SCIENCE & TECHNOLOGY

March, 1972

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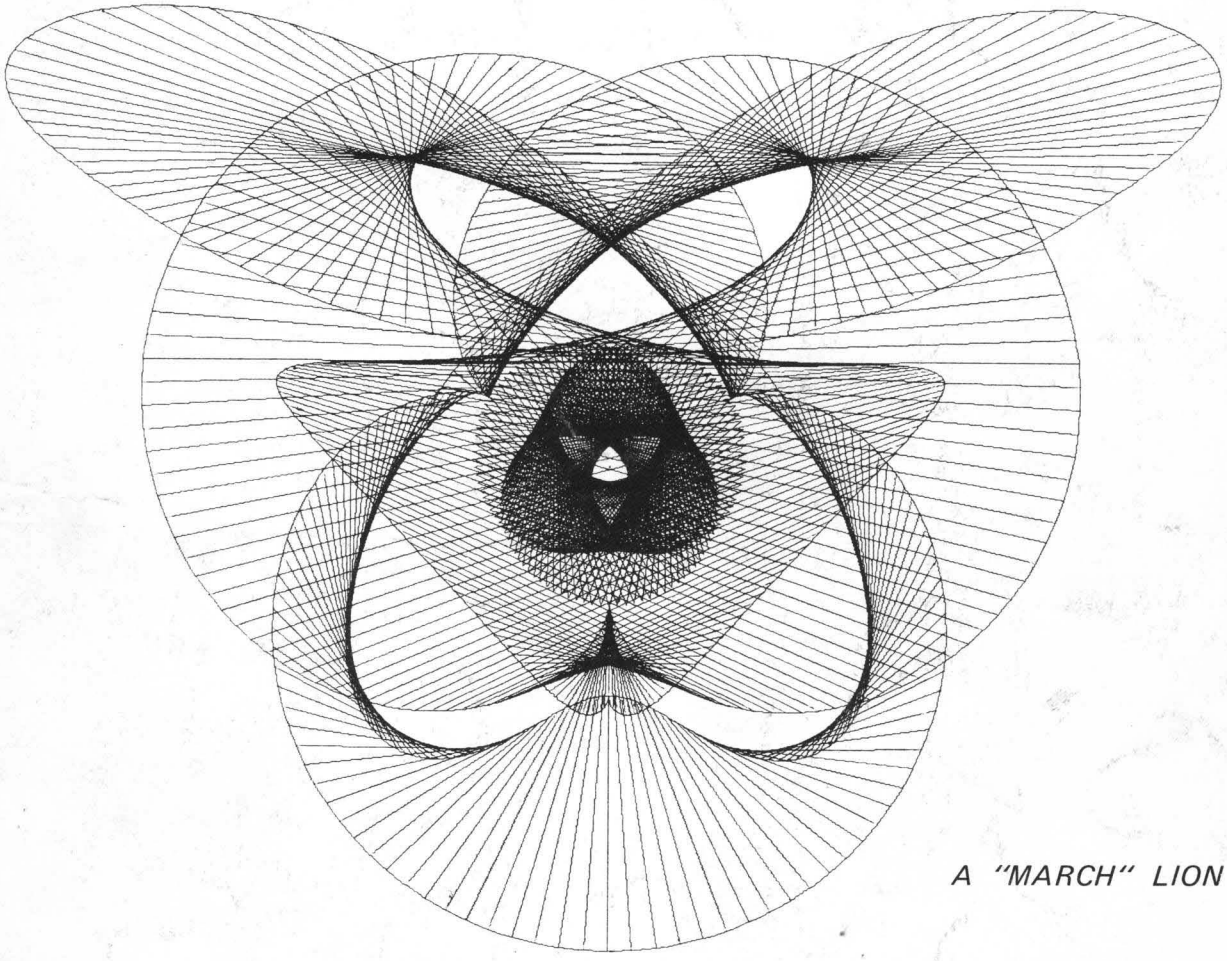
computers and automation



A "MARCH" LION

The U.S. Center for Computer Sciences and Technology -- Its Responsibilities and Visions — *Ruth M. Davis*

Computer Thinking — *G. M. R. Graham*

Forty Plus One Ways to Cut a Coat — *Hughes Aircraft Co.*

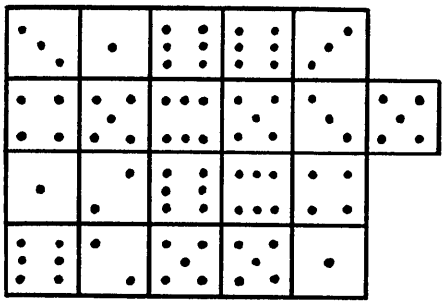
Pictorial Reasoning Tests — Analysis and Answers — *Neil Macdonald*

Dallas: Who? How? Why? — *Mikhail Sagatelyan*

Advertisement

ZINGO —

A New Game for Computers and/or People



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

From time to time computer people hunt for games that are fun to investigate, fun to play with another person, and fun to play with a computer, which should be rather easily programmed to play the game.

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

Rules of Zingo

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

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

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

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

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

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

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

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

The Working Out of a Throw

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

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

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

USE OF THE THROW TO PRODUCE 35

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

For more information — especially on the computer program — see the article "Zingo — A New Computer Game" starting on page 33 of the February 1972 issue.

Any reader interested in obtaining dozens of dice for use in Zingo (and similar games and statistical experiments), may use the coupon below.

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

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

( ) Yes, please send me ____ package(s) of 50 small dice (about 3/8-inch on an edge) for playing Zingo, and making other statistical investigations.

For each package, I enclose $2.30 plus 20 cents for handling (a total of $2.50 per package).

Total enclosed $_____ (Prepayment is necessary.)

Name_____

Address_____

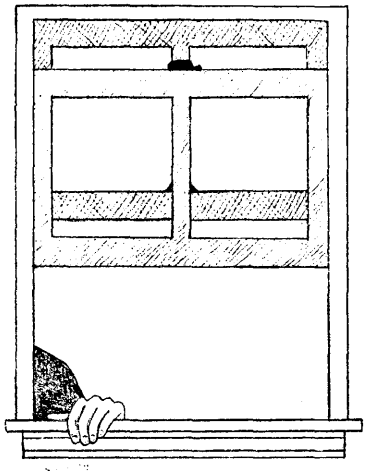
_____ Zip_____

DO YOU REALIZE THAT

- Every minute in the United States there are THREE burglaries?
- The total annual loss to Americans from burglary is over 500 million dollars a year? — AND CLIMBING?

ARE YOU EVER WORRIED ABOUT BURGLARS?

DO YOU WONDER if you will return some evening to find your home ransacked and your valuables taken?*



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THE BRAINIAC K40 KIT:

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- Enables you to design and make for yourself a reliable, effective, protective system (including locks and alarms) — not a toy system but a working system
- Gives you a vast saving over ordinary commercial protective systems (they are priced $300 to $3000 and higher)
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TAKE ADVANTAGE of our prepublication offer ... save $10 ... send $38.50 check (or money order) with your order now (please do not send cash)

Publication of this kit is scheduled for June: price after publication: $48.50

RETURNABLE WITHIN SEVEN DAYS AFTER YOU RECEIVE IT FOR FULL REFUND IF NOT SATISFACTORY (if in salable condition)

HOW CAN YOU LOSE? WHY NOT EXAMINE IT?

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

To: Berkeley Enterprises, Inc.
Publisher of "Computers and Automation"
815 Washington St., Newtonville, MA 02160

( ) Yes, please send me the Brainiac Homeowner's Protective Kit K 40 as soon as it is ready. I enclose $38.50 ( ) check ( ) money order. (DO NOT SEND CASH, PLEASE)

I understand the kit is returnable within seven days after I receive it, for FULL REFUND if it is not satisfactory (if in salable condition.)

My name and address are attached.

CONTENTS (Preliminary List)

Detecting and Sensing Devices

20 leaf-spring contacts
1 magnetic contact
1 tilt-sensitive contact
1 pressure-sensitive contact
2 heat-sensitive contacts
1 water-sensitive contact

Indicating and Acting Devices

1 alarm siren
1 continuity tester, to make sure that an electrical circuit is complete
1 red lamp for showing "alarm" condition
1 green lamp for showing "safe" condition

Other Hardware

2 relays: one is a "sensitive" relay which is in a 1.5 volt "sensing" circuit; if this circuit is interrupted, a second relay energizes a 6 volt alarm circuit
1 reset switch, so that the circuits can change back to the "sensing" condition
2 on-off switches
1 punched panel for experimentally wiring circuits
4 spring pins
40 feet of insulated wire
20 feet of foil strip, aluminum or lead;bolts, nuts, etc.

Books and Other Information

"Practical Ways to Prevent Burglary" by Val Moorman, paper-bound, 1971, 192 pp
"Protecting your Home against Burglary and other Hazards: Problems, Strategy, and Systems" by E. C. Berkeley (former member, City of Newton Crime Prevention Committee), paper-bound, 1972, 96 pp
"The Materials in the Kit — Instructions and Explanations"
"Buyers' Guide to Products in the Anti-Burglary Field"
Bibliography

* Note: It has happened to me, and I didn't like it! — E. C. Berkeley

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NOTE: The above rates include our publication "The Computer Directory and Buyers' Guide"; see "Directory Notice", on the page stated in the Table of Contents. If you elect not to receive "The Computer Directory and Buyers' Guide", you may subtract $9.00 per year from your subscription rate.

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computers and automation

The Computer Industry

7 **THE U.S. CENTER FOR COMPUTER SCIENCES AND TECHNOLOGY – ITS RESPONSIBILITIES AND VISIONS** [NT A]
by Ruth M. Davis, Director, Center for Computer Sciences and Technology, National Bureau of Standards, Gaithersburg, Md.
An important and far-ranging report on the "computer technological supporting system" . . . and the problems facing the computer world.

14 **COMPUTER SYSTEM MODELS** [T A]
by Salvatore C. Catania, Univac Div., Sperry Rand Corp., Blue Bell, Pa.
The requirements for general mathematical and simulation models . . . and a description of the models used to study the performance of proposed systems.

17 **COMPUTER THINKING** [T A]
by G. M. R. Graham, Brandon Applied Systems Ltd., London, England
The managing director of a computer consulting firm in Great Britain assesses changes in the computer industry from the 1960's into the 1970's.

19 **3400 ORGANIZATIONS REQUIRED BY COURT ORDER TO FURNISH CONFIDENTIAL DATA TO IBM – II** [NT A]
by Richard E. Sprague, Norman R. Carpenter, and from *Business Week*

22 **FORTY PLUS ONE WAYS TO CUT A COAT** [NT A]
by Staff, *Vectors* (magazine), Hughes Aircraft Co., Culver City, Calif.
The application of computers, other modern devices, and systems analysis, to cutting material for the apparel industry.

18 **"The 1972 Computer Directory and Buyers' Guide" Issue of "Computers and Automation" – Notice** [T G]

The magazine of the design, applications, and implications of information processing systems — and the pursuit of truth in input, output, and processing.

The Selection of Personnel — for Computers and Other Purposes

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by Mikhail Sagatelyan, Moscow, USSR
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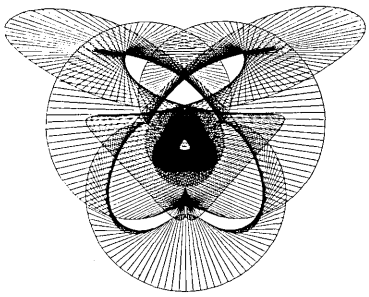

Front Cover Picture

"Lion" was produced by Jan Chlouba of Czechoslovakia, and was another of the entries in the Ninth Annual Computer Art Contest of "Computers and Automation" (see the August 1971 issue). The drawing was produced by an ALGOL program run on an Elliott 503 and drawn off-line on a Calcomp plotter. Three basic curves were used: two hypocycloids and a transferred hypocycloid. A fixed parameter step was chosen and corresponding points were connected.

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Key

[A] — Article
[C] — Monthly Column
[E] — Editorial
[F] — Forum
[G] — The Golden Trumpet
[NT] — Not Technical
[T] — Technical

EDITORIAL

Achieving "Personal" Response from a Computer

In this issue of *Computers and Automation,* we publish an interesting and important report by Ruth M. Davis, Director of the Center for Computer Sciences and Technology of the National Bureau of Standards. This report was given recently to a subcommittee of Congress responsible for overseeing the operations of the National Bureau of Standards.

Among a great many worthwhile remarks which Miss Davis makes in her useful report are some which are highly significant in understanding new uses of the computer:

- Some patients find it easier and more comfortable to give their medical history to the machine than to give it to the physician, apparently because they feel more private talking to a machine than talking to a person;
- Some students from minority groups find it easier to learn from a machine than from a human teacher, apparently because they are convinced that the machine is more "fair" towards them than any human teacher can manage to be.

