word harder to understand; also words for numbers, places, years, dates, and most proper names, since, in the way that such words occur, they do not make the explanation harder to understand.

No tagging is necessary for almost all of these words; but a proper name like "B. J. Smith" needs to be written with hyphens and tagged with a 1, as follows: "B-J-Smith 1."

Class 2, The Key Vocabulary:

Other words, consisting mostly of words of two or more syllables, that are used for explaining, that most readers know or probably know, and that are not explained.

The computer program automatically assigns untagged words to Classes 1 and 2 because it contains a subroutine that determines the number of syllables. However, some exceptional words have to be tagged. For example, the following words have to be tagged with a 2: "preempt," since the computer program cannot tell that the two e's next to each other in this case are pronounced as two syllables; "during," since the computer program cannot tell that "dur" does not exist as a one-syllable word.

The classifying and totaling of words in these categories accomplished by the Vocabulary Analysis Program[3] gives the explainer a large amount of control over the vocabulary he is using to try to convey understanding to an audience.

[3]The Vocabulary Analysis Program is stated in Appendix 1 of Reference 1, and is there expressed in symbolic assembly language. A copy of the operating binary program tape may be obtained on request to E. C. Berkeley, Information International Inc., 545 Technology Sq., Cambridge, Mass. 02139, and it should be usable on any PDP-7 computer.

Example of Vocabulary Analysis Using the Program

For example, consider the following passage from a sample explanation:

> Whether by biologists, sociologists, engineers, or chemists, sampling is all too often taken far too lightly. In the early years of the present century, it was not uncommon to measure the claws and carapaces of 1000 crabs, or to count the number of veins in each of 1000 leaves, and then to attach to the results the probable error which would have been appropriate had the 1000 crabs or the 1000 leaves been drawn at random from the population of interest.

In this illustration of an explanation there are four special terms (belonging to Class 3, the Special Vocabulary):

sampling
probable-error
drawn-at-random
population

There is one term rather strange and unusual which does not have to be understood in order to understand the explanation, and so we may put it into Class 4, the Allusion Vocabulary:

carapaces

There are 18 words in the Key Vocabulary, Class 2:

appropriate	engineers	present
attach	interest	results
biologists	lightly	sociologists
century	measure	taken
chemists	number	uncommon
early	often	whether

None of these are unusual or difficult. All the rest of the words are in the One-Syllable Vocabulary, Class 1.

Most of the work needed, therefore, to guarantee that the explanation is clear to the audience may be concentrated on the four words in Class 3 and the word in Class 4.

For example, in the second sentence, "drawn at random" is clearly a special term in statistics; but here it is treated as if everybody reading this passage already knew what it was. This assumption may not be justified for the audience of intelligent laymen for which this passage was written. So some revision of the wording should be considered.

For another example, "carapaces," marked as belonging in Class 4, could easily be changed to "shells"; to talk of the shells of crabs (even if they do not have true shells) instead of their carapaces is likely to be helpful to the audience, and conserve their attention for the concepts like "drawn at random" which they must learn.

A sample of how this passage would be given as input to the Vocabulary Analysis Program, and a sample of what the program would produce as output, are shown in Table 3.

Method for Revising and Improving Explanations

A general (and rather obvious) method for revising and improving explanations can be stated as follows:

Re the Special Vocabulary:

1. Basic terms: Clarify their explanation. Make sure that they are adequately defined. Answer natural questions about them.
2. Terms probably understandable: Remove those not really needed. Make those that remain clearer and more understandable.
3. Terms that are not really necessary: Eliminate them by rephrasing.

4. Terms that are ambiguous: Remove the ambiguity.
5. Undefined, unguessable terms: Either explain them or remove them.

Re the Allusion Vocabulary:

6. Remove the allusions that are not really needed. Make those that remain clearer and more useful.

Table 3

A SHORT SAMPLE EXPLANATION ANALYZED BY THE VOCABULARY ANALYSIS PROGRAM

Input:

WHETHER BY BIOLOGISTS, SOCIOLOGISTS, ENGINEERS, OR CHEMISTS, SAMPLING 3 IS ALL TOO OFTEN TAKEN FAR TOO LIGHTLY. IN THE EARLY YEARS OF THE PRESENT CENTURY, IT WAS NOT UNCOMMON TO MEASURE THE CLAWS AND CARAPACES 4 OF 1ØØØ CRABS, OR TO COUNT THE NUMBER OF VEINS IN EACH OF 1ØØØ LEAVES AND THEN TO ATTACH TO THE RESULTS THE "PROBABLE-ERROR" 3 WHICH WOULD HAVE BEEN APPROPRIATE HAD THE 1ØØØ CRABS OR THE 1ØØØ LEAVES BEEN DRAWN-AT-RANDOM 3 FROM THE POPULATION 3 OF INTEREST.

Output:

CLASS 3
DRAWN-AT-RANDOM 1
POPULATION 1
PROBABLE-ERROR
SAMPLING 1
NU 4 FQ 4

CLASS 4
CARAPACES 1
NU 1 FQ 1

CLASS 2

APPROPRIATE	1
ATTACH	1
BIOLOGISTS	1
CENTURY	1
CHEMISTS	1
EARLY	1
ENGINEERS	1
INTEREST	1
LIGHTLY	1
MEASURE	1
NUMBER	1
OFTEN	1
PRESENT	1
RESULTS	1
SOCIOLOGISTS	1
TAKEN	1
UNCOMMON	1
WHETHER	1

NU 18 FQ 18

CLASS 1

1ØØØ	4
ALL	1
AND	2
BEEN	2
BY	1
CLAWS	1
COUNT	1
CRABS	2
EACH	1
FAR	1
FROM	1
HAD	1
HAVE	1
IN	2
IS	1
IT	1
LEAVES	2
NOT	1
OF	5
OR	3
THE	9
THEN	1
TO	4
TOO	2
VEINS	1
WAS	1
WHICH	1
WOULD	1
YEARS	1

NU 29 FQ 55

Re the Key Vocabulary:

7. Words that can be eliminated by commoner ones just as precise in meaning: Replace them.

There is nothing unusual or remarkable about this set of directions. Usually though, an author is preoccupied, thinking about his ideas and trying to express them. So he forgets to apply these directions in his explanation to the particular audience he is seeking to reach.

No computer program to apply these directions seems at present feasible. Such a program, though not impossible, is still a long way off.

This method has been applied to three sample explanations, and the resulting revisions of the sample have been analyzed by the Vocabulary Analysis Program. The details may be found in several chapters and appendices of Reference 1.

The Practical Value of Good Explanation

The value of a good explanation is like the value of a key. You may not need a key to go through a door, but if the door is locked, and you need a key, and you have the right key, then you can pass through and otherwise you can't. In other words, a good explanation may unlock knowledge that is otherwise not accessible.

The value of a good explanation also depends on the number of people who will be using the explanation, and the degree of difference between a good explanation and an ordinary explanation.

Suppose: that an audience of 10,000 people will use an explanation; that a good explanation will require one hour to be understood; and that an ordinary explanation will require two hours to produce the same degree of understanding. Suppose that the time of the people in this audience is worth $3 an hour on the average. Then the difference in value between the two explanations is $30,000. Suppose it takes an extra eight-hour day from a competent explainer receiving $10 an hour, to make a good explanation instead of an ordinary one. Then the investment of $80 in the explainer's time gives a return of $30,000; this is a good bargain.

Of course, these figures are sample figures only. But they show the pattern in which similar calculations could be made for other cases with different data.

Suppose we try to estimate roughly the possible annual gain from good explanations instead of ordinary ones. Suppose the United States has a working force of 70 million people. Suppose that a dozen times a year a good explanation instead of a poor one saves one hour of their time. Suppose the average rate of pay is $2 an hour. Then the annual saving would be:

70 million people/year x 12 times in a year x 1 hour/time x 2 dollars/hour, which equals $1.7 billion a year

or, to be a little conservative, say, a billion dollars a year. The cost of making the good explanations might be 1/100 of the saving or $10 million. Here again, the pattern of calculation may apply, although more carefully chosen data should be used.

There is probably even a larger value from good explanation as compared with ordinary explanations: it enables some persons to acquire capacities (training) that otherwise they could not (or would not) acquire. Suppose that in each year good explanation instead of ordinary explanation allows 1/20 of the workforce to pass through a gate (acquire a capacity) that otherwise they would not pass through. Suppose the value of passing through (like the value of an education) is 100 times the cost of the time spent to pass through, say 20 hours at $3 an hour (since this part of the workforce will be more highly paid). Then the additional value from the acquired capacity resulting is:

70 million people/year x 1/20 x 100 x 20 hours x 3 dollars/hour, which equals $20 billion/year.

It must be emphasized that these calculations are just rough estimates; essentially, they only show possible magnitudes, and possible patterns for estimating.

Personally, I have been studying explanation and seeking to explain clearly to various audiences, for more than thirty years. And now at last, the vast monotonous, intolerable, clerical labor for thoroughly investigating words, vocabulary, and ideas in explanation is now ended, thanks to the powers of the computer in the field of explanation.

REFERENCE

1. "Computer-Assisted Explanation: A Guide to Explaining: and Some Ways of Using a Computer to Assist in Clear Explanation," by Edmund C. Berkeley, published by Information International Inc., 545 Technology Sq., Cambridge, Mass. 02139, May, 1967, paperbound, 280 pp.

Copies are available from Information International Inc. (so long as the original supply lasts) on request from persons working in the field of explanation, computer-assisted instruction, and related subjects. Other persons may purchase copies from "Computers and Automation."

The table of contents of the published report appears in Table 4.