So it is not true, she says, that "a computer does only what a human being tells it to do" – but instead, something new has been added, that is:

> On some occasions, the computer is more personal, more receptive, more satisfying to interact with, more patient, than almost all human beings.

For a long time some computer people have seen clearly the powers of computers. They have even asserted that since the computer is a revolutionary kind of machine, if it is well-programmed, it could eventually become more human than many human beings.

Here is the beginning of proof by actual experience of such a thesis.

It is appropriate to think of a good interactive computer program as representing the well-thought-out responses of a score of clever persons who have together devised the good interactive system, which then operates without "human" mistakes. Such a program can always be polite, friendly, comfortable, and as instructive as the best of human teachers endowed with an inhuman degree of patience!

It is rather hard for a human teacher to maintain his patience when a student makes just the same mistake again and again – and cannot seem to remember not to make it. For example, I have a friend who has been learning conversational French for more than four years. Let us call him Martin Murphy. He has difficulty in pronouncing the sound "u" in French, as in the word "vu" meaning "seen". Even currently he is making the same mistake most of the time week after week, saying the French "u" as if it were "u" in English "June". I have no patience to hear him continue to mispronounce the "u". I become disgusted and my attitude shows. I estimate that Martin has made exactly this same mistake at least 2000 times, say 10 times a week for 50 weeks for 4 years. Though Martin asks me to correct his French pronunciation, my patience in correcting him has worn thin. But the machine – and the day will come when the machine can correct one's pronunciation of a foreign tongue – can be inexhaustibly patient: the machine's patience will never wear thin.

So along with the fiendish memory of the data banks and the criminal willingness of the computer to do the exact bidding of a dictator, it is good to remember some other places where the computer can be more patient than the best of human beings can manage to be, in fact, divinely patient.

As C. P. Snow, the English scholar, said in an article, "Science and the Advanced Society", published in *Computers and Automation* in April 1966:

> The computer is the most remarkable machine by far, yet made by man.

Edmund C. Berkeley

EDITOR

The U.S. Center for Computer Sciences and Technology

Ruth M. Davis, Director
Center for Computer Sciences and Technology
National Bureau of Standards
Gaithersburg, MD 20760

"Computer technology is changing so rapidly that its review, its assessment, its documentation, its modification, and its control must all occur in real time."

(Based on a statement before the Subcommittee on Science, Research and Development of the House Committee on Science and Astronautics)

The Center for Computer Sciences and Technology was established six years ago, by Congressional action. Simply stated, the Center serves as the scientific and technical conscience of the computer world. The Center is organized into five operating divisions and has a staff of 166. The Center's fiscal year 1972 appropriated budget is approximately $2.1 million; other revenues are estimated at $1.8 million for other agency work; and $2.0 million from the sale of computer services.

The "computer world" it serves is complex and sprawling, affecting every segment of our society, our economy and our government. The computer world now consists of far more than the equipment which we call the computer system. Rather, it is dominated by software, the schemata which makes possible the desired applications of any computer system.

Computer Technological Supporting System

Another crucial element of the computer world is what we call the computer technological supporting system. This latter system consists of all the essential legal, economic, administrative, ethical and intellectual arrangements through which computer power is made available to customers. The importance and significance of technological supporting systems has been highlighted by this subcommittee in its reports and deliberations for the last several years. Indeed, at this moment in computer history such supporting systems and software have become the "Achilles Heel" in all our attempts to channel the power of computers to serve our best interests. This fact attests to the rightness of the emphasis placed on the problem of technological supporting systems by this subcommittee.

Another component of the computer world over which the Center for Computer Sciences and Technology watches is computer science and technology from which are derived improvements in computer applications and products. We, as users and customers, see just products and applications. It is difficult to remember that their utility is a direct manifestation of the maturity of their supporting science. Because of the great technological explosion in the computer field during and immediately subsequent to World War II, computer science was overwhelmed by the surge of computer applications. This resulted in a takeover of the computer field by vendors and implementors and a de-emphasis of mathematical, philosophical, and scientific study in computer science. Computers, programming languages, and other computer related concepts were valued almost solely for their usefulness as tools in specific applications rather than as objects of interest and study in their own right. Not surprisingly, we now have an imbalance between computer science and the industries and applications it supports. The current imbalance is highly visible in that our ability to produce computer equipment and computer programs has far outstripped our ability to measure and judge their quality.

Problems

Every aspect of the computer world is beset with problems — problems of the type associated with a technology changing so rapidly that its review, its assessment, its documentation, its modification and

Dr. Ruth M. Davis is the Director of the Center for Computer Sciences and Technology of the National Bureau of Standards. Prior to that she was the first Director of the Lister Hill National Center for Biomedical Communications, DHEW. She went to DHEW from DDR&E, DOD, where she was Staff Assistant for Intelligence and Reconnaissance for six years, and in her first job established the first technical support group for Navy Shore-Based Command and Control Systems, now known as NAVCOSSACT. She is Visiting Professor of Computer Sciences at the University of Pittsburgh and serves on the newly-established AAS Committee on Technology, Industry and Society. She obtained her Ph.D. in mathematics at the University of Maryland.

its control must all occur in real time; and these actions must occur in the same real time as does the production of computer software and equipment. The rapidity with which problems appear must be matched by the rate at which solutions are advanced. An increase in the gap between the rate at which problems are occurring and the rate at which solutions are introduced could seriously stress our government and society.

Mission: Decrease the Problems

The role of the Center for Computer Sciences and Technology, as the conscience of the computer world, calls for it to use its Congressional and Department-derived charter to attempt to decrease the problems now besetting the computer customer and, most importantly, to predict and prevent the occurrence of additional problems, to the extent permitted by conscious action.

The Center possesses its unique responsibilities and authorities partially through its Congressional mandate, P. L. 89-306 (Brooks Bill), enacted in 1965 to improve the Federal management and utilization of computer technology. Under authorities delegated to the Secretary of Commerce by P. L. 89-306 and policy guidance issued by the Office of Management and Budget, the Center is specifically responsible for providing scientific and technological advisory services to the Office of Management and Budget and the General Services Administration to support the formulation of ADP management and procurement policies and to other Federal agencies to assist in the solution of specific automation problems. The Center is responsible for recommending Federal Information Processing Standards and participating in the development of voluntary ADP standards, and for conducting research necessary to support the scientific and technical objectives of P. L. 89-306. Finally, the Center operates a computer facility to meet the computer services needs of NBS and to provide services to other Federal agencies on a reimbursable basis.

The Center also derives its responsibilities and authorities from the NBS Organic Act which allows it to share in the overall NBS responsibility for promoting strength in science and technology and applying them effectively for public benefit. Thus, the Center serves both the producers and the consumers of computer products and services, and has a special obligation for ensuring that computer technology serves the American citizen in ways that enrich and improve his life without encroaching on his right to privacy and dignity.

Federal Computer Customers

One principal responsibility, then, of the Center is to serve the Federal computer customer. Of equivalent importance is the individual citizen when he becomes either a customer for computer services or the recipient of computer services. In the first instance — that of being a customer — he has made a conscious decision to use computers. In the second instance — that of being a recipient — he has generally not made a conscious choice. The latter case is illustrated by most of us who in our private lives, suddenly begin to receive computer processed bills. Widely-based frustration results when, say, we find that time-honored methods for bringing errors in our bills to someone's attention no longer work when that someone is a computer. The problem is not the computer: the problem is the management arrangement made — or, rather, not made — for coupling the computer to the customer.

Software and Management

We have found that as the computer world has grown and matured, most of the problems and issues of computer utilization have been in the software and management of computer resources. Further, the widespread and increasingly rapid proliferation of computers everywhere has caused computer problems and issues to be of Federal and national concern. One can only compliment the foresight of Congress when six years ago it established the Center and located it at the National Bureau of Standards. For we now realize that computer issues are national problems and that they are technologically-rooted problems.

A World of Services

We have attempted to act with equal foresight as we extend the program of the Center for Computer Sciences and Technology. Priorities for the allocation of our limited resources to Center projects reflect not Bureau of Standards priorities nor even Department of Commerce priorities, but Federal and national priorities. As a result, the central theme of our program is that the computer world of today is a world of services and not of equipment. The customers for computers are interested in the services their computer systems will provide. Their interest in computer hardware is secondary. So also is their interest in individual programs written for computers. Quality service provided so as to make American society comfortable with computer applications and products is our greatest need today.

Major Objectives

In line with national priorities, there are several major objectives towards which the program of the Center is aimed. These are:

The utilization and application of computer services and technology to improve the productivity of the major service areas of our economy.

The improvement of computer services so that they are of better quality and are less costly. Less costly implies both that the customer pays less and that computer manpower is more productive.

Increased beneficial application of automation technology for society through greater reliance on the computer as the hub of versatile automation.

The development of performance guidelines and standards for computer products and services so that the computer marketplace is a better one for both buyer and seller.

Quality Control and Measurement

Within these broad objectives the resolution of outstanding issues and problems demands an immediate focus of our efforts on quality control and measurement of computer services and products, on increasing professionalism in the computer field, on intensifying the applications of automation technology, and on decreasing the enormous dissipation of skills in unproductive labor in the computer field.

Urgency

There is an urgency here resulting primarily from a growing apprehension everywhere over undesired and unforeseen consequences of computer use. "Everywhere" is a most significant and meaningful term in the com-

puter world. There are currently some 63,000 computers in the United States and an additional 33,000 in the rest of the world. Their importance to a nation's capability is apparent from the serious attention given to the advisibility of allowing the British to sell two ICL 1906A computers to the Soviet Union. The question received the direct attention of the President of the United States and the British Prime Minister. Two computers were considered to measurably improve the strategic position of a world power.

Accrediting a College: Does It Have a Computer?

Approximately one-half of the 2,500 colleges and universities of this country have computer facilities. A recent Congressional report questioned the advisibility of accrediting a college or university not having computer facilities for students. Such concern has rarely been expressed over equipment facilities in schools.

Space and War

It is almost trite to point out that space exploration and defense are impossible without computers. The computer's demonstrated capability in unmanned space systems causes some scientists to question the need for men in space as necessary companions to computers. The possibility that World War III has already been fought with computers is not mere science fiction. There have not been the large scale wars feared, even anticipated two decades ago between countries advanced in computer technology. We, and no doubt the other technologically advanced countries, used computers to simulate war plans, play war games, and formulate strategies and counterstrategies, thus maintaining a world balance of strategic power. Wars that are occurring appear to be those characterized by human behavior we understand too little to simulate.

Welfare and Insurance

Medical care, welfare, social security, and insurance payments on their present massive scale would be impossible without computers. The Social Security Administration has 35 computers on site in Baltimore. The Blue Cross/Shield organization processes its records with 240 computers in 90 locations. Some ten percent of the approximately 7,000 hospitals in the country have computers used mainly for administrative functions.

The Federal Government possesses about 5300 computers. State Governments use more than 500 computers. In addition to Federal, state and local governments, which account for some 18 percent of total computer usage, computers are diffused broadly through the economy. Some 40 percent of all computer facilities are used in the manufacturing industries; the financial community, including insurance companies, accounts for another 16 percent; the remaining 26 percent is distributed among the utilities, wholesale and retail trade, health care facilities, and data processing firms.

Pervasiveness of Computers

Virtually every American citizen is served by the computer almost daily in a variety of way — receiving a computer-prepared Social Security check, getting mail with computer generated address labels, buying goods whose manufacture was controlled by computer, travelling on rapid transit vehicles whose schedules are computer controlled, obtaining medical treatment from a physician who uses a computer to aid in diagnosis and maintain patient records, or using a telephone in a network where switching is controlled by computers.

Horror Stories

One cannot discuss the pervasiveness of the computer without introducing the "horror stories" so rampant today. Two of the most frequently heard are, first, that computers are replacing man, and, second, that computers are dehumanizing and constitute a threat to the individual's privacy. In the first instance, the charge cannot be dispelled by the simple statement that "The computer can only do what it is told to do by a person" because computers are indeed being programmed to perform an increasing amount of "intelligent" tasks. Perhaps a more sensible view is that man coupled with the computer will outlast man without the computer.

The second horror story begins with "We're no longer individuals, we're just numbers" and typifies the attitude of those who say the computer is dehumanizing.

People More Comfortable with Computers Than with Human Beings

Countering these reactions are others where physicians have reported that patients, in certain instances, have shown a greater willingness to answer questions posed by a computer terminal than to answer questions by the physician. Similarly, studies by educators have shown recurrently that deprived children respond to "teaching" by computers more readily than that provided by human teachers. The hypothesis here is that these students feel intuitively that the computer is fair in its treatment of them. They have an inherent disbelief, because of their background, that they are getting such equality of treatment from the human teacher.

Costliness of Problems

With computers and their services so widespread and their customers so diverse and dispersed it is apparent that any accompanying problems are going to be extremely costly to the economy as a whole. Further, these problems are going to cause far-ranging discomfiture throughout industry, government and society. This has indeed happened. Computers have, in fact, become the major technological ingredient of progress in the world of today and it is the problems accompanying their services and utilization which must demand our attention and resources. The urgency of isolating and describing these problems so as to permit some resolution has been felt by the Center for Computer Sciences and Technology.

Quality Control in Software

One serious problem is the inadequacy of computer software selection, procurement and management procedures. There is probably no more elusive commodity bought and sold today than computer software. Software in this sense is the schemata which permits the successful use of computers. Included in software management are program production, measurement, testing, validation, documentation, control, transferability, legal and proprietary rights of buyer and seller, maintenance, and costing.

Today, it is difficult to find software documentation that tells you how long it will take to run a program and produce a given result. We must insist, as customers, that vendors tell us it will take two seconds per medical record say, to calculate the cost of a hospital stay along with medication prescribed. Then we can begin to compare computer services of-

fered in the tradition of an effective marketplace. Today, as sellers, we must insist that a prospective customer define the services he wants per unit time along with needed maintenance and reliability. Too many customers enter the computer marketplace with only the desire to replace their existing system with a computer system. Nothing begets an unstable market faster than an unsure customer.

Although the United States is the world's greatest producer of computer software, there is virtually no quality control in the computer service industry. No one has yet paid adequate attention to software management in spite of the fact that it is through software management that a whole new dimension of efficiency is opened to the customers of computer services. A recent report by the General Accounting Office has stressed the seriousness of the software management problem and the associated lack of quality control.

Software Management

Software management is becoming increasingly complex because computer customers are being confronted by a rapidly growing number of alternatives in software products. Until quite recently, the customer had few alternatives available in the software area. But now, software is being produced in large quantities by computer manufacturers, computer users, independent software producers, research institutions, universities and others. The customer's selection, utilization and costing problems are complicated and further compounded by the lack of measuring sticks or product "guarantees" by the seller. The urgency of solving the problems of software management is underscored by the fact that initial software costs invariably equal hardware costs for any application and that for a majority of applications initial software costs are estimated to run three to eight times hardware costs.

Software Documentation

Software documentation is the detailed description of a computer program. Standardized documentation procedures are crucial to good software management; without them the result is the kind of chaos that would occur in accounting if CPA's didn't have standardized nomenclature and conventions. Effective documentation is essential to the buyer in evaluating software for purchase and application to his problem. The Center has recently collected some 60 indexes, directories and catalogs containing descriptions of programs available for shared use in both the public and private sectors. This effort has underscored the urgent need for standardized ways of describing computer programs so that potential users can make decisions on a program's applicability to the solution of a given problem. The ability to share computer software extensively is directly dependent upon the uniform documentation system for describing computer programs. If a reduction of only 5 percent of the $182 million spent by the Government in 1970 for programming and related services could be achieved through more effective program sharing, savings on the order of $9 million could be realized. The Center has placed high priority on the development of software documentation standards as an important part of the Center's program to improve the effectiveness of computer services and insure the customer equity in the computer marketplace.

Software Validation

Software validation is the process of determining the extent to which software conforms to certain stated conditions or requirements. The process is analogous to that of determining whether a newly manufactured watch satisfies the conditions and accuracy requirements necessary to be called a chronometer. Software validation services, in their totality, are an essential ingredient of effective computer utilization; none exist today. The result of the software validation process is software certification — designating which stated conditions or requirements the software has met.

The absence of software validation services has resulted in customers buying software without knowing the extent to which the software conforms to stated conditions and requirements. In most instances each customer performs his own validation of the same piece of software. An example within the Federal computer environment will illustrate the problem. The FY 1970 GSA ADP inventory shows that Federal agencies bought 180 computer systems for which the vendor maintains a COBOL compiler. Under present procurement practices, 720 COBOL validations were required, assuming there were four bidders for each procurement. At an average cost of $3,000 per validation, the total expenditure for all the required validations on a decentralized basis would have been $2,160,000. Since there are only about 33 unique COBOL compilers maintained by computer vendors, the entire validation process could have been performed for about $99,000 — 33 validations at $3,000 each — or a savings of more than $2 million.

The Center has initiated an effort to determine the best means for instituting COBOL and FORTRAN validation services. The Center is working closely with the General Services Administration in serving Federal customers.

Performance Measurement of Computer Services

Presently, the computer industry has few meters or gauges for measuring either hardware or software performance. After twenty years, there are only some half-dozen computer hardware monitors which can provide data on how various components of a computer system are performing; these have been developed, generally, within the last five years. And yet, first tentative findings show that a 25 percent improvement in computer utilization can be expected from simple changes apparent from primitive analyses of the data produced by these hardware monitors. Grossly, this could mean a 25 percent decrease in the cost of computer services provided by a given installation. In the case of large computer systems whose annual operating costs are on the order of $1.7 million, this would mean a savings of $420,000; total Government-wide savings for computers in this range could amount to about $192 million.

The Center has included in its technical program an effort to develop and provide to the computer customer a body of techniques and guidelines for measuring the performance of computer systems.

Standards

Finding the remedy for computer hardware and software incompatibilities is not an easy task. We believe that properly conceived ADP standards can usefully serve to resolve incompatibility problems. Standards in this sense are consensus agreements on how the design, performance and other characteristics of computer products, processes, services and systems are to be described and, when possible, measured. Desired compatibility among computer hardware is achieved when one set of equipment can accept and process data prepared by another set of equipment

without having to convert the data or modify its own program. The desired compatibility among software packages is achieved when the operating system of one computer can run programs written for another (compatible) computer and achieve the same results.

The standards program of the Center for Computer Sciences and Technology attempts to achieve these objectives through support of and cooperation with the nation's voluntary ADP standardization activities, especially those of the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO).

To date, fifteen standards which are aimed at resolving problems of ADP incompatibility have been issued as Federal Information Processing Standards. In addition, the Center is actively participating along with representatives from other Government agencies and industry in the standards committees of ANSI and ISO, where some 80 other ADP standards are in various stages of development. We intend to continue a vigorous technical participation in these standards activities.

Professionalism in the Computer World

The effective utilization of computer technology to solve pressing national problems is directly dependent upon the availability of an adequate force of professional computer personnel capable of advancing computer science. Presently, there is a serious shortage of properly trained, experienced computer professionals. Current estimates are that the total need for computer personnel of all types will double in the next five years. The Department of Labor has estimated that there are currently about 500,000 computer personnel in the United States; most of these are applications oriented personnel without formal education in computer science.

The trained professional manpower base capable of contributing to the advance of computer science is a small but increasing fraction of total computer personnel. As of 1969, only 4343 computer science degrees had been awarded over the preceding five years; only 163 of these were at the Ph.D. level. As a result, the current ratio of application manpower without formal education in computer sciences to those who have formal degrees in computer science is at least 100:1. This imbalance is producing a drag effect on computer application and utilization.

The primary responsibility for developing computer professionals lies with our colleges and universities. Currently, there are 51 college or university computer science programs leading to a Bachelor's degree, 40 at the Master's level, and 13 that award the Ph.D. The Center endorses all efforts leading to increased computer manpower skills and to a respectable computer science.

Dissipation of Skills

The dissipation of skills in the computer world today is enormous. This intolerable condition exists for several reasons. First of all, we cannot exchange software except in highly restrictive situations. Two customers both wanting a computer system to perform administrative tasks in their university will each pay total development and application costs for their computer system even though the needed services are identical. The culprit is lack of compatibility of computer equipment and software and our present inability to document and thus define a computer system. The result is duplicative costs for the same development and a waste of computer manpower. Our economy can afford neither.

Low Productivity

A second reason for low productivity of computer professionals results from the inability of the computer customer to specify the performance he requires from the service he is buying. When this problem is coupled with the present lack of performance measurement tools and techniques for computer products we have the almost ludicrous situation of a marketplace where the buyer does not know whether his "purchase" is satisfactory and where the seller does not know how to describe his product. The result is the well known horror story of the organization with an unacceptable computer system after two years of contractual development and several million dollars outlay.

Still another reason for dissipation of expensive computer manpower skills is our inability to find ways of sharing the costly computer products and resources we as a nation now possess. It is frustrating to know that superb computer programs for architectural design at the Univeristy of Utah cannot be used at the University of Alaska without the expensive duplication of the entire Utah computer facility at the University of Alaska. The computer system in Ohio for retrieving legal information cannot be used today in Kentucky without duplication of equipment. We are taking the first steps towards removing the obstacles to remote sharing of costly computer resources developed through large manpower expenditures. The process of sharing is called teleprocessing and is accomplished through the networking of computers and customers by communications.

The Center for Computer Sciences and Technology is active in attempting to eliminate all these problems resulting in wasted resources and unsatisfied expectations. It has, as noted earlier, projects to increase compatibility of software and hardware and to develop and apply performance measurements to computer services. It is also developing teleprocessing as a radically better way of utilizing computers.

Teleprocessing

Not everyone who needs computer services can afford a computer, and, conversely, not everyone who has a computer needs all the services he has available. Similarly, those who do own computers cannot afford to develop all the software and data banks they would like to have to be completely self-sufficient. Clearly, then, there is a need for effective methods which will permit communities of customers to share expensive computer resources.

Resource sharing among computer customers is increasing but has not yet reached truly effective levels. Much of today's sharing is in the form of exchanging computer software and data files but even here effectiveness of sharing is severly limited by the lack of compatibility between hardware and software. Our ultimate objective is a set of procedures which permit the effective and efficient sharing of hardware, software and data files without the necessity to physically move resources or perform any conversion or modification of resources.

Computer Networking

The most advanced current concept in computer resource sharing is computer networking. A computer network is a set of independent computer systems interconnected by telecommunications lines to permit interactive resource sharing between any combination of systems and customers. Teleprocessing is the popular term used to describe computer

networking. Teleprocessing systems can be as simple as a single computer to which several remotely located access terminals are connected via standard telephone lines, or as complex as a nationwide network of large scale computer systems interconnected by highspeed dedicated communications lines.

The new and different applications and services afforded by teleprocessing can already be speculated. They represent breakthroughs for our society and perhaps are best characterized by terms such as "the electronic society" or "the checkless and cashless society", which have begun to appear regularly in the industry literature.

It is clear even at this early stage of its development that the future structure of teleprocessing usage will be affected by Federal policies and that these policies may well be the determining factor in future trends as teleprocessing is applied to increasing numbers of applications within our society.

Telecommunications Policy

The Office of Telecommunications Policy (OTP) was established just a year ago in recognition of the importance of Federal policies on communications practices and trends. On September 1st of this year, this office asked the National Bureau of Standards to assume a distinct and special role in assisting the OTP in carrying out its functions assigned by the President in the area of computers and communications. In particular the NBS was asked to provide technical advice and analysis in teleprocessing matters.

We consider this an extremely important assignment and appropriate for the Center for Computer Sciences and Technology under its Congressional mandate.

Teleprocessing

We have already identified some 237 systems in our country employing teleprocessing. These are found in twenty major segments of our economy including banking, welfare services, airline reservations, colleges and universities, agriculture extension services, and credit services.

Teleprocessing usually introduces cost savings. For example, hotels have estimated that the manual handling of a single reservation ranges from $1.50 to $4.50 in labor costs. With the teleprocessing reservation system, the cost per reservation has been reduced to from $.58 to 10 percent of the room rate.

The use of teleprocessing is growing. Within the U. S. the market value of the non-government network data service has grown from $100 million in 1968 to some $345 million in 1970 and is estimated to grow to some $2 billion by 1975. This represents a rate of growth of 40 percent per year compounded.

In 1970, teleprocessing techniques were employed in systems representing about one-fifth of the total computer services market. By 1975, they are estimated to comprise at least one-third of that industry.

At least 150 firms are currently offering services based upon teleprocessing or computer network interconnections. Within the Washington, D. C. area, it is now possible to access at least 43 time-sharing computer services by local telephone dialing.

At least 16 teleprocessing oriented ADP systems are currently centered in the Washington, D. C. area alone. The Center maintains an inventory of these. They range from the "on-campus" system at NASA Goddard making use of an IBM 360/95 to permit some 40 odd terminals within the Goddard Laboratories to interact with each other, to the FBI's National Crime Information Center making use of an IBM 360/40 located in Washington, D. C., which is interconnected to over 3,000 law enforcement agencies in 49 states, and which is today handling more that 50,000 inquiries per day from these agencies.

Privacy

There are many concerns with the technology and economics of teleprocessing. Some of these concerns are socio-ethical in nature and deal with questions of the privacy aspects of the information, and to the integrity of such information, especially when that information is transmitted from computer to computer. Very serious concerns exist with respect to the methodologies for verifying electronically stored information concerning an individual or business. Similar concerns arise regarding procedures for correcting erroneous information, especially if that information has been disseminated to locations where it may be used to respond to inquiries. We have classified this problem of privacy of data as one of controlling the accessibility to computer maintained data bases.