Table 4

COMPUTER-ASSISTED EXPLANATION

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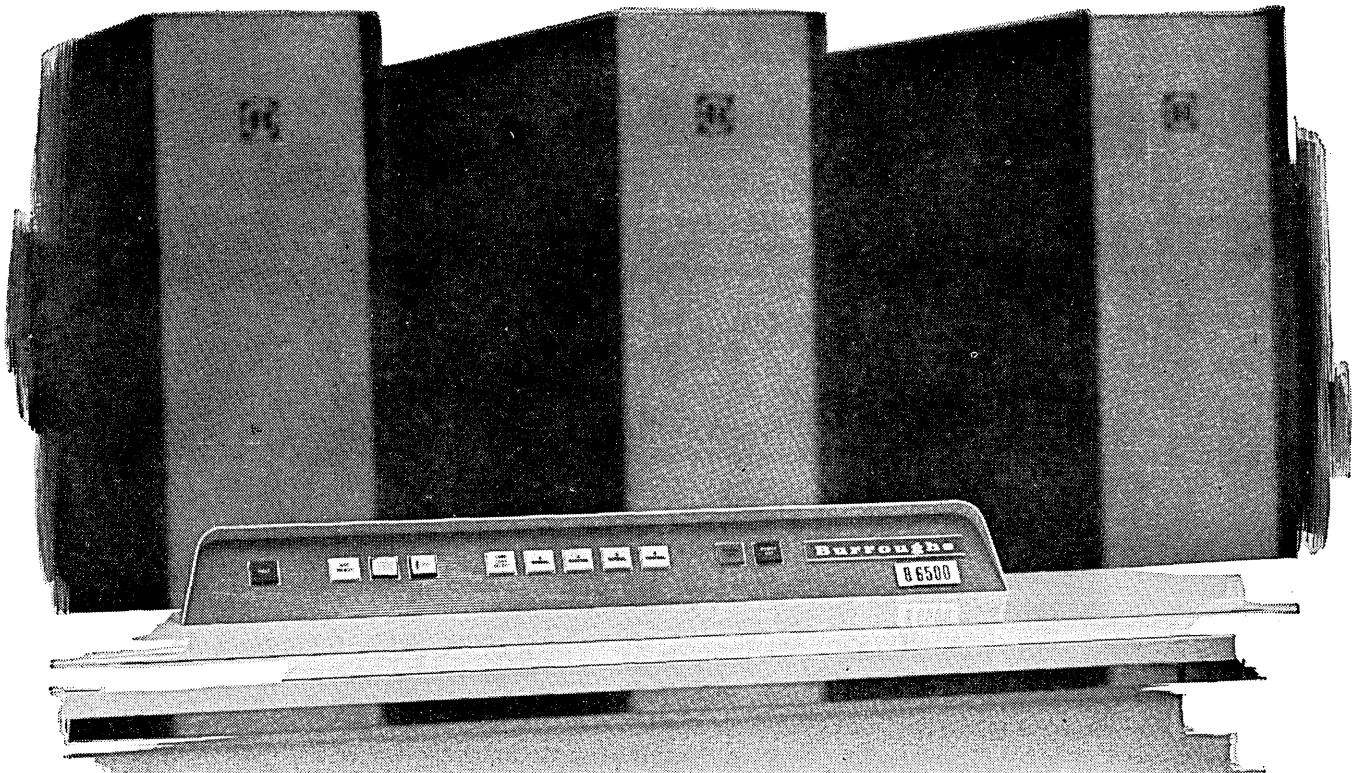
The Burroughs theory of evolution



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ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

AUTOMATIC INTERCEPT SERVICE

Electronic equipment, capable of remembering thousands of telephone numbers, now is being used by telephone operators in Washington, D.C. to provide faster, more accurate status reports to callers on non-working numbers. The computer-like system, known as "Automatic Intercept Service," was introduced by the C&P Telephone Company in July. The system was developed jointly by C&P engineers and IBM Corporation. Initially, about half of the intercept calls are being handled electronically, and by the end of the year, C&P hopes to complete the conversion.

"Intercept" is the 24 hour-a-day service provided to handle calls to telephones which, for varying reasons, are not working numbers. This includes calls to numbers that are not assigned, have been disconnected or have been changed. Because of the high mobility of telephone users in this area, Washington has the largest "intercept bureau" in the Bell System. Calls to "intercept" have increased steadily from 33,000 a day in 1960 to 51,000 this year. A company spokesman estimates that this will grow to about 85,000 in 1970.

Before conversion to electronic intercept equipment, operators had to thumb through a printed directory in order to answer each call to an out-of-service number. Directory information now is stored in the computer's IBM 1311 magnetic disk files. The picture shows C&P employee Kathy Moore comparing a printed number intercept directory to an IBM disk pack.

The new system incorporates an IBM 7770 audio response unit and an IBM 1440 computer. A vocabulary of words and sounds were recorded by human voice and stored on a magnetic drum within the 7770 unit.

When the caller gives the operator the number he dialed, she keys it into the computer through a 10-key button keyboard at her station. The computer searches its records, determines the status of the number dialed, and translates the computer message into a voice reply by selecting and assembling the proper words from its 128-word recorded vocabulary. The voice message is heard by the caller within 10-20 seconds after placing his call. A typical answer would be, "The number you have called, 628-1139, has been changed. The new number is 737-3549. The new number is 737-3549. This is a recording." Following a brief pause, an operator will come in on the line automatically to offer further assistance if necessary.

Although only one IBM 1440 computer and 7770 audio response deivce are required to operate the automatic intercept system, C&P has installed two of each. While one system answers calls, the other stands ready as a back-up to insure continuous 24-hour service. Initially the intercept system will be able to handle up to 64 incoming calls simultaneously. Future plans call for the capacity to be increased to 128 at one time or about 11,000 an hour.

SCIENTIFIC SAILMAKING NOW A REALITY

Two of the United States' most technically-oriented sailmaking companies have joined forces to produce sails designed by a computer. Hard Sails, Inc., Islip, L.I., N.Y., has purchased the computerized design techniques and assets of Milgram and Hopkins, Somerville, Mass., presidents Wallace C. Ross of Hard Sails and Dr. Jerome Milgram of M & H have announced.

For the past five years Dr. Milgram, who is also a research

associate at Massachusetts Institute of Technology, has been using computers in converting related data to finished sail design. These designs have been noticeably successful in the 5.5 Meter class.

The computerized design, Dr. Milgram explained, is the organization of critical data of a particular boat's hull form, sailing qualities, rig plan, and dimensions into a design technique that can be programmed on a computer. The program then gives the cross sectional shape the sail should be at various heights up the mast for the particular boat in the particular wind condition described. The program also computes the curvature (in offset dimensions) for both edges of each panel in the sail so that the predescribed shape can be reproduced. In addition, the computations show the exact trim angle for the jib or genoa and the exact traveler setting for the main.

"EARLY WARNING SYSTEM" FOR OPEN HEART SURGERY PATIENTS

Hours before clinical signs become apparent, a new "early warning system" alerts attending physicians at Presbyterian Medical Center, San Francisco, Calif., to impending changes in the condition of patients recovering in the Cardiopulmonary Intensive Care Unit. The specially-designed patient monitoring system is linked to an IBM 1800 Data Acquisition and Control Computer. The system was developed under the terms of a joint study between PCM's Institute of Medical Sciences (under National Institutes of Health grants) and IBM Corporation. It currently is being used primarily in the post-operative treatment of open heart surgery patients.

The system measures and detects trends indicated by some 25 vital factors involved in the patient's progress, displays its accumulated finds to medical personnel on a television screen near the patient and signals attending physicians if an abnormal condition begins to develop. Circumstances under which an alarm will be sounded and emergency information displayed are prescribed in advance for each patient by his attending physician and entered into the system.

PMC's computer-based "early warning system" can: monitor and analyze a variety of patient data and predict complications based on related changes in several aspects of the patient's physical condition; automatically calculate important physiological values which cannot be measured directly with available instruments and were previously obtainable only through manual calculation by the hospital staff; maintain an up-to-the minute patient history in the computer memory for use in detecting trends in the patient's condition; and support the medical team by monitoring up to three patients simultaneously.

"The primary purpose of this computer-based system is to assist us in providing improved care for patients in our Cardiopulmonary Intensive Care Unit," Frank Gerbode, M.D., the institute's president said. "Since becoming operational in March, it has shown the capability of alerting our surgeons to impending complications hours before they would have been observed by usual clinical signs and routine procedures".

LEGAL DATA WORLDWIDE PINPOINTED BY COMPUTER, COMMUNICATIONS LINK

The capabilities of a computer and international communications recently were teamed up to initiate the first step in a program to place the world's legal archives at the fingertips of attorneys any place on the globe. In a three-day demonstration for the World Peace Through Law Conference meeting in Geneva, Switzerland during July, answers to a variety of domestic and international legal questions were supplied through the medium of a computer at the New York headquarters of Law Research Service, Inc. The connecting communications with Geneva were provided by the international telex facilities of Radio Suisse and ITT World Communications Inc., a subsidiary of International Telephone and Telegraph Corp.

Seconds after the queries were initiated, by dialing a 10-digit coded number on the telex machine, a teleprinter produced the requested information in printed form. From the computer's massive "legal library" came precise references to laws and decisions on matrimonial property rights, labor agreements, the validity of oral contracts and similar statutes and cases in a half dozen different countries — in the language of each country.

This "legal library" is kept up to date bi-monthly. As new decisions are received from the courts, administrative bodies, and other agencies, Law Research Service incorporates them into the computer's memory.

Basically the conference delegates did what many of their profession are doing now throughout the United States and Canada. With the aid of a Computer Thesaurus or glossary of legal terms and phrases coded with 10-digit numbers, they were able to pinpoint specific legal data in a fraction of the time required by conventional methods.

The computerized approach to the retrieval of legal information also overcomes the vexing problem of language differences. "With it," said Ellias C. Hoppenfeld, president of Law Research, "a lawyer in Denmark can secure the pertinent French law to his problem without the need of translating his question from Danish to French."

COMPUTERIZED BALLISTICS IDENTIFICATION SYSTEM

A computerized weapons identification system that can quickly identify the "fingerprint" of a bullet found at the scene of a crime and trace it to the weapon from which it was fired has been developed by Computing Technology Inc., Paramus, N.J.

The BALID system, as it is called (for Ballistics Identification), may someday make it possible to instantaneously identify the owner of any weapon by scanning the ballistic markings of an evidence bullet (bullet found at the scene of a crime) and entering quantitative information into a computer to trace its origin. The BALID system consists of an electromechanical scanning component, a small scientific computer, and computer programs.

Basically, the BALID system makes use of three programs. One accepts the output from the scanner and produces indices of the internal ballistic markings. These indices are numerical values representative of such markings. A second program will store this information in the appropriate mechanical bullet files kept on magnetic tape. The third program matches a search bullet against these files to find the most probably match, or the most probable matches. The computer for the BALID system is the PDP-8S, a small, inexpensive scientific computer manufactured by the Digital Equip. Corp., Maynard, Mass.

To scan the bullets, the BALID system makes use of a surface-analyzer manufactured in England by Rank Taylor Hobson. The instrument, called the Talysurf 4, is a solid-state electromechanical scanner capable of providing horizontal amplifications of up to 500 X and vertical amplifications of up to 100,000 X. Operationally, the system permits the scanning of a six-land bullet in about 10 minutes, including the necessary set-up time.
(For more information, designate #41 on the Readers Service Card.)

COMPUTER-CONTROLLED REAL-TIME GAS DISPATCH SYSTEM IN OPERATION

A Westinghouse Prodac® 50 computer system is being used for natural gas dispatching and remote control of system pressures by the United Gas Improvement Company of Philadelphia, Pa. The equipment went into operation recently at Reading, the center of UGI's gas territory.

In this application, the Prodac equipment acts as brain for a telemetering system that measures the flow of gas and controls certain pressures in a pipeline system covering a territory of about 2400 square miles. The computer's real-time operations result in a more economical flow of gas from transmission company lines through UGI's vast distribution system to its customers.

The computer also gives UGI officials up-to-the-minute reports on purchases, sales, and storage of gas for demand control and bookkeeping purposes.

COMPUTER RECOGNITION OF HUMAN DISEASE PATTERNS

Techniques with which computer systems can recognize or help physicians recognize disease patterns are being developed at the University of Missouri School of Medicine, Columbia, Mo. The Public Health Service recently awarded $129,676 to support the second year of the study, "Computer Recognition of Human Disease Patterns." Dr. Donald Lindberg, associate professor of pathology and director of the Medical Center computer program, is project director.

Studies are suggesting patterns of blood chemistry which might prove significant in aiding early detection of certain diseases. A 16-channel autoanalyzer (designed at the University Medical Center) is directly linked to the Center's computer system. Sixteen tests can be performed simultaneously with the autoanalyzer. With another device, a computer analysis linked to the autoanalyzer, it is possible to capture on tape the voluminous data provided by the autoanalyzer and to blend this information into the computer's storage and reporting system.

With earlier computer techniques, the researchers found that by using serum electrolytes and other blood chemical measurements, the computer system can give a more accurate and consistent measure of kidney function than the physician can determine.

In other studies, results from the multiphasic testing are suggestive enough to merit an intensive search for meaningful patterns that could indicate a person's predisposition to a particular disease. Such patterns of association could aid the physician in detecting heart disease, renal disease, and other major illnesses while in the early stages and still curable, the researchers believe.

EXPO 67 USING COMPUTER TO CONTROL TICKET SALES

Among computer applications which are contributing to the efficient management of Canada's Expo 67 is a program for the control of ticket sales. The procedure is carried out with a National Cash Register Series 500 computer.

A magnetic ledger card is created for each performance of a particular show. As tickets are sold, the appropriate dollar value is taken out of inventory on that performance card. Deduction codes are keyed into the cards to denote discounts, complimentary tickets and amusement tax. Thus, complete and up-to-the-moment information is maintained on the whole spectrum of Expo 67's entertainment. Management reports are made regularly available.

"We believe this to be a unique use of a computer," said R. E. Gobeil, deputy director of the Finance Branch of the Canadian Corporation for the 1967 world exhibition. He added, "The system keeps Expo's management informed at all times. If advance ticket sales are low, we know exactly where to place our advertising dollar. There's no point in advertising a sold-out show."

ORGANIZATION NEWS

MEMOREX MOVES INTO COMPUTER HARDWARE WITH PERIPHERAL SYSTEMS

Peripheral Systems Corporation (PSC), a subsidiary of Memorex Corporation of Santa Clara, Calif., has established a new headquarters plant in Sunnyvale, Calif.

President of PSC Robert Brumbaugh said that the firm represents the first step for Memorex into computer hardware. Initially, PSC is introducing an all new disc storage drive unit for advanced computer systems. The 630 Series Disc Drive is produced for original equipment manufacturers.

NCR SETS UP ELECTRONIC PARTS DEPOT FOR EUROPE

An electronic parts depot, to expedite the servicing of National Cash Register computer equipment throughout Europe and the Middle East, has been established in The Netherlands. The new facility is located adjacent to Amsterdam's Schiphol airport.

NCR said 24-hour service will be available in most cases because of the city's outstanding transportation connections to the rest of Europe and to the Middle East. The new central facility will give NCR organizations rapid access to components not stocked locally.

The new depot is in direct telex communication with NCR's world headquarters in Dayton, Ohio, and with the company's Electronics Division at Hawthorne, Calif.

AUTOMATIC BANK DEPOSITORY TO BE MARKETED NATIONALLY

Milgo Electronic Corporation, Miami, Fla., has obtained the national marketing rights for Lectro-Teller, an electronic bank deposit station, from Automated Machines Corp., Nashville, Tenn. The automatic depository, originally developed by Milgo for AMC, is the first major innovation for customer convenience since the introduction of drive-in banking.

The Lectro-Teller uses a patented sensing mechanism to distinguish the difference between $1, $5, $10, and $20 bills in any combination. It accepts cash, checks and coins for payments on loans and utility bills, and deposits for savings and checking accounts up to $999.95. Each transaction is confirmed with a validated receipt to the depositor.

Milgo Product Manager D. Barry Boyce stated, "We have initiated a nationwide marketing program to make Lectro-Teller equipment and service available to all banking institutions. Eventually, not only banks, but savings and loans, department stores and utilities will benefit from on-the-spot deposit stations."

In the initial Lectro-Teller installation, the First National Bank of Arizona is using 50 Lectro-Tellers to provide their customers with deposit stations in shopping centers, supermarkets, industrial cafeterias, and public buildings.

I.C.P. SUBSIDIARY ACQUIRES CONTROL OF I/C/C

Britain's International Publishing Corporation (I.P.C.) is broadening its interests in computer-based publishing on a worldwide scale. Its wholly-owned U.S. subsidiary, Iliffee-NTP, Inc., has acquired control of International Computaprint Corp. (I/C/C), Fort Washington, Pa. The transaction involves the cash purchase of all outstanding stock formerly held in the corporation by National Computer Analysts, Inc. of Princeton, N.J.

I/C/C deals exclusively in computerized composition of directories, dictionaries and index volumes. I/C/C, using sophisticated input, computer and high-speed phototypesetting equipment, produces books for leading U.S. publishers, manufacturers and printers, and plans for rapid expansion into related fields.

MAGI ACQUIRES DATA RECORDING

The acquisition of Data Recording, Inc., White Plains, N.Y., as a wholly owned subsidiary of Mathematical Applications Group, Inc., also located in White Plains, has been announced by Dr. Phillip S. Mittelman, President of MAGI. Mr. Thomas Amoriello, who served as President of DRI prior to the acquisition will remain in that capacity. Data Recording provides data processing and keypunching services in the Metropolitan New York area.

SANDERS ACQUIRES MITHRAS, INC.

Royden C. Sanders, Jr., president of Sanders Associates, Inc., Nashua, N.H., has announced that the acquisition of the assets of Mithras, Inc. of Cambridge, Mass., by Sanders has been concluded. Mithras will be operated now as the Mithras Division of Sanders in Cambridge under the direction of Dr. Eugene Rubin, president of Mithras. The new division is engaged in research and development in the areas of applied aerothermodynamics, electromagnetic detection and quantum physics.

NEW COMPANY FORMED TO SELL STANDARD SOFTWARE PACKAGES

New trends in computer technology are transforming the field of software development, according to Robert V. Head, founder and president of Software Resources Corporation, Los Angeles, Calif., a new firm specializing in standard software packages. Software Resources specializes in the distribution of computer programs having wide applicability to the needs of many users in a variety of industries.

Software Resources provides much more than a listing or brokerage service, Mr. Head emphasized. "Before a program is considered, it must meet rigorous standards for documentation and error-free operation and it must possess enough generality to appeal to a broad class of users," he stated.

His company will provide an application package service, marketing broadly applicable programs on a national basis. A staff of top professionals is being set up to evaluate candidate programs for both scientific and commercial applications in several major industries.
(For more information, designate #42 on the Readers Service Card.)

UNIVERSITY COMPUTING BUYS KEYSTONE COMPUTER ASSOCIATES

University Computing Company, headquartered in Dallas, Texas, has purchased Keystone Computer Associates, Inc., a Philadelphia computer programming and systems analysis company, it has been announced by Sam Wyly, president of UCC, and John Guernaccini, president of Keystone.

The purchase was made by an exchange of 33,300 shares of UCC stock for the assets and business of Keystone. Keystone will continue to operate under its own name and management, as a wholly-owned subsidiary of UCC.

Immediate plans include opening an office in Washington, D.C., and melding Keystone's activities with the Computer Utility centers of UCC.

CANADIAN FIRM ASSOCIATES WITH PLANNING RESEARCH CORP.

Read-Voorhees and Associates, Toronto-based transportation and planning consultants, now is associated with Planning Research Corp., Los Angeles, Calif. The association results from a planned merger of Alan M. Voorhees and Associates, Inc., of Washington, D.C. with Planning Research. Read-Voorhees, which currently is partly owned by the Alan M. Voorhees organization, will remain Canadian in majority ownership.

The announcement, made jointly by Arthur E. Read, president of Read-Voorhees, and Dr. Robert W. Krueger, president of Planning Research, stated that the new association represented an extension of Planning Research's professional services into Canada and an expansion of the services offered by Read-Voorhees.

Planning Research offers systems analysis and computer software to governments and industry. Read-Voorhees, known for its transportation and planning studies also develops information systems and computer applications for land-use planning.

EDUCATION NEWS

AI ACCREDITED

Automation Institute of Chicago has been honored as the first data processing school in the country to be accredited by a national accrediting agency. The Accredit-

ing Commission for Business Schools, recognized by the United States office of Education, accredited the Chicago School at a summer meeting in Washington D.C.

In a letter from Dr. James R. Taylor, executive director of the Accrediting Commission for Business Schools, received by Paul Pair, President of Automation Institute, AI was cited for its continuing effort to develop quality training programs. In pointing out that this is the first accreditation of a data processing institution by a nationally recognized accrediting agency, Taylor said that the commission has accredited more than 300 business colleges during the last 15 years.

Automation Institute of Chicago was the first private business school in the midwest to offer training in the new field of electronic data processing and computer programming when it opened 10 years ago.

INFORMATION PROCESSING CENTER ESTABLISHED BY THE NEW SCHOOL

A new Information Processing Center, which will provide instruction on the use of electronic computers and other information processing techniques, opens this month at The New School for Social Research, New York, N.Y. The new Center will serve both professionals and laymen, including the growing number of business executives who require a background in information processing.

Beginning the week of September 25, twelve different courses are being offered. Students who complete five courses, two of which deal specifically with the IBM System/360, will be eligible for a Certificate in Information Processing. Many of the course offerings will have several sections, allowing students to choose the day of the week they wish to take the course. All courses will be taught in the evening or on Saturdays.

The curriculum will range from general introductory courses in data processing to specific offerings concerning linear programming and Cobol and Fortran programming. Specialized courses have been designed for personnel in the medical and accounting fields. Advanced courses in systems analysis, operations research, and network analysis techniques also will be offered.

Registration forms and further information concerning the Information Processing Center may be obtained from the Office of the Registrar, The New School, 66 West 12th Street, New York, N.Y. 10011

COMPUTER RELATED SERVICES

SCIENTIFIC COLLEGE SELECTION — NEW PROCESSING SERVICE

Statistics indicate that the selection of a college has frequently not been successful since 49% of the nation's college freshmen either transfer or drop out of college. Now a guidance tool has been developed which will help the student select a college efficiently and effectively. The American College Selector, Los Angeles, Calif., a computerized service, recommends to the high school student six colleges which are best for him. These recommendations are based on a multi-level weighted system designed for the IBM 360-50 computer. Extensive data about the educational, social, and physical environment of all the 1079 accredited four year liberal arts colleges and universities have been programmed.

A student now can quickly and easily identify the colleges which he should consider by completing a 16 page questionnaire in which he indicates his needs, objectives, desires, and qualifications. This official ACS questionnaire is available without charge. The questionnaire is itself an interesting document which helps a student clarify his thinking about what he really wants his college to be like. The student who completes the questionnaire returns it with a check or money order for $10 which is the only charge ACS makes for this service.

Not only are the names and addresses of six colleges sent to the student but a suggested procedure for learning more about them and guidance in investigation is provided as well. This enables the student with the assistance of his parents and counselor to make the final decision.

The American College Selector employs a built in college quality rating as well as an admission quotient. ONLY four year accredited liberal arts colleges are recommended. ACS does not in any way apply to any college or university for the student, nor does it in any way guarantee admission to any college. The colleges recommended by ACS will most likely suit a student's needs and will most likely accept his application for admission.
(For more information, designate #43 on the Readers Service Card.)