Controlled Accessibility to Computer Data Bases

The pervasiveness of the computer has raised widespread fear of the computer as a threat to the privacy of the individual. Teleprocessing has escalated such fears. Although the issue has been frequently exaggerated and charged with excessive emotion, there is a necessity for a rational approach to the problem of security, privacy and confidentiality of information contained in computer data banks.

The problem of controlled accessibility of data bases has two major facets, the technical problems of protection by use of hardware or software techniques and the social or legal aspects of privacy and the protection of property rights. It appears that the technical aspects of the problem while significant are not insurmountable, although their adequate resolution will require analysis of the social or legal problem to determine what limitation on access must be provided for.

Social and Legal Problems

The social or legal problem has two major facets: the protection of privacy and property rights. In the first case, all of us have misgivings about the accumulation of vast amounts of personal data about ourselves in an information system with that data made available to users of the system. The uses of this data by properly motivated people could be of immense social value; however, the potential for abuse of the information by unscrupulous individuals is equally immense. Such misuse may range from using credit rating information to determine likely prospects for making unauthorized charge account purchases to blackmail through use of collected and correlated facts about past conduct which individually are insufficient to prove

anything but when taken in the aggregate tend to circumstantially show some undesirable conduct.

In the case of protection of property, the problem involves not only the use of the data but the control of the data base.

The technical issues underlying all aspects of privacy of data are a major program thrust of the Center for Computer Sciences and Technology.

Beneficial Applications of Automation Technology

We mentioned earlier that one of the major objectives of the Center was to increase beneficial applications of automation through greater reliance on computers.

The technology of automation is of prime importance to manufacturing and in service areas such as education, health care, law enforcement and postal service. In a broad sense, it encompasses practically any device that reduces the amount of human effort — physical, mental, or both — necessary to achieve material objectives (i.e., to do work). In a more specific sense, it means mechanical or electronic control that takes the place of man-exercised control. The highest degree of automation today is epitomized by digital computers. In this sense, computers not only control other machines and their processes: they communicate with them, receive information from them about processes as they occur, and use this information to correct or guide the process while it continues (feedback). Machines under computer control may be turbogenerators in a regional power grid, microscopes, instructional displays, brake testing devices for trains, finger print recognition devices, or aircraft traveling at twenty miles a minute.

Automation Needs Infusion of Technology

Automation in 1971 now needs an infusion of technology. There is evidence that the use of automation in industry and in service areas is slowing down. One of the reasons for this is simply the fact that in the technological stage in which it now exists, automation has progressed in many industries to the point where the cost of labor is not the primary factor in the cost of the finished product. For example, the total amount of labor remaining in the manufacture of an American automobile is only about 100 hours. A lot of the present automation existing in both the service and manufacturing areas takes the form of fixed-purpose machinery. It does not permit basic changes without extensive changes in the equipment itself. Only high volume production can justify further costs for this rigid, fixed-type of machinery that is epitomized by industrial robotry today. With sales volume no longer expanding at its previous rate, there is little to encourage further automation simply on the basis of economies of scale.

Most of the emerging developments in labor-saving machinery and in operations hazardous to man or occurring in remote environments dangerous to man are likely to arise through exploitation of the electronic computer and its associated devices. The type of automation epitomized by the use of the electronic computer, as a control device using communications as its controlling element, is known as "soft automation." It is called "soft automation" because it depends upon software — that is, upon programming of the computer and its related devices. Products of soft automation can be changed and/or directed to entirely different tasks without any change of the computer equipment involved. In fact, even the welding devices, the lifting cranes, the manipulators or the extensors or the other machinery that carry out the commands of the computer need not be replaced. It can simply be reprogrammed to do different tasks using the same kind of fixed manipulative ability.

Increasing Productivity

There seems to be no question that automation increases productivity. There appears to be no question that automation technology, whether in its most simple or its most complex humanoid-like form, provides better quality output than the replaced manual technology. The measurement of just how much productivity is increased or how to quantify the increase in productivity is uncertain. It is no more uncertain, however, than in most areas utilizing high technology. Equivalently, productivity in the service area appears to be increased through the use of automation technology. Hospitals have installed remotely-controlled carts that, through remote controls, are programmed to carry material, food and drugs, to predetermined floors and rooms. It is estimated that this will both increase productivity in hospital service and decrease the cost of health care services. What is perhaps more important is that it will certainly increase the quality as well as the availability of health services to patients in a hospital.

It seems clear that the Federal government should take an active role at least in the beginning stages of a new injection of technology into automation. The role of the Government has to be complemented or augmented by incentives for productivity increases by industry and by incentives to industry for increasing their research and development budget. The stakes for an increase in productivity are a concern of the Federal government. The National Bureau of Standards intends to mount a significant and well-organized effort to pursue a program for productivity enhancement over broad segments of the economy through beneficial applications of automation technology.

The Major Technological Ingredient of Progress

Computer applications and products constitute the major technological ingredient of progress today. Computers enhance the intellectual capabilities of individuals; at times computers even replace people. Computers impact on the daily activities of all of us. Computers are about to inject a new dimension into automation which will surely result in major increases in productivity and in the quality of services offered society.

The use of computers and computer services is so widespread that accompanying problems are going to be extremely costly to our economy as a whole. These problems are already causing far-ranging discomfiture throughout industry, government, and society. The problems are those of quality control of computer services, software management, sharing of expensive computer resources, dissipation of costly computer manpower skills, a marketplace without adequate performance measures or standards and automation without versatility. These problems are all technology-based.

The Congressionally and Departmentally-derived charter of the Center for Computer Sciences and Technology assigns it responsibility within the Federal government for resolving computer-based problems. The Center believes the solving of these problems to be essential if society is to benefit from and feel comfortable with computers. We would like the recognition and resources necessary to carry out our responsibilities. We have the motivation and the sense of urgency □

Computer System Models

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"Once a system designer — whether a user or a manufacturer — decides to perform an analysis to study the system being considered for a particular application, how does he proceed?"

(Reprinted with permission from *Univac Technology Review*, Spring 1971.)

The process of designing and configuring a computer system has never been an easy task. And now, with the ever increasing emphasis on communications-oriented real-time systems, the design problem has become enormously complex.

Where can a user begin his study to determine the feasibility of accomplishing his application on a particular computer system? The only alternatives available to him are benchmark testing or mathematical modeling. Benchmark testing techniques, while practical for evaluating small portions of systems, are not particularly applicable to studying total system concepts in large real-time applications. Thus, almost by default, simulation and mathematical modeling techniques are the only course open to both the user and the manufacturer in studying total system performance.

Once a system designer—whether a user or a manufacturer—decides to perform an analysis to study the system being considered for a particular application, how does he proceed? How does he gather the applications data, organize the data for an analysis, gather the necessary hardware and software timing information and derive the models and methods to be used in the analysis in a short amount of time? (Usually, of course, he has an insufficient amount of time to perform the required analysis.)

Salvatore Catania has an AB in Mathematics, an MS in Engineering, and a comprehensive background in system simulation and analysis. At Univac he is responsible for system configuration simulation studies in the marketing environment.

There is only one way to complete the overall task. The procedures to be followed and the subtasks to be executed must be predefined. Specific applications data must be sought out, and it must be gathered in a pre-determined format. Hardware and software timing data must be at hand and ready to be used. Lastly, and most certainly not the least important, generalized analysis models must be available and ready to use.

The derivation of simulation, logical, or mathematical models is a time-consuming task even for the most skilled analysts. If it is necessary to formulate and build the models needed for each analysis from scratch, meaningful analyses cannot be conducted within short time frames. The models must be available which have applications data and configuration definition information as input data. The designer then gathers data in the proper format, specifies the hardware to be included, and defines the configuration to be modeled. When operating in this manner, the system designer has the ability to produce meaningful results quickly.

STARTING THE STUDY

If a designer decides to work in this fashion, how many and what types of models must he have at his disposal? To answer this, we must explore the types of questions that must, typically, be answered by a configuration study. We must also examine the type and quality of the applications definition information that is readily available at the time when such studies are normally performed.

Suppose the system under consideration is to be used in a real-time communications-oriented application. Then, some important determinations to be made would be:

- How long, after an inquiry from a remote station has been made, will the response

arrive back at the same remote station (response time)?

- What are the utilizations of the various hardware components within the configuration?
- What is the ultimate thru-put capability of the configuration?
- How will an increase in the number of inquiries (volume) affect the important system parameters (utilization and response time)?
- What are the system bottlenecks, and how can we improve thru-put (more hardware or better software)?
- What is the Mean Time Between Failure (MTBF) and the Mean Time To Repair (MTTR) of the proposed configuration?

The type of applications definition data available to the designer can vary over a wide range. It can be very crude or it can be extremely detailed. Typically, the designer must know:

- The communications network layout and the message generation rates at the various drops in the network.
- The size and the structure of the files to be read/written in the processing of transactions.
- The frequency of access to the files.
- The volume of work to be handled.
- The timing characteristics of the hardware and software being proposed to handle the workload.
- The MTBF and the MTTR of the individual hardware items in the configuration.

REQUIRED MODELS

In generalized categories, the following types of models are required to complete a system study using simulation and mathematical modeling techniques.

COMMUNICATION NETWORK MODELS

The networks required to channel the sometimes voluminous number of inquiries to and responses from the computer center (Central Site) are necessarily complex and expensive. The analysis model should accept as input:

- The network configuration to be studied.
- Data on the characteristics of the hardware being used.
- Algorithm specifications, timing data, and the line handling procedures to be employed by the Central Site Computer in controlling the network.
- Message generation rates and message characteristics for each of the network drops.

As output, the model should yield the utilizations of the various hardware devices within the network and statistics on the queue points and service times which account for the overall transit time of a message within the network. The important queue points and service times within the network are: the wait for poll time, input message transmission time, the central site turn-around time, the wait for output line time, and the output transmission time.

CENTRAL SITE MODELS

Here, two types of models can be used effectively. One model should be an input/output (I/O) configurator and the other a configuration performance analyzer. The first model should be used to place the files to be referenced on storage devices and place the storage devices on I/O channels. Specifically, this model should accept as input:

- The size of all files to be referenced.
- The frequency of access of these files by the various transactions that will use the files.
- The transaction volume.
- The hardware characteristics (access times, latency, transfer rates, etc.) of all storage devices to be considered.

As output, the model should give the utilization of the specified storage devices to be used to store the files and the utilization of the I/O channels which contain the devices. The best model format is to place every file defined on every device specified, and then compute the device utilizations.

Immediately upon examining the output, some interesting things will become readily apparent. Some devices will be more than 100 percent utilized if they contain a given file (a physical impossibility). Placement of this file on this device should, therefore, not be considered. Other devices will have low utilization and plenty of physical space available. Files can then be permuted so that all devices are utilized at an acceptable level and all the available space is being used.

After using this model, the designer has an I/O configuration which can be combined with other hardware to yield a Central Site Configuration which is ready for performance analysis. The

model to be used here should accept as input the following types of data:

- The hardware configuration
- Hardware timing and software execution speeds.
- Transaction volumes.

As output, the model should yield sufficient statistics to give the model user a comprehensive view of the overall behavior of the main frame under the application being studied. Some of the more important output information is:

- The response times of the different type inquiries.
- Queue statistics on the various system queues.
- Hardware utilization.
- The proportionate amount of the time spent in the various software routines.
- Facilities management information.

RELIABILITY OR AVAILABILITY MODELS

For almost any computer configuration designed to accomplish any given task or set of tasks, the question of the availability or the amount of time that the system will be "up and running" is of importance. The Mean Time Between Failures (MTBF) and the Mean Time To Repair (MTTR) must be considered when the ability of the system to accomplish its design goals is being considered. Normally, the designer can obtain unit reliability data, i.e., what is the MTBF and the MTTR of a memory module, a mass storage device, etc. However, generally, there is no data available on the composite MTBF and MTTR of a configuration. This is understandable because, with few exceptions, configurations are unique.

To aid in the transformation of unit reliability data to configuration MTTR and MTBF projections, the designer needs a model that will predict the configuration's availability statistics when given unit reliability figures. If such a model is at hand and the proposed configuration's availability falls below an acceptable minimum, the designer can replace some critical hardware items or add redundancy (back-up equipment) in the most critical areas.

Typical input data for such models are:

- The hardware configuration.
- Specification of which units must remain on line to constitute an "up and running" system.
- Specifications of which units are prime units and which are back-up.
- Unit reliability statistics.

When the above mentioned input is applied to the model, the output generated should include:

- Configuration MTBF and MTTR statistics.
- Data which pinpoints the weak links—from an availability standpoint—in the configuration.