LEASE ELECTRONIC ACCOUNTING SYSTEM

The Reynolds & Reynolds Co., a leading producer of automotive forms and systems, has placed on the market a new computerized management report and accounting service for auto leasing companies. Walter G. Pfeiffer, Sr., executive vice president, said the new Lease Electronic Accounting System (LEASe) assures the user of up-to-date, accurate management information and analysis. He noted that the lack of such information is the primary cause of lease business failures.

LEASe automatically supplies the user with all the important profit and loss history on each in-

dividual vehicle both monthly and lease-to-date. It also provides valuable termination figures charting the complete history of a vehicle from acquisition to wash-out, Pfeiffer said.

Additionally, the system enables the user to automatically pre-bill his leasing customers with combination invoice/statements supplied the user each month. These are pre-addressed, itemized, balanced and ready to mail by the first. An aged analysis of lease accounts receivable is supplied, along with an alphabetical listing of the accounts receivable.

In addition to all of the above, the LEASe system automatically does the user's regular accounting. It gives a guaranteed set of accurate balanced books each month including all journals, analyses as desired and a complete general ledger tailored to the user's chart of accounts.

The only equipment needed is a rented special adding machine on which daily transactions are entered. The adding machine paper tape is periodically mailed to a Reynolds & Reynolds data processing center where it is fed to computers which then compute and print the reports and accounting books. The cost of the system is governed by volume of use.
(For more information, designate #44 on the Readers Service Card.)

3-D PLOTTING SERVICES AT SPATIAL DATA SYSTEMS

A specialized new direct service has been instituted at Spatial Data Systems, Inc., Goleta, Calif., to provide complete 3-dimensional plotting services for customers from digital data supplied. The firm is using its recently announced Model 501 Plotter System (see Computers and Automation, April 1967, p. 50). Many industries and activities now may obtain low-cost, accurate (1/100-inch resolution) three-dimensional models from digital data without a major investment in a system.

Thus, relief maps, antenna patterns, geophysical models, engineering designs, among others, become permanent 3-D displays. Pertinent users are cited to include electronics, aerospace, oceanography, cartography, medical research, mathematics, meterology, economics, education, and civil engineering.

Initially two Service Plans are available. Plan I requires punched paper tape to be supplied in correct form from the user. Plan II offers those without such facilities to have this supplier produce paper tape from customer-furnished magnetic tape or punched cards which are translated directly using SD's PINPLOT program.

The firm emphasizes that charges for this unique plotting service are minimal. An initial Price Schedule is available upon request, detailing each Plan, together with hourly rate structure and plotting board cost. It is indicated that the present work backlog of the firm will allow them to schedule production of plots within one or two weeks after receipt of customer tapes.
(For more information, designate #45 on the Readers Service Card.)

NEW PRODUCTS

Digital

BURROUGHS 500 SYSTEMS FAMILY INCREASED BY FIVE NEW MODELS

Burroughs Corporation, Detroit, Mich., has announced two models of the large scale B7500 electronic data processing system and three new models of the B6500. All five models are third generation systems using monolithic integrated circuits throughout the central processors. The systems are designed for business and scientific users who require continuous multiprocessing, time sharing, remote communications and real time processing as normal methods of operation, in addition to conventional 'batch' processing of jobs.

The integration of the hardware and software design of these systems, and their modularity, permit users to make many choices among processor and main memory speeds, number and kind of peripherals, and size of main memory and data storage.

The systems can accommodate more than 2000 remotely-located communications devices, such as teletypes, input and display or other input and output units in a time sharing situation, and simultaneously be processing several other independent programs. The new systems provide ascending choices of processing speed and power, and options of either magnetic core memory or thin film memory. Choices of speed include three central processors with clock rates of 2.5, 5 and 10 megacycles; core memory access time is 600 nanoseconds, and thin film memory read access time is 300 nanoseconds.

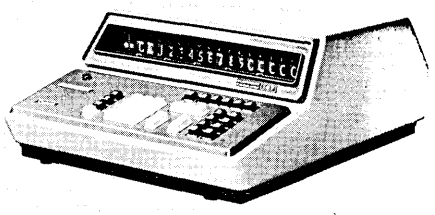
All programs for the B6500 and B7500 are written in compiler languages, providing the user with a simplified method of program writing. Programming languages of the two systems include COBOL (COmmon Business Oriented Language), FORTRAN (FORmula TRANslation), and ALGOL, (ALGOrithmic Language). Software for the new systems will be ready at the time the systems are delivered. Deliveries are scheduled for the first quarter of 1969.
(For more information, designate #46 on the Readers Service Card.)

CANON ELECTRONIC CALCULATOR HAS MAGNETIC DRUM MEMORY

A desk-top electronic calculator with a magnetic drum memory has been developed by Canon U.S.A., Inc., New York, N.Y. The calculator, named the Canon #167, has an input capacity of 30 digits.

The possibility of mistaken entries has been reduced almost to the vanishing point by the inclusion of two sets of cumulative memories and no less than five sets of constant memories. Another bottleneck to high speed calculation has been eliminated in the Canon #167 through the use of a completely automatic decimal point system. It is self-adjusting as well as being fully automatic. The memory banks also have automatic decimal systems.

The performance data of the new Canon #167 includes: (a) a 10-key system, (b) 16 digit capacity, (c) addition and subtraction to 15



digits input, (d) sum or difference to 16 digits, (e) multiplication to 15 digits input, (f) product to 30 digits, (g) division to 15 digit input, (h) quotient to 15 digits, and (i) square root to 15 digits input, covering places to 8 digits.

Operational speeds of the new machine are: addition and subtraction, 0.01 sec.; multiplication, 0.9 sec.; ascertaining the square root, 0.06 sec.; and division, 1 sec.

Power to operate the completely solid state circuit calculator can be obtained from any standard AC outlet. Its size is equal to a standard typewriter, 8½" x 12" x 23½".
(For more information, designate #49 on the Readers Service Card.)

LOW-COST COMPUTER FOR ENGINEERING AND LAB RESEARCH

A new digital computer, for use in college and university engineering and science labs, has been developed by INTERDATA, Eatontown, N.J. The Model 3 System, designed with ease of interface as a prime consideration, is modular and field expandable.

Although a conventional line of standard peripheral devices is offered, the manufacturer also provides a group of system modules for interface to 8 or 16-bit oriented laboratory instruments, sense line, relay or contact closure modules, oscilliscope displays, and a variety of conversion equipment and special devices. A line of compatible logic components is also available for design of special interface.

Memory modules are incremental up to sixty-five thousand bytes all directly addressable by the primary instruction word; paging or indirect addressing is not required. The Model 3 has 16 General Registers used as accumulators or index registers. A repertoire of 77 instructions is standard; multiply and divide are optional. Customer specified instructions can be included in additional 'Read-only-memory' modules.

The INTERDATA Model 3 processor includes a priority interrupt multiplexed input/output channel able to handle 256 devices. Block read/write is an option. A selector channel provides cycle stealing 8-bit byte transfer direct from and to memory and standard peripheral devices. In addition, a direct memory access channel gives cycle-steal transfer of 16-bit data and includes a 'Read-Increment-Write' instruction. Both features are optional.

Five software packages are available for the INTERDATA computer including a symbolic assembler, on-line debugging and a math subroutine library. The machine is compact in size and light in weight.
(For more information, designate #47 on the Readers Service Card.)

CONTROL DATA 3500 SYSTEM

A new third generation, time-sharing computer system — the Control Data® 3500 Computer System — has been announced by Control Data Corp., Minneapolis, Minn. The 3500 is a large-scale, general purpose, multiprogramming system designed to meet the specific needs of business, scientific, and industrial data processing users.

The built-in paged-memory organization and program-relocation features of the 3500 permit efficient multiprogramming for time-sharing applications. The system's paged memory organization also provides inherent memory protection, and allows for the expansion of core storage up to a maximum of 262,144 words, or over one million characters. Average access time for the 3500's is 600 nanoseconds and complete cycle time is 900 nanoseconds.

— Control Data® 3500 System

Other standard 3500 hardware features include floating point arithmetic for large-scale scientific data processing; also, a special self-contained Business Data Processor which permits the efficient execution — apart from the central 3500 processor — of business data processing and code conversion instructions.

INTEBRID® circuitry is used throughout the 3500 system. Specially developed by Control Data for use in the 3500's transistor current switch (TCS) logic, it offers the advantages of both monolithic integrated and hybrid circuitry.

A complete set of software already is available under MASTER, a mass storage oriented, multiprogramming operating system, and another mass storage operating system known as MSOS. These include COBOL, MASS STORAGE SORT, FORTRAN, PERT/TIME, PERT/COST, ALGOL, and the COMPASS assembler. In addition, programs written for Control Data 3100, 3150, 3200 and 3300 Computer Systems will run on the 3500. Additional software will be released during the coming months.

The first 3500 is scheduled to be delivered in mid-1968.
(For more information, designate #48 on the Readers Service Card.)

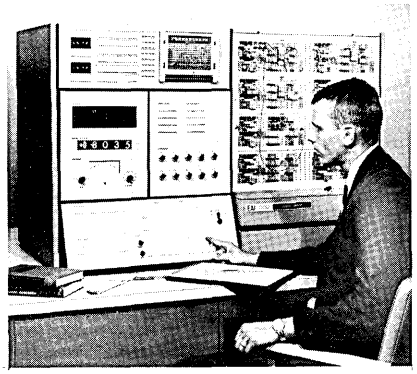
Newsletter

Analog

DESK-TOP ANALOG COMPUTER — THE EAI 580

A desk-top scientific computer providing advanced analog computing capabilities plus all of the requirements for expansion to a full-scale hybrid computing system has been developed by Electronic Associates, Inc., West Long Branch, N.J.

The EAI 580 Analog/Hybrid Computing System, as it is designated, is a general-purpose, solid state system which is pre-wired for immediate analog and/or logic expansion. It is a 10-volt system which features 80 operational amplifiers. The system offers a self-contained, all integrated circuit logic facility which is designed to fit into the 580 console. A self-contained, four-channel oscilloscope monitor is optional.



The EAI 580 offers the features a digital computer user needs plus the additional capability for hybrid computing. It provides: logic signal control over mode selection, time scale selection and component operation; a new electronic keyboard addressing system for automatic setting of the 70 servo-set potentiometers; a new low-drift track/store capability; a simplified set-up system for diode function generators; a color-coded analog and logic patch panels, eight push button-controlled comparators, each with its own amplifier; and low-drift, high speed operational amplifiers.

The entire computer — 32" H x 51" W x 29" D — weighs less than 600 pounds when fully expanded. It sets easily on any normal laboratory bench or desk. The 580 operates from any 110 or 22p VAC outlet, and requires less than 500 watts when fully expanded. No special environmental controls are needed. The first units will be available in Octobar.
(For more information, designate #50 on the Readers Service Card.)

TEACHAID — FOR EDUCATION AND DESIGN APPLICATIONS

A low-cost fully transistorized analog computer for use in schools, technical colleges, universities and design laboratories is to be shown by its British manufacturer at the ISA Instrument-Automation Converence and Exposition in Chicago, September 11-14.

A product of A. M. Lock and Company of Oldham, Lancashire, England, the Teachaid, using conventional techniques, is capable of solving up to third order differential equations. It also can solve differential equations of a much higher order, when using more advanced techniques. The solution operation rate is 25 c/s and the compute period is 35 milliseconds, with a reset time of 5 milliseconds.

Teachaid measures 12" by 7" by 7" and weighs less than 10 lbs. The instrument operates from a 110/115V or 200/250V, 50 or 60 c/s supply and has a power consumption of about 3 w. Maximum voltage on the front panel is kept at the safe level of 12V.

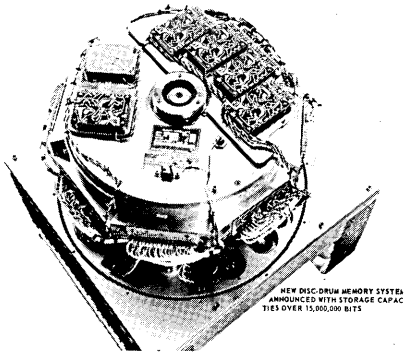
The computer has four operational amplifiers which can be used as integrators. These are shown graphically on the front panel of the instrument. Solutions to problems may be presented on a recorder or on an oscilloscope. Computation can be repetitive where oscilloscope display is being used for demonstration purposes. Several of the computers can be linked together to extend the range of applications. The computer will sell here at between $560 and $700.
(For more information, designate #51 on the Readers Service Card.)

Memories

SERIES 7300 MEMORY SYSTEMS FROM DIGITAL DEVELOPMENT

Digital Development Corp., San Diego, Calif., has announced an improved series of disc-drum memories designed to increase the efficiency of mass storage and random-access computer applications. Capacity of the new DDC 7300 systems is rated at up to 15.36 million bits with an average access time of 8.5 milliseconds.

The new Series 7300 design has an increased capacity of 50%. It combines the high storage capacity of magnetic discs with the speed and reliability of magnetic drums. Volumetric efficiency of the disc unit allows maximum data density in a package less than 1/2 of conventional drum size and weight. Each disc has a rated capacity of 3.84 million bits on its 128 data tracks of recording surface. With four discs, up to 512 data tracks are available in a single unit. Recording heads are organized into groups of 64 and each group services one disc surface. The heads never touch the recording surfaces and require no field adjustments.



Modular design of the compact units facilitates selection according to individual system requirements. System capacity may be field-expanded as needed by the addition of head assemblies. Optional provisions are available for multiple bank storage with simultaneous read-write, write "lock-out" switches, and special protection circuitry.
(For more information, designate #52 on the Readers Service Card.)

Software

AUTOFLOW SYSTEM / Applied Data Research, Inc., Princeton, N.J. / expanding 'Autoflow' computer documentation system for flow-charting computer programs to nearly all computer systems; Autoflow, which produces high quality two dimensional flow-charts automatically and directly from COBOL,

FORTRAN and Assembly Language programs, automatically performs all statement analysis, page allocation, line drawing and rearrangement of program flow; formerly available only on three-year lease basis — now available nationally on a service bureau basis / For more information, designate #53 on the Readers Service Card.

C-E-I-R ACCEL (Automated Circuit Board Etching Layout) / C-E-I-R Inc., Boston Center, Cambridge, Mass. / a computer program which designs printed circuit boards used in electronics manufacture and automatically produces the drawings needed for their construction; utilizes an IBM 7090 or 7094 computer for initial processing; graphic output then produced off-line on a Stromberg-Carlson 4020 Cathode Ray Tube Plotter / For more information, designate #54 on the Readers Service Card.

COMPUTER MARKETING/MAILING (CM/M) / The Don James Co., a division of Information Projects Corp., Los Angeles, Calif. / a computer-based information system, especially designed for managing, maintaining and analyzing mailing lists in large organizations; available as a "package" which includes the system setup, a set of non-technical forms for operating the system, an operating manual, and the necessary computer programs if desired; firm customizes and adjusts system to precisely meet needs of each user; CM/M may be operated on any computer / For more information, designate #55 on the Readers Service Card.

DDP-124 SORT / Honeywell Computer Control Division, Framingham, Mass. / a three-tape sort program for use with Honeywell DDP-124 computers in payroll preparation, inventory control, processing of tracking and telemetry information and other data processing tasks; also may be used with Honeywell's DDP-24 and DDP-224 computers; program consists of three self-loading object paper tapes which contain magnetic tape and card punch service routines, control and dispersal segments, and the merge phase of the process; program requires a minimum 8K memory, paper tape reader, three magnetic tape units, a card reader to enter control parameters, a card punch to punch out unreadable records and a typewriter — may be modified to substitute paper tape I/O for a card reader and punch / For more information, designate #56 on the Readers Service Card.

DOPIC (Documentation of Programs in Core) / COMRESS, Inc., Washington, D.C. / a proprietary software package for the automatic documentation of existing computer programs; capable of generating completely machine-produced flow diagrams, cross-reference lists, and chart indices for actual object programs for a wide variety of computer systems; marketed on a service basis, via nation-wide direct mail - cost to users will be 10¢ per object program step / For more information, designate #57 on the Readers Service Card.

ENCUMBRANCE ACCOUNTING SYSTEM / CT Data Processing Inc., Cleveland, Ohio / a computer system designed and programmed to do expense-distribution accounting for school districts; six basic programs include Vendor File and Account Trailers, Expense Ledger, School-by-School Report, and District-Wide Report / For more information, designate #58 on the Readers Service Card.

INTEGRATED MANAGEMENT REPORTING SYSTEM / Datametrics, Inc., Cape Canaveral, Fla. / a series of computer programs designed for use in support of the man-rated Gemini Launch Program and suited for industrial and commercial use; system contains elements necessary to schedule manpower, equipment, work progress, and detailed documentation of a project; system was processed on a CDC 3100 computer with 16K memory and four tape drives using paper tape from teletypewriters as input; majority of programming done in COBOL / For more information, designate #59 on the Readers Service Card.

JANTZEN'S EMULATION PROGRAM / Jantzen Inc., Portland, Ore. / users faced with a conversion problem between second generation IBM 1410 or 7010 disk systems and the third generation IBM System/360 can benefit from this new technique; any model of disk drive available with the System/360 can be used to run programs written for the IBM 1301 "as is" on a model 40 system 360; program available in two versions (one for 2311 disk units, other for 2314 disk drives) for a one-time charge of $6000 / For more information, designate #60 on the Readers Service Card.

MARK IV FILE MANAGEMENT SYSTEM / Informatics, Inc., Sherman Oaks, Calif. / a set of general purpose integrated software for automating file creation, maintenance, processing, and report preparation for modern business data processing; this proprietary software package is sold or leased on a "per installation" basis; Mark IV operates under DOS or OS on IBM System/360 / For more information, designate #61 on the Readers Service Card.

MULTIPLE UTILITY PERIPHERAL SYSTEM (MUPS) / The Service Bureau Corp., New York, N.Y. / designed to meet the requirements of input/output peripheral support of a large scale computer; peripheral functions are performed concurrently in a multi-programmed environment; actual number and combinations of functions depends upon the number of I/O units attached to the IBM System/360 and the storage capacity of the computer; MUPS program is open ended, permitting easy addition of new routines and units to the system / For more information, designate #62 on the Readers Service Card.

PEGASUS / Management Computer Services Corp., West Hartford, Conn./ a "translator" that converts most IBM 1401 computer instructions into instructions for any 360 series IBM computer in 1½ minutes per program with at least 98% efficiency; developed by Northwestern National Life Insurance Col of Minneapolis; purchase price of Pegasus based on number of steps translated; maximum dollar cost has been established for each program; if total cost prohibitive because company has a large number of programs, contract price for entire translation is negotiated / For more information, designate #63 on the Readers Service Card.

Input-Output

DOCUMENT-READING MACHINE FOR THE GE-400 SERIES

General Electric Co., Phoenix, Ariz., has developed a new document-reading machine for the GE-400 Series computers that employs optics to speed up processing of data against computer-stored records. The machine, known as the DRD-200 document reader, is designed to

handle either printed forms or, as an additional option, hand-marked forms.

The DRD-200 uses an optical sensing device that reads GE's COC-5 Coded Optical Characters 5-bar font at 2400 characters per second. A similar innovation — offered as a modification to existing reader-sorters — was offered to the banking market a year ago, and is in use today (see Computers and Automation, August, 1966, p. 41).

The new reader "makes it possible to eliminate costly keypunching or tape-perforating methods for entering information on conventional forms," said Louis E. Wengert, GE deputy division manager for Information Systems Equipment.

The DRD-200 accepts a variety of form sizes and thicknesses, from 2-3/4 by 4 inches up to 3-7/8 by 8 inches, and from .003 to .0075 inches thick. The reader processes 1200 check-size documents per minute, stacking them into one of two — "accept" or "reject" — pockets. Where printed or marked data on forms corresponds to system requirements, the documents are directed into the "accept" pocket. When a document has irregularities of data, it can be directed by computer control to the "reject" pocket for manual processing.

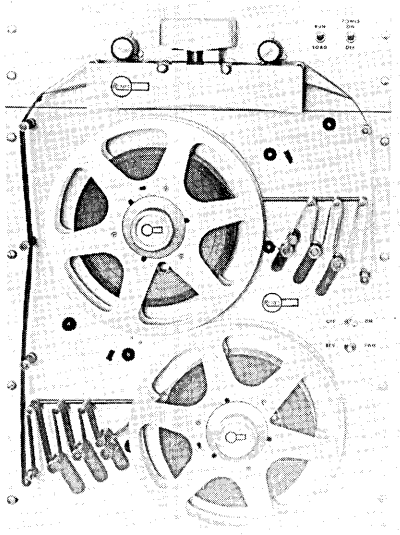
The DRD-200 system reads in COC-5 or mark-sense, or intermixed. It reads simultaneously on the same side of a form, as with a typical meter-read or inventory control form, or on both sides, as with re-entered utility bills or loan repayments.
(For more information, designate #64 on the Readers Service Card.)

REMEX 1000 CPS TAPE SPOOLER

Remex Electronics, a Unit of Ex-Cell-O Corp., Hawthorne, Calif., has announced full capability in a newly designed, all solid state, RS-1000 high speed punched tape spooler. The RS-1000 spooling speed is 1000 characters per second with a full 2000 feet of tape on 10½ inch reels. Rewind speed is 2000 characters per second in either direction.

This spooler can be immediately placed in rewind while in normal spooling in either direction or while in reverse rewind without spilling or breaking the most fragile 5 channel tape. This is made possible through the use of full proportional servo controlled torque motors.

The RS-1000 operational temperature range is 0^{o} to 70^{o} C. Any input line frequency from 50 to 400 cycles at 115 volt can power the unit with 230 volt optionally available. To demonstrate



its integration with high speed readers, the RS-1000 is pictured with the recently released, RR-5000 photoelectric punched tape reader system.
(For more information, designate #67 on the Readers Service Card.)

DATA EQUIPMENT ANNOUNCES NEW GRAPHIC DATA PROCESSOR

A new Graphic Data Processor designed to reduce and manipulate graphic information has been developed by Data Equipment Division of Bolt Beranek and Newman Inc. of Santa Ana, Calif. The system can digitize oscillographs, slides and arbitrary graphic forms; mathematically scale and operate on digitized curves; and display or record the resulting forms on an associated CRT or X-Y plotter.