UNIVAC SYSTEM DESIGN MODELS

An approach identical to the one outlined above has been followed in building up the analysis and design capabilities of the Systems Design and Simulation Group with Univac. The approach has led to the development of the following generalized models.

Central Site Queueing (CSQ) Model

The CSQ Model is a static model which utilizes Queueing Theory to analyze the performance of a real-time computer system. Basically, the model views the processing of a real-time transaction as an excursion through a set of serial queues. Statistics on the wait times, the service times, and the utilizations of the various queues are gathered along with the response times of the various transactions defined. The model is easy to use and provides gross information on a configuration's performance very quickly.

Central Site Simulation Model (CSSM)

This dynamic simulation model is a SIMULA representation of a generalized, transaction-processing computer system. The model allows a variety of configurations—unit processors, multiple processors, multi-associated processors, front end systems—to be simulated. Detailed statistics on all pertinent hardware and software components of the system are gathered. Average response times and response time distributions for each transaction defined are also computed. If detailed information on the application to be studied is available, CSSM is a tool which can give the designer an in-depth look at performance of his configuration.

File Layout and Allocation Program (FLAP)

This model was designed to assist the system designer in his selection of mass storage devices and the allocation of files to these devices. The designer specifies the full complement of files and data on the frequency of access to these files. The model computes the utilizations of a series of devices to which these files are assigned on a trial

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COMPUTER THINKING

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"The computer industry . . . will be judged increasingly by its ability to do a job on time and within cost."

(Based on a report in the *Financial Times,* London, England.)

After 15 years and 100-fold growth in the use of computers from 50 to 5,000 installed machines, the viability of computers is being questioned ever more closely. The vaunted plans of computer people to put computers in the boardroom and at the elbow of most £100,000-plus turnover organisations now seem further away than in the halcyon mid-sixties. Within the past few months two computer bureaux, the Barclays/ICL consortium and Autonomics, have curtailed their activities after investing several million pounds.

There are some 15,000 organisations using computers, and two-thirds of this total buy their computer power from the 250 computer bureaux providing a service. The growth of computer use in the next decade will largely take place with computer bureaux, as most organisations with £10m-plus turnover have now installed their own machines. However, 1971 has been a bleak year for innovation and the extended use of computers demands reorganisation and change if it is to be effective.

Most companies have started with computers anchored firmly to the financial end of the boardroom table. The reason for this has been understandable enough, in that payroll, sales, purchase and nominal ledgers, labour and stock costings are applications which even under manual operation are well defined and therefore need minimum change to run them through a computer. Relatively few companies have graduated from these accounting applications to more general use, as the accompanying table, taken from a survey conducted by the British Institute of Management and my company, shows.

Working Projects

The same survey pointed up the future applications on which the respondents were working. These include project evaluation; financial and marketing models; control of cash and the assessment of opportunity for profit; investment planning; and profitability forecasting.

The gulf between the existing applications and those that are planned for the seventies is considerable. In the seventies, the location of a particular car with precisely the customer's required options (out of perhaps a million possibilities) will be less than a minute away over the telephone to a car data bank. Capital projects will generally be subject to the most rigorous simulation and risk analysis through mathematical business models run on computers. Whereas the current applications are essentially administrative jobs which have been converted from manual or a punched-card processing, the future jobs will be concerned with the fundamental policy and planning methods of the organisation.

There has been much talk of the need for top management to be more involved with the computer applications installed in their companies. The chief executive and his senior colleagues can hardly be expected to get involved with computers when the machine's role is confined to elementary accounting tasks. However, if these potential applications are to be effective, senior management will ignore the computer department at the risk of finding their computer people riding rampant through their company organisation and their profit and loss account.

Computer Applications	% of Companies
Stock control	55
Payroll/Salaries	44
Sales Statistics/Analysis	43
Sales Ledger	40
General accounts	36
Purchase ledger	35
Costing	33
Sales invoicing	32
Production control	27
Stock valuation	13
Labour costing	12
Purchase analysis	10
Fixed assets	10
Order book	8
Share registration	6
Production control	27

Terminals + Storage = Accessibility

The computer terminal with its typewriter keyboard and screen that can display both characters and graphs, and immense computer storage facilities with capacities measured in billions of characters, have together made information as potentially accessible as electric power. Even now these capabilities are being exploited by stock and insurance brokers, airlines and mail-order houses. These facilities enable virtually all the records of a firm to be held on a remote computer. With a single transaction, such as the hiring of a new staff member, entries are automatically generated on the records of the personnel department, the payroll section, and at employee's new department. Information is accurate and up-to-date and company communication is improved.

These developments counter the greatest obstacle to computer use in the mass of small to medium-scale companies by overcoming the problems of turnabout and security of information when using a computing service bureau. Such bureaux are the natural suppliers of information processing power. Just as few organisations now contemplate installing their own electrical generating plant, so the majority will seek to "plug-in" to a computer service centre.

Graham — *Continued from page 16*

However, such organisations will still need "maintenance men" in the form of systems analysts and programmers, and a really effective Computer Systems Manager who comprehends both the business and computers, and can purvey to senior management the capabilities and limitations of both.

The key factor affecting the growth in the number of companies using computers is the scope for lowering the "front-end" cost of converting. Development and conversion costs may amount to two to five times the subsequent annual operating costs, which has obvious implications for the smaller company with limited cash. Many attempts are being made to overcome this problem, including the development of applications packages for use by a number of companies. Such packages are generally concerned with the regular standardised accounting procedures.

Too Little Time

The computer industry — manufacturers, bureaux, consultants and specialist staff — will be judged increasingly by its ability to do a job on time and within cost. During the sixties there has been ineffective project control, general overspending and poor management. The D.P. manager has had little time to gain even a basic understanding of sound management practice with the frenzied growth of the sixties and decimalisation. Now management courses specifically for computer men are being developed, techniques of data processing and management are being defined in standards for project and quality control, and the computer installation review is being established as an important check on the health of both the system development and computer operations functions.

"THE COMPUTER DIRECTORY AND BUYERS GUIDE" ISSUE OF "COMPUTERS AND AUTOMATION"

NOTICE

The U.S. Postmaster, Boston, Mass., ruled in January 1972, that we may no longer include "The Computer Directory and Buyers' Guide" issue of "Computers and Automation", calling it an optional, thirteenth issue of "Computers and Automation" regularly published in June.

Accordingly, we have decided to try to turn this ruling to our advantage. We hope to publish "The Computer Directory and Buyers' Guide of Computers and Automation" as a separate publication, probably on a quarterly basis. We hope to issue the usual parts of the directory plus additional reference information in June, September, December, and March. The main advantage of this change to our subscribers "with Directory" is that we can keep the "Computer Directory and Buyers' Guide of Computers and Automation" more up to date with quarterly publication than with annual publication; therefore, it should be more useful.

The domestic annual subscription rate for the "Computer Directory and Buyers' Guide" will be $14.50. However, regular subscribers to "Computers and Automation" may subscribe to the directory at $9.00 a year (there is thus no change for them).

We have applied to the Post Office for approval to so publish the "Computer Directory and Buyers' Guide of Computers and Automation" with postal second class mailing privileges. Since they have not yet had time to act on our application, our plans remain, to some extent, tentative.

Nevertheless, the regular computer directory information for 1972 will be gathered and WILL BE PUBLISHED in 1972. "The Computer Directory and Buyers' Guide of Computers and Automation" has been published every year from 1955 to 1971, and 1972 will not be an exception.

Catania — *Continued from page 16*

basis. After perusing the first level of output, the designer can assign his files to specific devices and the devices to I/O channels. The next level of output gives device and channel utilizations. Both device and channel usage equalization are easily achieved with the use of this model.

Communications Analysis Package (CAP)

CAP is a combined queueing and simulation model, which, primarily, computes the average response time of a communications network. Network queue statistics are gathered in addition to line utilization data. Generally, it may be said that CAP generates gross estimates of a communications network's performance. It is easy to use and allows a designer to quickly equalize the total workload over the entire network.

Communications Simulation Model (COSMO)

COSMO is a dynamic simulation model of a generalized communications network. The model allows most network configurations to be simulated and also allows a variety of network operating philosophies to be employed in the processing of the traffic. Designers can quickly evaluate the merits of different hardware and software configurations using this model.

System Availability Model (SAM)

This model computes the MTBD and the MTTR for complex configurations when unit reliability data is known. The model allows for the definition of prime and redundant (back-up) hardware and aids the designer in configuring the minimum cost system required to meet his reliability requirements.

CONCLUDING REMARKS

The above approach to systems study is a segmented one, i.e., the system is studied from several different aspects and each study is conducted independent of the others. It could be argued that you cannot treat the communication network and the central site separately or that reliability should be dynamically included in each of the other types of studies. The truth of the matter is that all of the study phases listed above are interrelated, but they are not highly interactive.

Because of this, statistical output data from one model can be used as input to another model. This results in an iterative approach to the design, which is preferable to developing a super model which would attempt to accomplish all the design tasks simultaneously. Such a model would most probably be unwieldy from a computer mechanization standpoint and unmanageable from a user's viewpoint. □

3400 Organizations Required by Court Order to Furnish Confidential Data to IBM — II

Richard E. Sprague, Norman R. Carpenter, and Business Week

"The permeating effects of IBM's dominance can be felt in every walk of life, business, government, education, science, labor, politics, professions, and the public. Some of these effects have been good, measured on the scale of the greatest good for the greatest number of people. However, most of the effects have been bad . . . It is much more likely that the dominance *itself is what has caused the problems. . . . The interesting thing about this is that IBM management is well aware of the bad effects due to the consent decree of several years ago."* — Richard E. Sprague

This article is a continuation (consisting of new developments) of the 10-page article in the February, 1972, issue of "Computers and Automation", in which we began to publish information on the following subject:

> The use of a U.S. District Court to give IBM an extraordinary amount of confidential business information about 3400 competing companies in the United States.

Contents

11. "An Incredible Story" by Richard E. Sprague, President, Personal Data Services Corp.

12. "You Should Respond" by Norman R. Carpenter, IBM Attorney, acting for Philip Neville, Judge, U.S. District Court, to Leon Davidson

13. "A Mountainous Defense by IBM — A Court Clerk's Error Gives a Reporter a Peek at the Records of 1500 Companies" by Business Week

14. "The Really Basic Issue" by Richard E. Sprague

11. "An Incredible Story"

Richard E. Sprague

PERSONAL DATA SERVICES
A New York Corporation
193 Pinewood Road
Hartsdale, N.Y. 10530

January 20, 1972

Judge Philip Neville
U. S. District Court
316 North Robert St.
St. Paul, Minnesota 55101

Dear Judge Neville:

This is in response to your order of December 13, 1971, to provide information from Personal Data Services Corp. to assist the court and IBM in defining the EDP market for products and services.

In my twenty-six years of experience in the computer field, I have never been so surprised, amazed, and startled to a point of disbelief, as I was when I received your court order. As one of my old time associates from the computer field said to me when he heard about the case: "It is a staggering thing. How could the court have ruled as they have to date?"

The documents forwarded to me by IBM's attorneys, John French and Norman Carpenter, tell an incredible story about what has been happening to our courts, our system of justice, and to the computer field itself.

As one of the pioneers in the field, and a long-time consultant to nearly all of the large suppliers of computers as well as to many users, I believe it is desirable for me to enlighten the court on several issues raised by the entire case. These issues are fundamental and go directly to the core of many problems in business, government, society and the computer field.

The prime reason for my calling these to your attention is that I do not believe you can achieve your objective of market definition using your present approach. In addition, the definition of the market on the traditional basis will not help detect the most fundamental problem of all; namely, the extreme dominance by one company of a field of interest and endeavor second in importance to very few in this country.

The issues are as follows:

IBM Dominance

The dominance of IBM in the computer field is well known to nearly everyone. The measurement of that dominance is tricky and complex. Most opinions are based on measuring the percentage of dollar volume sales of main frame computer equipment. IBM's percent has always been in the range of 70 to 75, with the second competitor in the 3 to 7% range.

This method is probably not too far off, if one is seeking a quantitative figure. Admittedly, IBM's percentage of the grand total of dollars spent for Information Systems and Services (a category much broader than main frames) is much lower. However, IBM's true dominance cannot be measured by percentages of things bought or sold.

There is only one word to describe the real dangers inherent in IBM's dominance, and that is "influence". The influence extends throughout all of the decision making and business processes in government, education, industry, science etc., most of which are based upon information. Thus, the dominance should be measured in terms of the number of decisions, or reports, or other information factors permeating the American way of life in the 1970's.

For example, walk into any corporate office of a large or small company today, and ask what supplier furnishes the business system upon which they depend. The odds are greater than three to one (more than 75%) that the answer will be, IBM. That, is real, and dangerous, domination. No other industry of any major importance (except the telephone industry) is so dominated by one company.