Data Equipment's GRAFACON Model 1010A is the digital graphic input component of the new system. It consists of a 10" x 10" writing surface based on the Rand Tablet, and a stylus for selecting a point on the two-dimensional surface. The system includes basic software to operate upon the curves or functions.
(For more information, designate #66 on the Readers Service Card.)

SDS ANNOUNCES NEW HIGH-SPEED CARD READER

A new card reader with a 1500-card-per-minute reading speed has been announced by Scientific Data Systems, Santa Monica, Calif. The high-speed reader is designed for use with SDS Sigma computers. Model 7140, as it is designated, reads standard 80-column punched cards in either Extended Binary-Coded Decimal Interchange Code (EBCDIC) or binary code. Cards are read serially by columns.

The Model 7140 consists of a photoelectric reader mechanism with its associated transducer electronics, housed in a free-standing cabinet, and a controller that provides the necessary interface between the reader and the Sigma input/output channel. Two program-selectable stackers facilitate card-stacking operations and afford a convenient means of separating cards that contain errors.

This high-speed reader is especially useful in large, high-volume batch processing installations and is designed to effectively utilize the power of the Sigma Batch Processing Monitor. It is program-compatible with the 400-card-per-minute Model 7120 Card Reader currently used with SDS Sigma computers.
(For more information, designate #65 on the Readers Service Card.)

GENERAL ELECTRIC EXPANDS PAPER TAPE READER LINE

General Electric's Printer-Reader Business Section, Philadelphia, Pa., has expanded its paper tape reader line with the introduction of its PTR70 series of readers. The PTR70 series is General Electric's medium speed reader and reads at 300 characters per second synchronously or 140 characters per second asynchronously.

The PTR70 series can read opaque tape or opaque and translucent tape in either a unidirectional or bidirectional mode. In addition, no mechanical adjustments are required in the drive mechanism. The PTR70 series uses solid-state circuitry with no electronic adjustments.

An additional feature is a variable width tape guide which permits the use of all standard tape sizes. The standard model is equipped with negative 12-volt logic but other options are avail-

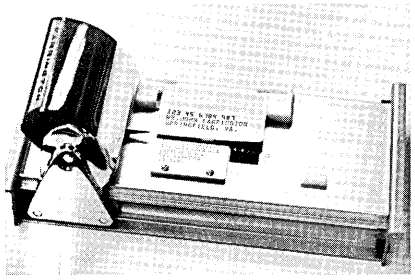
able to provide readers for all applications in the medium speed range.
(For more information, designate #68 on the Readers Service Card.)

Data Processing Accessories

LOW-COST IMPRINTER FOR CREDIT OUTLETS

A low-cost embossed card imprinter for use in credit, data creation or identification systems is available from Farrington Manufacturing Co., New York, N.Y. The flat-bed, positive action design of the new Model 888 imprinter creates highly legible information on sales or record documents that can be read by optical scanners.

The Model 888 can imprint both 51 and 80 column size documents from either "A" or "F" size embossed cards. Interchangeability of use with "A" or "F" size cards is made possible by a plastic card guide that accurately positions and holds either size card firmly while a document is imprinted.



The Model 888 has an input power balance feature that produces distinct, uniform imprints regardless of the amount of force applied by an operator. The head assembly moves effortlessly across the imprint area. This means the uniformly imprinted point-of-sale documents produced by the Model 888 can be used as direct input for a computer system. The need to manually key punch the recorded information to provide computer input is eliminated.

High-strength aluminum and use of few moving parts virtually eliminate maintenance problems with the Model 888. Weather-proofed construction allows full time outdoor use.
(For more information, designate #69 on the Readers Service Card.)

RESEARCH FRONTIER

SINGER RESEARCH UNIT DEVELOPS CO-PLANAR INTEGRATED MICROSYSTEM

A major breakthrough in the tomorrow-oriented science of electronic miniaturization — the development of a co-planar integrated microsystem — has been disclosed by The Singer Company's Friden Research Center, San Leandro, Calif. "Though still in the research stage, this advance ultimately will result in phasing out of the comparatively bulky and hard-to-handle printed circuit boards," said George E. Comstock, Friden Vice President - Research and Engineering, of the business machines division of The Singer Company.

Mr. Comstock said that the breakthrough means, for example, that Friden has devised a way of eventually reducing the total volume of the computing circuitry required for the Model 132 Electronic Calculator so that all of the circuits could be comfortably packed in a Co-Planar Integrated Microsystem (like the one shown in the picture) that is no larger than the plus key on the calculator's keyboard. Further it means that

the factors which will determine the size of machines in the future will not depend at all on the logic component, which will be truly microscopic. In the future, the size will be determined solely by human requirements, i.e., the keyboard must fit the hand.

Not long ago the introduction of the printed circuit board was acclaimed. Use of discrete components on circuit boards represented an important advance in the complex and challenging area of solid-state electronics. Next came integrated circuits fabricated on minute chips of silicon which sharply reduced the need for discrete components. This greatly reduced the amount of space required to house logic units of ever-increasing capacity.

However, many problems arose from the efforts to mate the microgeometry of the ICs with the macrogeometry of the printed circuit wiring. The largest overall dimension of an integrated circuit often was less than the width of the printed circuit wires used to interconnect the IC units. In products built with discrete components the space required for wiring was comparable with the space required by the components.

"Now the packaging engineer will be able to avoid changing geometries each time he wants to go from chip to chip," L. P. Robinson, Vice President and Director of Research, said. "This is made possible by the encapsulation of all the logic chips in an insulating substrate so that the surface of each chip lies in a common plane with the substrate. The position of each chip is controlled to within .001 of an inch."

Above the chips are an interconnecting grid of microscopic wires and two layers of insulating material with windows over the chips' connecting pads. The interconnecting grid takes the place of the printed circuit board.

Interconnection of the co-planar microsystem with the macroscopic outside world is achieved by means of a pin, usually gold-plated. The pin is encapsulated so that one end is on the same plane with the substrate and is joined with the interconnection pattern in the same manner that the microcircuit chips are. The other end of the pin protrudes through the back of the substrate and may be plugged into a connector, soldered, or welded.

"While much remains to be done, we have demonstrated the feasibility and practicality of co-planar encapsulation technology and have made significant progress towards establishing is as a consistent, dependable process," Mr. Robinson concluded. "Co-planar microsystems will play an important part in the incorporation of microelectronics into the future products of Friden."

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
System Development Corp. (SDC), Santa Monica, Calif.	U.S. Air Force, Logistics Command, Sacramento Air Material Area office	Continuation of work in support of U.S. Air Force air defense systems and training programs; principal task includes design, development and maintenance of computer program elements of the SAGE (Semi-Automatic Ground Environment) and BUIC (Back-Up Interceptor Control) air defense systems	$14,389,265
ITT Federal Laboratories, a division of International Telephone and Telegraph Corp., Nutley, N.Y.	U.S. Air Force, Electronic Systems Division, Air Force Systems Command, Laurence G. Hanscom Field, Bedford, Mass.	A computer-based message-switching system to be integrated into military communications networks in the United States and abroad	about $7 million
Sperry Rand Corp., UNIVAC Federal Systems Division, St. Paul, Minn.	U.S. Navy, Navy Ships Systems Command, Washington, D.C.	Computers and related equipment to perform a variety of ship and shore functions	$4.7 million
Auerbach Corp., Philadelphia, Pa.	Department of Labor, Washington, D.C.	Development of prototype automatic data processing systems which will match workers with employment and training opportunities in Michigan, Florida, Utah, and the metropolitan New York city area, including adjacent regions of N.J. and Conn.; system will provide an exchange of employment and manpower information between city and state offices	$3,282,783
ITT Federal Laboratories, a division of International Telephone and Telegraph Corp., Fort Wayne, Ind.	U.S. Air Force, Electronic Systems Division of the Air Force Systems Command	A system that will display computer data for Strategic Air Command operations planners; includes procurement of equipment and computer programs	about $3 million
National Cash Register Co., Dayton, Ohio	U.S. Army	Thirty-five additional mobile computers constructed around the NCR 500; the transportable data centers are assigned to Army logistical units	$1,725,000
The Datex Division of the Conrac Corp., Duarte, Calif.	Westinghouse Electric Corp.	Subcontract for data transmission equipment for use with the train control system in San Francisco Bay Area Rapid Transit District (BARTD) project	about $1 million
University of Illinois, Urbana, Ill.	National Science Foundation	Computer network combining large central facilities and smaller localized units; system, called ILLINET, will be financed by National Science Foundation, University funds, and by service charges for computer time	$850,000
Computing and Software, Inc. (C&S), Panorama City, Calif.	National Aeronautics and Space Administration	Provision of research data processing and document conversion services at NASA's Langley Research Center, Hampton, Va.	$460,000
Stanford University, Stanford, Calif.	U.S. Office of Education	Development of practical ways for large university libraries to manage "knowledge explosion" with computers; study is known as BALLOTS (Bibliographic Automation of Large Library Operations using Time Sharing)	$417,000
Auerbach Corp., Philadelphia, Pa.	U.S. Army Procurement Center, Frankfurt, Germany	Studying capabilities and future needs of digital communications system now used by Seventh U.S. Army, based in Germany	$104,000
The Mathematical Applications Group, Inc. (MAGI), White Plains, N.Y.	Jet Propulsion Laboratory, Pasadena, Calif.	Development of mathematical models and computer programs to analyze combustion instability phenomena in storable liquid propellant rocket engines; includes comparison of models with actual JPL engine experiments	$91,000
Planning Research Corp., Los Angeles, Calif.	Navy Electronics Laboratory, San Diego, Calif.	Implementation of the time-sharing aspects of a computerized ship command system	$83,000
Lockheed Missiles & Space Co., Sunnyvale, Calif.	National Aeronautics and Space Administration, Marshall Space Flight Center	Analyzing the field of "computer graphics" with an eye to NASA use	$67,590
	U.S. Public Health Service	Nine-month study to plan and recommend two alternative information collection systems that could be used by any hospital in nation; one for manual tabulation, the other for mechanical or electronic data processing	$40,000
McDonnel Automation Co., a division of McDonnel Douglas Corp., St. Louis, Mo.	The Mental Health Commission, Jefferson City, Mo.	A survey and planning project designed to increase efficiency of the operation of the Missouri Division of Mental Diseases via use of modern automation procedures	—
Collins Radio Co., Dallas,	The Societe Internationale de Telecommunications Aeronautiques (SITA)	High speed data transmission modems to be used in SITA's European and transcontinental data communication network	—
Information Development Co., Santa Ana, Calif.	Raytheon	Design and implementation of two Meta Assemblers to be used with the Raytheon 520 and 730 computer systems	—
Lockheed Missiles & Space Co. Sunnyvale, Calif.	Franklin Hospital, San Francisco, Calif.	Long-term contract for computerized business office service	—

OF	AT	FOR
Control Data 6400 computer system	Batelle Memorial Institute, Columbus, Ohio	Research needs of both industry and government ranging from scientific investigations in many fields to development of materials for national defense — replaces smaller CDC 3400
GE/PAC 4020 process computer	Canal Electric Co., a subsidiary of New England Gas and Electric Association, Sandwich, Mass.	Helping to control start-up and operation of the 560 Mw Canal Plant; assisting in attaining maximum plant efficiency. Start-up of plant in spring of 1968; computer to be used for early checkout of plant components and controlling preliminary turbine start-up
Honeywell 120 computer system	Royalmetal Corp., Plainfield, Conn.	Payroll processing, accounts payable, production orders, purcahse parts and sales statistics
IBM System/360	Foodco, Inc., New York, N.Y.	Further expanding and expediting its services to the food service market; entire operation centered on computer
IBM System/360 Model 20	First Pyramid Life Insurance Co., Little Rock, Ark.	A computer-based daily review of each of firm's 30,000 life and health policies in force
IBM System/360 Model 30	AVCO Corporation Ordnance Division, Richmond, Ind.	Simulating design of new military devices, eliminating need in many cases for building expensive prototype models
IBM System/360 Model 40	University of Pennsylvania Computer Center, Philadelphia, Pa.	Providing needed capacity for next few months; also serving as training device for University staff, faculty and students; Model 40 will serve as an "interim machine" until a Model 65 is delivered later this fall (system valued at $1 million)
IBM System/360 Model 50	Walston & Co., Inc., New York, N.Y. (2 systems)	Controlling a tele-processing network connecting all 98 offices of Walston & Co. directly to the trading floors of major stock and commodity exchanges (systems valued at $3 million)
IBM System/360 Model 75	Stanford University, Stanford Linear Accelerator Center (SLAC), Stanford, Calif.	Nuclear research computation previously handled by University's IBM 7090 and Burroughs B5500 computers (system valued at $5 million)
	University of California, Los Angeles, Calif.	Helping process data from more than 300 medical research projects — including studies of brain surgery, kidney transplant, cancer and microscopic X-rays
IBM 1130 computer	T.I.M.E. Freight, Inc., Lubbock, Texas	Assisting five long-line dispatchers to locate and control firm's 1425 trailers; system acts as constant inventory and status control
RCA 301 computer	Dow Jones & Company, Chicopee Falls, Mass.	Same-day updating of over one million subscription accounts for the Wall Street Journal, The National Observer and Barron's National Business and Financial Weekly
RCA Spectra 70/35	State of Oregon, Department of Employment, Salem, Ore.	More rapid and accurate processing of employers' tax payments, unemployment insurance claims and clients' wage records
RCA Spectra 70/35 and 70/45 systems	New York Telephone Company	Handling the computerized phototypesetting of its telephone directories
RCA Spectra 70/45	The Commonwealth of Pennsylvania, Bureau of Management Information Systems, Harrisburg, Pa.	The nucleus of a planned state data center for rapid collection, storage and retrieval of vital government statistics; planned complex would consolidate information needed by the governor from the 40 departments and agencies under his immediate jurisdiction for planning, programming, budgeting and resource management purposes
SDS 940 computer system	Harvard University Computing Center, Cambridge, Mass.	University-wide applications; will give Harvard research workers, graduate and undergraduate students access to more than 100 Teletypewriter consoles at the University and at nearby Harvard-affiliated hospitals
SDS Sigma 7 computer	UCLA, Los Angeles, Calif.	Monitoring, analyzing, and evaluating the performance of other computers presently used on campus and providing data useful in comparing computer performance and in developing new computer designs
UNIVAC 418 real-time computer system	Atlantic Container Line Ltd. (A.C.L.)	Expediting the movement of cargo in its new fleet of containerships; primary application will be in control of overland movement of containers in U.S., as well as maintenance of up-to-the minute inventory records of containers and associated equipment
UNIVAC 1108 computer system	New England Mutual Life Insurance Company, Boston, Mass.	Checking and updating all policyholder records on a daily basis (system valued at $2.5 million)
UNIVAC 9200 computer system	Consumers National Life Insurance Co., Evansville, Ind.	Replacement of tabulating equipment formerly used for premium billing
	Crestline Furniture Company, Valdese, N.C.	Invoicing general accounts, acknowledgements, payroll processing, inventory control, and shipment scheduling
	Automated Records Corp., Richardson, Texas	General accounting tasks and payroll processing

BOOKS AND OTHER PUBLICATIONS

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*.

Reviews

Allen, Paul III / Exploring the Computer / Addison-Wesley Publishing Co., Reading, Mass. 01867 / 1967, paperbound, 111 pp., $3.95

This book for the layman is written in the form of programmed instruction. Sections are: "How to Use this Book," "Sizing Up the Computer," "Card Reader," "Tape Drive," "Central Processing Unit," "Memory or Storage," "Disk Drive," "Printer," "Programs," "The Computer at Work," and Appendix: "How a Computer Program is Produced." There is a glossary, and a Pre-test and Post-test to measure the reader's increase of understanding.

Bailey, Leslie F. / Tables of Folded-Sin x/x Interpolation Coefficients / U.S. Government Printing Office, Washington, D.C. / 1966, hardbound, 161 pp., $2.75

This publication contains the following sections: "Introduction," "Scope and Use of Tables," "Errors," "Examples," "Applications," "Fortran Computer Program"; as well as the tables.

Bates, Frank, and Mary L. Douglas / Programming Language One / Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632 / 1967, paperbound, 375 pp., $5.95

The language PL/I is described by the authors as being "a single language of more general utility." Contents of the book include: "Basic Principles," "Logical Program Structure," "Attributes," "Arrays (Tables)," "Input/Output," "Procedures," "Block Structure," "Program Interruptions," and "Character Manipulation." The chapters contain exercises and the solutions are given at the end of the book.

Booz, Allen Applied Research, Inc. / Study of Mechanization in DoD Libraries and Information Centers / Clearinghouse of Fed. Sci. and Tech'l. Information, U.S. Dept. of Commerce, Washington, D.C. / 1966, paperbound, 200 pp., $?

For this report 76 libraries and installations were visited to determine the extent of mechanization and its effectiveness. These are all listed and individual reports on 35 are included in the text. Sections of the book are: "Introduction and Summary," "Input Processing," Control Serials," "Circulation Control," "File Structure," "Storage and Retrieval," "Selective Dissemination of Information," and "Equipment."

Glushkov, V. M. / Introduction to Cybernetics (633642) / Clearinghouse for Fed. Sci. and Tech'l Information, U.S. Dept. of Commerce, Washington, D.C. / 1966, softcover, 475 pp., $2.00

This book was translated from the Russian and is intended to inform scientists and mathematicians of the developments in modern cybernetics. Chapters are: "Abstract Theory of Automata," "Boolean Functions and Propositional Calculus," "Theory of Automata," "Self-Organizing Systems," "Electronic Digital Machines and Programming," and "Predicate Calculus and the Problem of Automation of the Scientific Creative Processes."

Giuliano, Vincent E., et al / Study and Test of a Methodology for Laboratory Evaluation of Message Retrieval Systems / Clearinghouse for Fed. Sci. and Tech'l Information, U.S. Dept. of Commerce, Washington, D.C. / 1966, softbound, 186 pp., $?, produced by Xerox

This is a report of work done at Arthur D. Little, Inc. under an Air Force contract from 1964 to 1966. It contains: "The Message Retrieval Evaluation Problem"; "Experimental Design Considerations"; "Measures and Tools for Evaluation and Comparison of Information Retrieval Systems"; "Experimental Data Bases and Retrieval Tools"; and "Experimental Results." Four appendices and 25 tables are also included.

Business Equipment Manufacturers Assoc. / USA Standard Character Set for Optical Character Recognition, X3.17-1966 / United States of America Standards Institute, 10 E. 40 St., New York, N.Y. 10016 / 1967, paperbound, 44 pp., $?

This work defines the alphanumerical characters and symbols for use in Optical Character Recognition systems. Sections are: "Scope and Purpose," "Standard Characters," "Reflectance Measurement," "Paper Specifications," "Print Characteristics," and "Character Spacing and Alignment." There are a great many precise drawings of characters included.

Coombs, Clyde H. / A Theory of Data / John Wiley & Sons, Inc., 605 Third Ave., New York, N.Y. 10016 / 1964, hardbound, 585 pp., $14.95

This book analyzes the foundations of psychological measurement. Parts include: (1) Basic Concepts, (2) Preferential Choice Data, (3) Single Stimulus Data, (4) Stimuli Comparison Data, (5) Similarities Data, (6) Interrelations. An extensive bibliography, author index, and subject index are included.

Rosen, Saul, ed., and 28 authors / Programming Systems and Languages / McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N.Y. 10036 / 1966, hardbound, (?), 731 pp., $?

This book (reviewed in galleys only) is intended for two groups; graduate and undergraduate students studying computer sciences; and people who are interested in computer software but have not taken formal courses in the field. It is a compendium of much useful information previously published in computer journals and in proceedings of computer conferences.

Brown, Elmer, et al / Printing & Publishing; Management of Automation — a Collection of Important Papers Presented at American University, Washington, Jan. 16-19, 1967 / Composition Information Services, 1605 North Cahuenga Blvd., Los Angeles, Calif. 90028 / 1967, softbound, 55 pp., $?

These are the papers presented at an American University Institute on "Printing and Publishing: Management of Automation" which was concerned with automation in typesetting. Presented were: "Role of Employee Unions in Automation," "Automating Hot Metal Composition," "Progress and Outlook in Newspaper Composition," "Federal Government Progress in Computer Composition," "Optical Character Recognition in the U.S. Government," "Cost Data and Interpretation," "Research Program Needs in Technology and Systems," and "Report on the Copy Processor System at Time, Inc."

Lo, Arthur W. / Introduction to Digital Electronics / Addison-Wesley Pub. Co., Inc., Reading, Mass. 01867 / 1967 / hardbound, 223 pp., $10.75

This book is an introduction to the digital operation of solid-state electronic devices and circuits essential to digital information processing systems. It is written for seniors and graduate students and for practicing engineers who are newly entering the field. It assumes that the reader is familiar with general physics, mathematics, and the basic principles of electronic circuits. The author is a professor of Electrical Engineering at Princeton University.

Chapter headings include: Transistor Logic Circuits; Cryoelectric and Oproelectric Circuits; Magnetic Logic Circuits; Logic Circuits Using Negative-Resistance Switching Elements; Random-Access Memories, etc.

NEW PATENTS

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

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

June 27, 1967

3,328,597 / James E. De Witt, Waukesha, and Roy Hyink and Richard P. Potter, Wauwatosa, Wis. / Cutler-Hammer, Inc., Milwaukee, Wis. / Magnetic memory means and systems.

3,328,603 / Roger Stanley Dunn and Carl Siegmund den-Brinker, Bedford, England / Texas Instruments Inc., Dallas, Texas / Current steered logic circuits.

3,328,604 / Joseph R. Burns, Trenton, N.J. and Robert A. Powlus, Yardley, Pa. / Radio Corporation of America, a corporation of Delaware / Integrated semiconductor logic circuits.

3,328,761 / Shinji Yamamoto, Kokubunji-machi, Kitatama-gun, Tokyo-to, and Sho Narita, Kodairashi, Japan / Kabushiki Kaisha Hitachi Seisakusho, Tokyo-to, Japan / Character reading system by detection between electron scanning lines and characters.

3,328,765 / Gene M. Amdahl, Poughkeepsie, Edwin D. Councill, Wappingers Falls, Robert J. Flaherty, Pleasant Valley, and Joseph J. Zagursky, Wappingers Falls, N.Y. / International Business Machines Corp., N.Y. / Memory protection system.