Effects of Dominance

The permeating effects of IBM's dominance can be felt in practically every walk of life, from business, to government, to education, to science, to labor, to politics, to the professions, and to the public. Some of these effects have been good, measured on the scale of the greatest good for the greatest number of people and organizations. However, most of the effects have been bad, measured on the same scale. The list of bad effects covers several pages. Briefly, six of them are:

1. Disappearance of competitors and impossibility of survival.
2. Excessively higher systems costs, especially software.
3. Slow progress in types of systems needed by customers; example: On-line Real-time systems.
4. Misleading of users, especially smaller users.
5. No competitive bidding; consultants frozen out or handed IBM as only selection.
6. Ingrown IBM attitudes; insiders from IBM; user fear of going against IBM.

Perhaps, the specific policies of IBM have brought about these bad effects. However, it is much more likely that the dominance itself is what has caused the problems. Any competitor dominating an industry as all pervading as the information industry, to the extent that IBM has dominated it (more than 75% of the market, based on influence) would probably cause the same bad effects or even worse ones.

The interesting thing about this is that IBM management is well aware of the bad effects, due to the consent decree of several years ago. The lawyers at IBM as well as the management continually question whether their dominance is really good for the country.

Plight of Competitors

The issue of how or whether competitors can stay in the information systems and services business is raised by the dominant influence of IBM. I served as one of several consultants to the management of the General Electric Co. when they were evaluating the question of what to do about their Information Systems Division in 1969-70. As you know, they decided to sell most of the division to Honeywell in the spring of 1970.

The evaluations made by the consultants as well as General Electric management at that time were quite comprehensive and complex. It was felt that to continue in the business, the division would have to increase its share of the market (measured on the basis of main-frame sales) to a level above some survival threshhold. It was felt that this would be impossible to accomplish, as long as IBM dominated the field, without an extremely large new investment on the part of General Electric.

Another approach might have been to attempt to compete in a broader market, (the information systems and services market) and to change the entire marketing approach, organization structure, and management policies. This would have involved an even greater investment and some fundamental changes within General Electric.

The only sensible decision available to General Electric management was the one they made. Basically, they decided to get out of the business except for a minority (10%) interest in the new Honeywell company.

While I am not completely familiar with the RCA case, I am sure that a similar situation existed. In fact, the same set of dominance problems faces, or will face, any of the major main frame suppliers. You can look for more of them to fold, or merge in the near future, unless something is done to change the IBM dominance.

The dominance also prevents newcomers from entering the field in any substantial way. The latest large entrant, Xerox, is having great difficulties.

Who Loses?

If the industry continues to be dominated by IBM as it has to date, the question is, who will lose? Who will suffer from the dominance problem? The answer is; everyone!! Everyone, including IBM, will suffer in the long run, from an unhealthy industry.

Any consulting firm active in the information systems field can tell you this. Even those doing marketing consulting for IBM, will, if they are pressed hard, make the same statements about the ill effects of IBM dominance.

What is the Market and How Dominant is IBM?

One issue raised by your survey of 3,400 companies is:

> Will you find out what IBM's dominance is (or what the market is that IBM dominates) by means of the questionnaire prepared for you by IBM?

The answer is that you will not find out. You will not find out, first, because the 3,400 companies are not going to answer the questions. Either they will not answer at all, or else they will send you sales literature and published price lists. Secondly, even if they did answer properly, the chances are you would be completely misled by the data. For example, the information systems and services field from a business system point of view, does not and never will include many, or even most of the products and companies on the IBM list of examples.

IBM's strategy is obvious. If they can convince you that the "total" market includes all of those products and services furnished by the 3,400 companies surveyed, they will look pretty good. Their percentage may even be as low as 50% measured on a dollar volume basis. If the court's only measuring stick is a dollar volume, then dominance will have been disproved.

As indicated earlier, IBM's true and real dominance is of a different nature, and amounts to a much high-

er percentage than the 75% dominance of the main frame market. The court should, (or some independent group of professionals should), set the proper ground rules for measuring dominance and set about collecting the proper, meaningful data. There are a number of professional groups and consultants sufficiently unbiased and knowledgeable to do this.

Security of Data

I get a very queasy feeling about how private and secure any data I might send you will be. One reason is the publicity in Business Week recently concerning the court clerk's error in allowing one Business Week reporter to see the 30 odd file drawers containing the responses of 1,500 companies. A second reason is that the court order was mailed to me with a cover letter, not from you, but from IBM's lawyers. Now, this may be standard legal procedure, but if it is, I object to it strenuously.

If I object, then I assume that the companies having the most to lose by exposing all of their secrets to IBM, would also object. The questions asked in your (or rather IBM's) questionnaire cover the most sensitive competitive data I can imagine.

There is no indication in the court order or in the material sent with it, as to who at IBM will be allowed to see the data or to use it. You will not be able to legislate the number of people, or the particular people within IBM who will see and use the data. Compared to the main issue, IBM's dominance, this is perhaps a minor issue. Nevertheless, it is altogether bothersome.

Costs of Data Collection

Your decision to force 3,400 companies to bear their own costs (rather than having IBM pay) in supplying data so that IBM can prepare a defense in the main suit, is really an unbelievable decision.

Surely, the U.S. Government has the resources to collect data to define a market in an antitrust case. Assuming that the U.S. Justice Department truly does want to do something about the information systems industry and its unhealthy state, why can't they pay the costs? Compared to the total amount of money the Federal Government loses every year because of IBM's dominance (in software overhead alone), the costs of gathering data pertaining to the problem would be small.

Appearance of Case on the Surface

The main reason the documents I received seem so incredible and unbelievable is the surface appearance of the case. It would seem that IBM is controlling the entire situation, dominating the courts, in just the way they dominate the industry.

1. The court has apparently accepted IBM's attempt to define the market in a way favorable to them.

2. The court has followed IBM's suggestion and and forced 3,400 companies to provide information.

3. The court has decided that the 3,400 companies will themselves pay the costs of collecting information and not IBM.

4. The court plans to turn data on a falsely defined market over to IBM for use in IBM's own defense.

5. The court is forcing highly sensitive data to be supplied by competitors and made available to IBM.

6. The court has allowed IBM's lawyers to send the court order along with other material to the 3,400 companies.

7. The court appears headed for a decision in which IBM's true dominance will be completely hidden.

The Overall Issue

The overall major issue with which the court, the U.S. Department of Justice, and everyone else should be concerned, is the business health of the information field. The Control Data position is important, in this overall context, primarily because if CDC fails, then the information industry will really be on the way to a total monopoly.

General Electric and RCA, together with Sperry Rand, Xerox, Honeywell, and to some extent even Burroughs and NCR have had other products and markets to keep them going. CDC has had to rely on Commercial Credit to keep going in recent years. But CDC was the only one of the big eight main-frame manufacturers, whose prime business always was computers.

Greyhound's interests are also important from the leasing and service point of view. But, if the court decides in favor of IBM, based on the data it will receive using the current approach, the entire major issue will have been missed, and total disaster may be expected. All of the basic principles of our democracy will have been violated.

Yours sincerely,

Richard E. Sprague (signed)
President
PERSONAL DATA SERVICES CORP.

cc: Clerk, U.S. District Court
St. Paul, Minnesota

U. S. Senator Hart
(Senator from Michigan)
Washington, D.C.

Mr. Richard Lareau
Control Data Corp.

Mr. Gordon Smith
Association for
Computing Machinery
New York, N.Y.

12. "You Should Reply"

Norman R. Carpenter

Faegre & Benson
1300 Northwestern Bank Building
Minneapolis, Minnesota 55402

January 10, 1972

Mr. Leon Davidson, President
Metroprocessing Corp. of America
64 Prospect St.
White Plains, N.Y. 10606

Re: Greyhound Computer Corporation v. IBM;
CDC v. IBM; CCC, Additional Defendant

Dear Mr. Davidson:

Your letter of December 20, 1971 has been received by the Clerk of Court and referred to us for reply.

(Please turn to page 38)

40 + 1 WAYS TO CUT A COAT

Staff, *Vectors* (magazine)
Hughes Aircraft Co.
Culver City, Calif. 90230

" . . . provision for: rapid response to fashion changes; better cutting tolerance; more efficient inventory control; high degree of automation; automatic advance of material to the cutting table; and a universally usable cutting tool."

(Reprinted with permission from *Vectors*, Volume XIII, Fall 1971, published by Hughes Aircraft Co., Culver City, Calif.)

Time was (long ago, of course) when, if you wanted a new suit you raised sheep, sheared them, combed out the wool, spun the thread, wove the cloth, cut it and sewed the garments. Then, with the inevitable advances in communication and transportation, specialism reared its prophetic head, and experts appeared to take over all the individual phases and processes involved in making clothing. To use the titles they called themselves when this fine division of effort first took place (in medieval days or before), there were the shepherd, the shearer, brander, dresser, curer, dyer, fuller, and webster. And there came to be subdivisions of each of these.

Now, the same thing happened in almost every line of human endeavor, some in early times, some in later days. The work of the construction industry today has divided itself among electricians, carpenters, tinners, plumbers, shinglers, lathers, decorators, masons, bricklayers, glaziers, furnace builders, and so on. The myriad of individual specializations grouped themselves into activities under generic terms, such as aircraft, automotive, mechanic, textile, building and electronic.

These more or less basic divisions of human activity required machines, tools, materials, all sorts of supplies and pieces of equipment, so the same feverish need to specialize infected manufacturing in general and industrial plants grew up in the production of one article, or a group of related items. Then, probably also inevitably, large firms got the idea to do the whole job intramurally and produce all the units to work together in a "system." The systems concept grew, quite naturally, out of a company's ability to produce system units, and the manufacturing objective changed and became the production of the entire show, from idea to operational test.

The systems concept came to include everything under the sun, even to the ivory tower dreamers creating initial ideas. A system would logically begin with an examination of the field of endeavor to be mechanized, with investigations "looking into" the possibilities and experimenters trying out the various ideas and methods suggested. Then would come a "proposal," either on request of a prospective customer, or a cold-turkey bid for work. The proposal once accepted and a contract signed the next stage would be for experimentation; then design with its almost countless drawings and prints; the fabrication of prototypes and their testing; settlement upon optimum design; manufacture of the units with individual environmental tests for each; and, finally, the complete system with system tests.

Each phase of the complete operation, from brainchild to the finished product's starting its career of service, must be meticulously worked out. Probably nowhere in the entire routine is so thorough-going a treatment as necessary or important as in the preliminary work on a project—the "proposal" for an initial study program, leading to later contract work.

A representative example of a meticulously-done proposal may be found in Hughes' entry into the apparel industry—a document complete in every respect, omitting nothing that could contribute to the objective of convincing the prospective customer that the Company was particularly well-qualified to pursue the work under discussion.

The story goes that, nearly four years ago, the Company was approached by Genesco, the world's largest apparel company, searching for improved methods for fabric and leather cutting. In response, Hughes "Proposal For a Study of Material Cutting Methods for the Apparel Industry," of some 80 pages, outlined in detail an initial study program aimed at filling the need for a "one-high" fabric and leather cutting system.

In this proposed initial study, the opening gambit plans a three-month program of work, including an

analysis of cutting from the physical standpoint; a lifting of the restraints of "one-high" cutting; a coverage of the techniques involved in "one-high" cutting; a selection of recommended experimental techniques; with a statement generating a follow-on experimental program plan with cost estimates, all this leading to the actual submission of the proposal.

Thus, the first phase of the overall project involves defining all of the functional parameters required for a "one-high" fabric and leather cutting system. The evolution of such a system suitable for use in garment production is planned in great detail, with each subdivision further broken down into component statements, each fully explained.

First in the suggested order for the study the objectives of the project are stated. These include provision for: rapid response to fashion changes, in comparison with present methods in use by the industry; cutting tolerance better than at present; random-size garment production; more efficient control of inventories; less material usage; high degree of automation; minimum possible factory floor space; acceptance of material direct from the bolt; automatic advance of material to the cutting table surface at the end of each cutting process. Also, and importantly, a chief design goal is to evolve a cutting tool universally usable for all fabrics and leathers.

Next in order, the results of a survey of "one-high" cutting methods indicated that four classes exist: (1) *physical* (variable-stroke shears, saber blade, circular knife, turret chop blade, knife wheel, nested punches, nibbler punch, garment perforation); (2) *thermal* (laser, electric arc, plasma cutting, hot wire); (3) *chemical* (pyrotechnic, decomposition); (4) *fracture (high velocity gas or liquid, ultrasonic probe or dicing roller)*. The field of existing cutting methods is covered completely, with full description of each.

Proceeding to an analysis of the system functional requirements, the study goes into the state-of-the-art in the technology of cutting physics as influenced by applied mechanical stresses, thermal action, chemical action and solvent action, with each process analyzed from some 17 angles, ranging from acuracy, response, speeds, costs (equipment and maintenance), floor space, number of dyes usable, denier range usable, and automation to percent scrap.

The experimental program involved the use of laboratory equipment to try out the cutting methods selected in the initial study. The operations analysis program, as its name implies, analyzed the various types of operation to select the optimum system to be presented for approval. (Though the men performing the initial study came up with 41 alternatives, ranging from the bizarre to the ingenious, they settled on the laser as the best way to go and so proposed.) Next, a demonstration model was fabricated and tested and, having proved satisfactory, a prototype model was designed and built.

This machine, now in commercial production, consists basically of two identical crossarm positioning devices controlled by a computer which has stored preprogrammed cutting instructions for many patterns and styles, and a conveyor for moving the material from its bolt to a position directly beneath the cutting beam. The computer turns on the laser beam (not the laser itself), which then cuts (vaporizes, really) the cloth in highly complex patterns, the cut being no wider than a single thread!

It is not a new mechanization of an old art, but is so completely new in concept it is called a "glamor development of the space age." In fact, it is also hailed as the first major advance in apparel manufacturing since the invention of the sewing machine in 1846.

The objectives for the project have been met in every particular. Though the "one-high" limitation might appear to be a drawback to production, or to the speed of production, it is actually the *summum bonum* of the laser process. The new system should be described as "allowing" the cutting of one garment at a time, rather than being limited to it. The standard dozen or more cut at once in the old method really handcuffed the industry, in forcing an overproduction of any one pattern.

The laser "one-high" cutting system will probably fulfill its predicted destiny and revolutionize the apparel industry, but evidence to this effect, to become irrefutable, will have to be the result of time. □

Pictorial Reasoning Tests — Analysis and Answers

Neil Macdonald
Assistant Editor, Computers and Automation

In the October 1971 issue, and again in the December issue, we published Pictorial Reasoning Test C&A No. 1. The directions were:

1. The following is a test to see how carefully you can observe and reason. It is not timed — but most people use about ten minutes.
2. In each row, find the four pictures that are alike in some way and find the one that is not like all the others and write its letter as your answer.
3. If you become convinced that no picture is essentially unlike the others, write F (for "defective" or "fatally ambiguous") as your answer.

The test which was set is shown in Figure 1.

The answers which we consider to be "correct" are given in Table 1. Also, the reasoning is briefly stated in Table 1 and Table 2. There is likely to be considerable argument about some of these "correct" answers; the arguments are interesting and worth considering. We shall now discuss them, and also discuss the principles which presumably should apply to observations and reasoning of this kind.

Principles of Analysis of Items

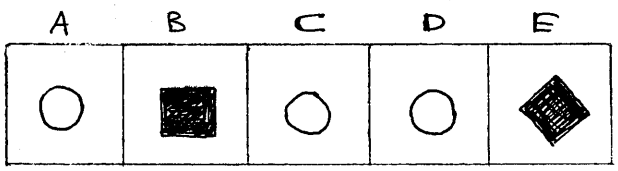
In considering Pictorial Reasoning Tests of this type, we can recognize some basic principles. Perhaps the first of such principles is:

> Principle 1: There are exactly 7 possible patterns of items; these are enumerated in Table 3, with their answers.

For example, the fourth row of Table 3 (1, 1, 1, 2, 3) expresses the following situation:

> If the three figures in an item are just alike, and the last two figures are different from each other and different from all the rest, then no correct choice among the figures is possible; and the answer has to be "fatally ambiguous", F.

For instance:

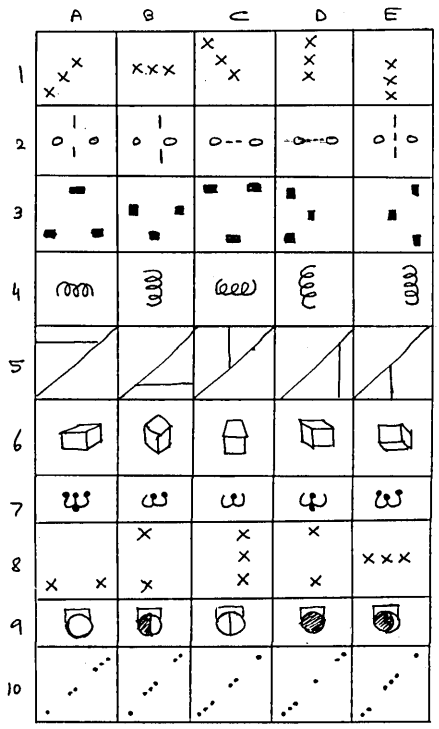


> "There undoubtedly is a place for non-verbal, non-mathematical testing which is not culture-limited, not occupation-limited, and not background-limited ... and which would enable finding and employing many useful people who do not have American, middle-class backgrounds."

Table 1

Item	"CORRECT" ANSWER "Correct" Answer	Reason	Percent Getting This Answer
1	B	Only one centered	94%
2	B	Only one asymmetric	62
3	B	Only one with pair of dots in center	76
4	E	Only one with coil off-center	66
5	D	A,B alike; C,E alike; D remains	40
6	C	Only one with 2 faces	90
7	B	Only one asymmetric	54
8	F	Fatally ambiguous*	24
9	E	Only one with crescent	33
10	D	A,C alike; B,E alike; D remains	72
11	C	Only one asymmetric	84
12	D	B,E alike; A,C alike; D remains	86
13	E	Only one with one small loop*	12
14	E	Only one with no center of symmetry	79
15	C	A,D alike; B,E alike; C remains	29
16	D	Only one with "steps" touching on a line only	77
17	C	Only one with 7 ends of lines, not 8	50
18	F	Fatally ambiguous*	31
19	C	Only one with small square touching only a side	48
20	C	Only one with "north-south road" going straight through	43

* See Table 2



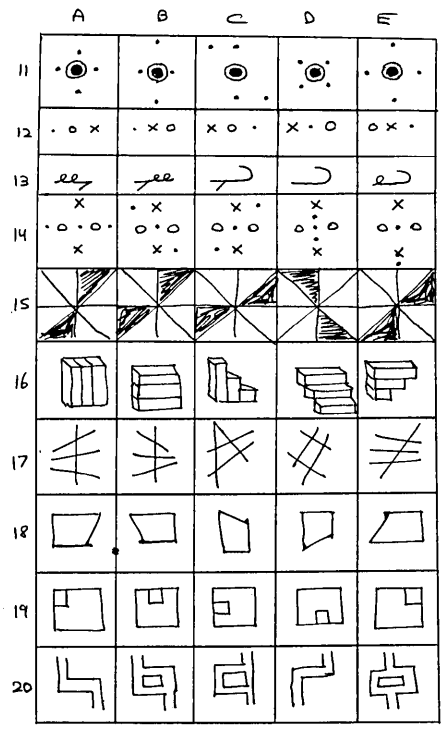


Figure 1

Table 2

REASONING FOR CHOOSING ANSWERS FOR ITEMS 8, 13, AND 18

Property	Score: Figure A	B	C	D	E	The Unlike One
Item 8: Each figure consists of an arrangement of x's.						
Number of x's?	2	2	3	2	3	-
Center of symmetry?	no	no	no	no	no	-
Horizontally symmetric?	no	yes	yes	yes	yes	A
Vertically symmetric?	yes	no	no	no	yes	-
Touching side of square?	yes	yes	yes	yes	no	E
Passing through center of square?	no	no	no	no	yes	E
Answer Chosen: F, fatally ambiguous						
Item 13: The figures contain: a horizontal line; 0 or 1 hooks; 0 or 1 angles; 0,1, or 2 small loops..						
Angle, present?	yes	yes	yes	no	no	-
Hook, present?	no	no	yes	yes	yes	-
Horizontal line, present?	yes	yes	yes	yes	yes	-
Small loops, present?	yes	yes	no	no	yes	-
Number of small loops?	2	2	0	0	1	E
Any symmetry?	no	no	no	no	no	-
Answer Chosen: E						
Item 18: Each figure consists of a trapezoid, with two right angles, in any one of various positions.						
Shape, the same?	yes	yes	yes	yes	yes	-
Size, the same?	yes	yes	yes	yes	yes	-
Any symmetry?	no	no	no	no	no	-
Aspect is like a right-handed glove	yes	no	yes	no	yes	-
Answer Chosen: F, fatally ambiguous						

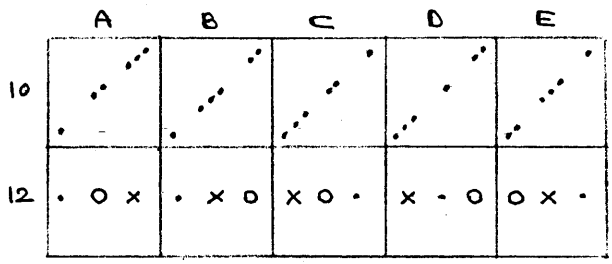
"The figures have been drawn freehand and not too carefully. It is a myth that all figures should be drawn professionally; one can do a great deal with an author's free hand, approximate drawings, and the reader's eyes to interpret them; and such drawings make the gap between the author and the reader less formidable."

In this example, figures A, C, and D are so alike that they appear identical. B and E are different from A, C, D and different from each other. And there exists no reason for choosing B in preference to E, or E in preference to B.

Another principle can be asserted:

> Principle 2: It makes no difference what pictorial elements are used; that is, only the pattern of likenesses and unlikenesses is significant.

For example, consider Item 10 and Item 12:

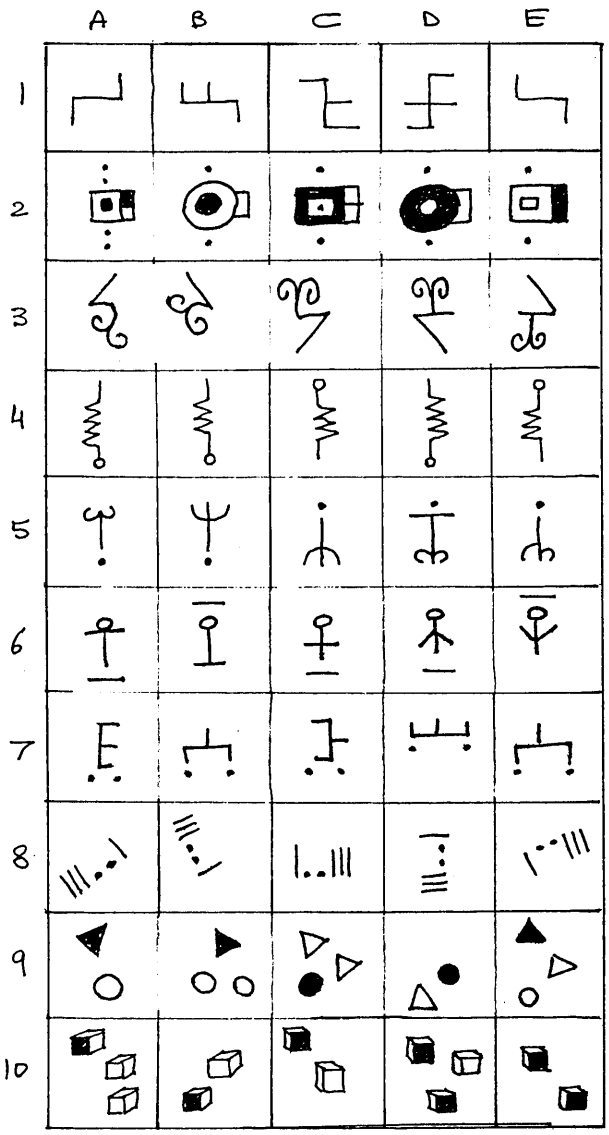


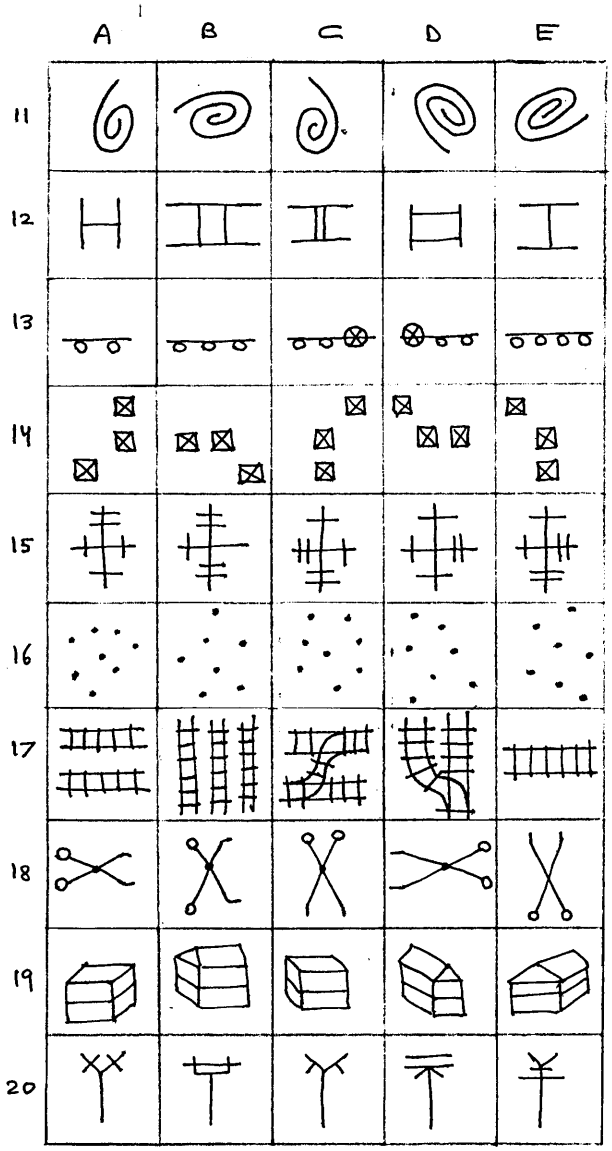
In these two items, one dot corresponds with dot, two dots correspond with O and three dots correspond with X. The reasoning is: figures A and C are alike; (symmetric); figures B and E are alike (symmetric); only D remains unlike; therefore the answer is D. It is curious to note that only 72% of respondents solved item 10 correctly whereas 86% solved item 12.