3,328,769 / Edwin S. Lee III, West Covina, Calif. / Burroughs Corp., Detroit, Michigan / Information sorting device.

3,328,773 / Arlen J. Zimmerman, Minneapolis, Minn. / Sperry Rand Corp., N.Y. / Data processor set and indicate control systems.

3,328,778 / Charles A. Rosen, Menlo Park, and George E. Forsen, Palo Alto, Calif. / Stanford Research Institute, Menlo Park, Calif. / Analog storage device.

3,328,779 / Hendrik van der Steeg and Albert Jan Ytsma, Hilversum, Netherlands / North American Philips Co., Inc., N.Y. / Magnetic memory matrix with means for reducing disturb voltages.

3,328,783 / Otto Stemme, Ulm (Danube) Germany / Telefunken Patentverwertungs-G.m.b.H., Ulm (Danube), Germany / Mosaic thin film storage means.

CALENDAR OF COMING EVENTS

Sept. 11-14, 1967: ISA (Instrument Society of America) Instrumentation-Automation Conference & Exhibit, International Amphitheatre Exposition Hall, Chicago, Ill.; contact Instrument Society of America, 530 William Penn Place, Pittsburg, Pa. 15219

Sept. 11-15, 1967: Fifth International Cybernetics Congress, Palais des Expositions, Place André Rijckmans, Namur, Belgium; contact J. Lemaire, Managing Director, same address

Sept. 11-15, 1967: 1967 International Symposium on Information Theory, Athens, Greece; contact A. V. Balakrishnan, Dept. of Engineering, U.C.L.A., Los Angeles, Calif. 90024

Sept. 19-22, 1967: Joint Conference of the Univac Users Association and the Univac Scientific Exchange, Hotel Leamington, Minneapolis, Minn.; contact Robert H. Beaton, Neisner Bros. Inc., 49 East Ave., Rochester, N.Y. 14604

Sept. 25-28, 1967: International Symposium on Automation of Population Register Systems, Jerusalem, Israel; contact D. Chevion, Chairman of Council, Information Processing Association of Israel, P.O.B. 3009, Jerusalem, Israel

Sept. 25-29, 1967: The British Computer Society, DATAFAIR 67, Southampton University, Southampton, England; contact Clive Wilkins, The British Computer Society, 23, Dorset Square, London, N.W.1, England

Oct. 1-4, 1967: 1967 International Systems Meeting, Cobo Hall, Detroit, Mich.; contact Richard L. Irwin, Systems and Procedures Association, 24587 Bagley Rd., Cleveland, Ohio 44138

Oct. 12-14, 1967: Computer Fundamentals Workshop, The Univ. of Mich., North Campus, Ann Arbor, Mich.; contact Haldon L. Smith, Industrial Development Div., The Univ. of Mich., P.O. Box 618, Ann Arbor, Mich. 48107

Oct. 16-19, 1967: UAIDE (Users of Automatic Information Display Equipment), Statler Hilton Hotel, Washington, D.C.; contact George E. Perez, Box 6749, Fort Davis Station, Washington, D.C. 20020

Oct. 18-20, 1967: Eighth Annual Symposium on Switching and Automata Theory, University of Texas, Austin, Tex.; contact Prof. C. L. Coates, Room 520, Engineering Sci. Bldg., Univ. of Tex., Austin, Tex. 79712

Oct. 19-20, 1967: The Association of Data Processing Service Organizations (ADAPSO), Fairmont Hotel, San Francisco, Calif.; contact Stan Stetson, Data II, Oakland, Calif.

Oct. 23-25, 1967: SWAP 13 — for CDC Small & Medium Scale Computer Users, Somerset Hotel, 400 Commonwealth Ave., Boston, Mass.; contact George Catuna, Conference Registration Chairman, c/o MIT Lincoln Labs., P.O. Box 73, Lexington, Mass. 02173

Oct. 26-27, 1967: American Society for Cybernetics, National Bureau of Standards Auditorium, Gaithersburg, Md.; contact Dr. Carl Hammer, UNIVAC Div., Sperry Rand Corp., 2121 Wisconsin Ave., N.W., Washington, D.C. 20007

Nov. 10, 1967: Annual Symposium on "The Application of Computers to the Problems of Urban Society," New York Hilton Hotel, New York, N.Y.; contact Dan M. Bowers, One Millet St., Deer Park, N.Y. 11729

Nov. 14-16, 1967: Fall Joint Computer Conference, Anaheim Convention Center, Anaheim, Calif.; contact AFIPS Headquarters, 211 E. 43rd St., New York, N.Y. 10017

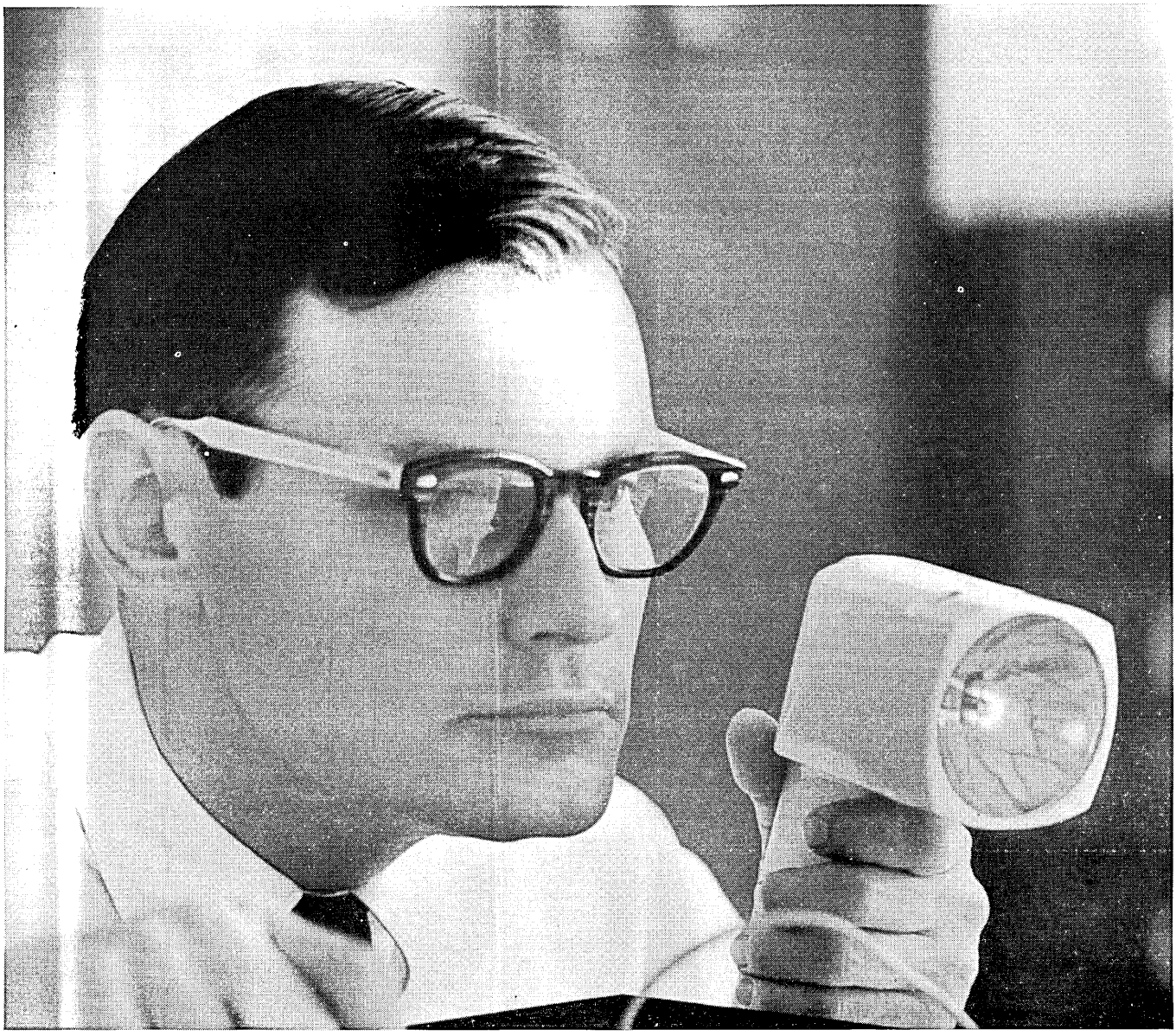
Apr. 30-May 2, 1968: Spring Joint Computer Conference, Atlantic City Convention Hall, Atlantic City, N.J.; contact American Federation for Information Processing, 211 East 43rd St., New York, N.Y. 10017

June 25-27, 1968: Second Annual IEEE Computer Conference, International Hotel, Los Angeles, Calif.; contact John L. Kirkley, 9660 Casaba Ave., Chatsworth, Calif. 91311

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

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.



Inventive maintenance.

There's an IBM lab devoted to it.

Nobody likes downtime.

That's why a select group of IBM engineers, mathematicians, psychologists and technicians have been assigned the job of inventing new ways to give you even more productive time on your system.

They work in IBM's Advanced Maintenance Development Lab—AMD. They work hard. And they've come up with some amazing new tools and techniques. Such as our new transistorized stroboscope (shown above) which makes fast-moving objects appear to stand still—or move in slow motion. This unique stroboscope is being used by Customer Engineers as an aid in installing and maintaining IBM data processing equipment.

They also developed a data communications system that speeds information on the latest maintenance techniques to service specialists across the country.

And they developed a SYSTEM/360 simulator console that helps Customer Engineers get additional hands-on problem-solving experience.

Great ideas. Great progress. But inquisitive minds are never satisfied. And our people at AMD are pushing further ahead—searching for new and better ways to minimize your maintenance hours.

Right now they're working on a special, long range project—trying to figure out the reasoning process that allows a man to diagnose a machine problem accurately and quickly. The answer to that one could change a lot of things.

We know how important it is to you to keep downtime down.

IBM®

how to set an oil well free

In the beginning, this was part of a Spontaneous Potential curve in an oil well log. Oil companies have thousands of oil well logs and seismograms. Miles of strip charts, storerooms full of paper. Because buried in there somewhere are correlations indicating the location of oil as yet untapped.

Buried, that's the problem. Too many curves for human analysis, impossible for a computer to recognize.

But this well log has been converted to digital numbers on magnetic tape ready for computer analysis. The bright dots on the curve show the final quantizations of our Programmable Film Reader — decisions made after the PFR found the curve, established the zero base line, located and identified the depth markers, and followed the curve at predetermined depth increments, differentiating between curve and grid lines. (The scope photo here is a small segment greatly enlarged.)

The entire process is automatic, precise, and fast. Accuracy is 0.1 per cent of full scale. Resolution is 0.005 inch on the original chart. Speed is 500 points per second. No other system in the world can equal PFR's performance. Semi-automatic methods are more expensive and less reliable.

Obviously a PFR is a sophisticated system. In fact it contains a complete computer of its own, programmed to find and recognize meaningful patterns while ignoring unwanted information. This kind of capability can be applied to any image analysis problem merely by change of program. PFR can record on film, too, with the same sophistication.

We've been pioneering automatic image analysis for years. Let us send you a summary of our latest achievements.

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