(Please turn to page 44)

PICTORIAL REASONING TEST: C&A No. 4 — *(may be copied on any piece of paper)*

1. The following Pictorial Reasoning Test is a test to see how carefully you can observe and reason. It is not timed.
2. In each row, find the four pictures that are alike in some way, and find the one that is not like all the others and write its letter as your answer.
3. If you become convinced that no picture is essentially unlike the others, write F (for "defective" or "fatally ambiguous") as your answer.





Answers: Insert in each blank one letter out of A, B, C, D, E, or F, designating your choice.

1 ___	4 ___	7 ___	10 ___	13 ___	16 ___	19 ___
2 ___	5 ___	8 ___	11 ___	14 ___	17 ___	20 ___
3 ___	6 ___	9 ___	12 ___	15 ___	18 ___	

Survey Data: 1. Name _____ 2. Title _____
3. Organization _____
4. Address _____

	Average?	Good?	Excellent?	Not your field?	Other? (please specify)
5. In computer programming, are you:					
6. In systems analysis, are you:					
7. In managing, are you:					

8. What fields (not mentioned above) are you fairly good in (or even expert in)? _____
9. What other capacities do you have? (Please don't be bashful — but be objective) _____
10. Any remarks? _____
(attach paper if needed)

When completed, please send to: Neil Macdonald, Survey Editor,
Computers and Automation, 815 Washington St., Newtonville, Mass. 02160

PICTORIAL REASONING TEST: C&A No. 5 — *(may be copied on any piece of paper)*

1. This is a test to see: (1) how carefully and completely you can observe; (2) to what extent you can detect each change that is reasonable; and each change (or failure to change) that is unreasonable. The test is not timed.

2. Compare Figure 1 and Figure 2. Figure 2 is assumed to be a picture of the same scene half a minute later than Figure 1. Consider each detail. Identify each detail that changes reasonably (mark it V), or changes unreasonably (mark it X), or should have changed reasonably and did not (mark it Z). You may write your answers in the spaces provided.

3. For example, if in Figure 2 a girl shown in Figure 1 has moved a little, you might write "Girl moved — V." If the pattern of her dress was different, you might write "Dress pattern, different — X." If an ocean wave had exactly the same contour, you might write "Ocean wave, no change — Z."

Figure 1

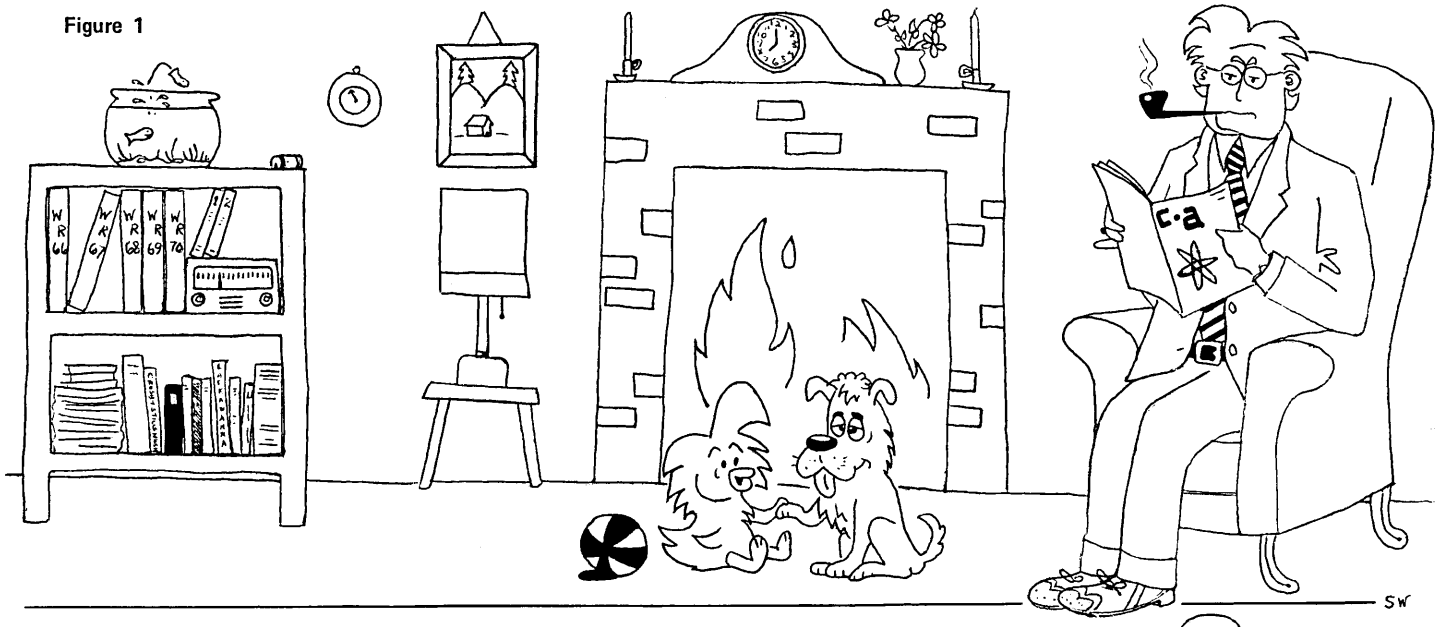
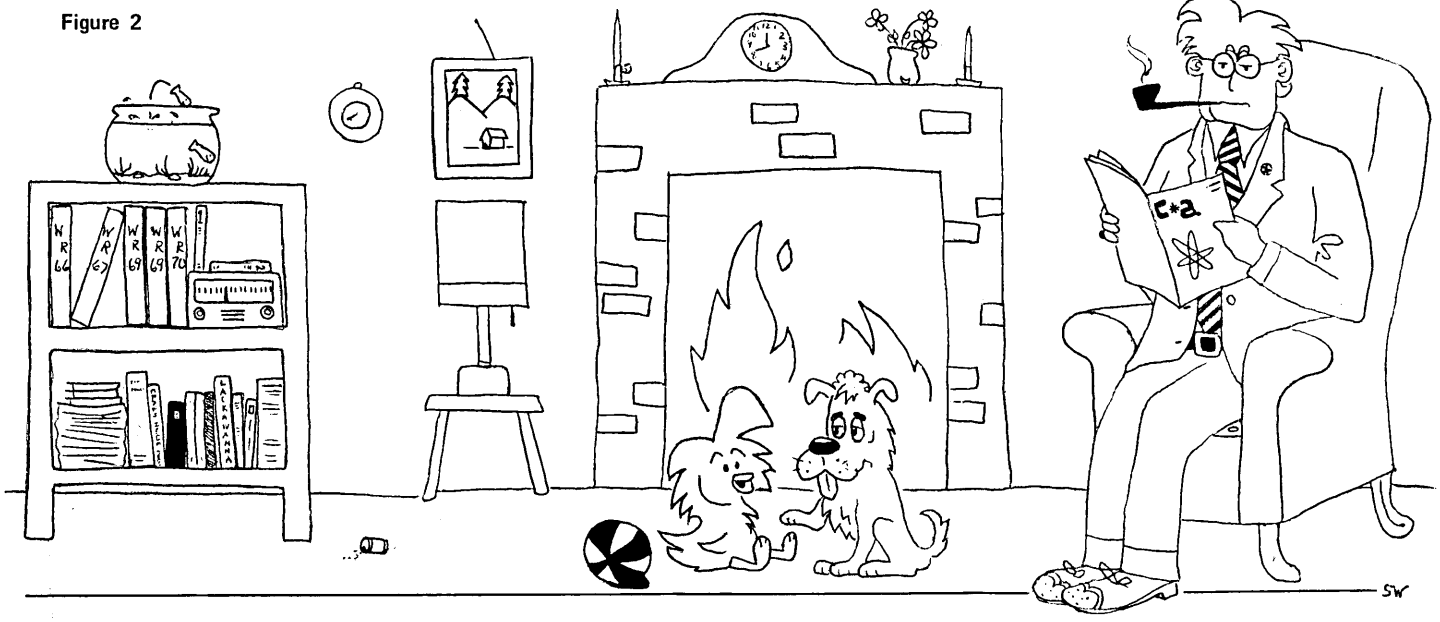


Figure 2



Answers: In each blank, identify each contrasting detail, and include OK or X as appropriate.

1	_____	6	_____	11	_____
2	_____	7	_____	12	_____
3	_____	8	_____	13	_____
4	_____	9	_____	14	_____
5	_____	10	_____		(attach paper if needed)

Survey Data: 1. Name_____ 2. Title_____

3. Organization_____

4. Address_____

	Average?	Good?	Excellent?	Not your field?	Other (please specify)
5. In computer programming, are you:					
6. In systems analysis, are you:					
7. In managing, are you:					

8. What fields (not mentioned above) are you fairly good in (or even expert in)?_____

9. What other capacities do you have? (Please don't be bashful — but be objective)_____

10. Any remarks?_____

(attach paper if needed)

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DALLAS: WHO, HOW, WHY? — Part I

Mikhail Sagatelyan
Moscow, USSR

"After the shooting in Dallas, when Martin Luther King was assassinated in Memphis and Robert Kennedy was killed in Los Angeles, it became clear that organized terror . . . had become a weapon of certain forces who were acting with confidence, insolence, and impunity. . . . It seems to me that the three killings done with astounding consistency and purposefulness . . . should sharply focus attention and interest on what is happening today and may happen tomorrow in . . . the United States of America."

About the Author

Mikhail Sagatelyan was born in 1927 in Saratov, on the Volga, but his family moved to Moscow when he was five years old. His schooling was interrupted by the war and Mikhail volunteered for the Navy. In 1943, as a naval cadet school student, he took part in operations on the Baltic Sea. In the victorious month of May 1945 he was not quite 18 years of age and held the rank of petty officer.

After demobilisation Mikhail returned to Moscow and entered the Institute of International Relations. Five years later he graduated as a journalist specialising in international affairs. His first job was with IZVESTIA, later he worked for the weekly NEW TIMES.

In 1959 he was offered a job with TASS, the Soviet news agency, which he accepted, and was posted to Washington.

At the present time Mikhail Sagatelyan is IZVESTIA'S deputy foreign editor. He is married and has one son.

A Word from the Author

A journalist is, in a sense, an apprentice historian. For obvious reasons his spade-work cannot be compared to that of the investigator, nor his conclusions to the sentence of a judge. Nevertheless, to describe what has been seen and heard, lived through and thought out (if it is of valid interest to the public at large) is the first duty of a reporter.

Taking all this into consideration, there are two main reasons why I have tackled the subject of the assassination of John F. Kennedy.

In the first place, fate ordained that in the years 1959-64 I was the TASS Washington correspondent covering the White House and State Department. Therefore, insofar as it is possible for a Soviet citizen, I was a very close witness of John Kennedy's election campaign for the White House, of the 1,036 days of his presidency, and of the first few months of his successor's term of office.

Secondly, after the shooting in Dallas, when Martin Luther King was assassinated in Memphis and Robert Kennedy was killed in Los Angeles, it became clear that organised terror in the country had become a weapon of certain forces who were acting with confidence, insolence and with impunity. In the circumstances, no one in present-day America, or anywhere else for that matter, would care to maintain (and no one tries) that the series of political crimes that began in Dallas have now ended.

It seems to me that the three killings, done with astounding consistency and purposefulness against the general background of problems and events troubling and rending the citadel of world capitalism, should sharply focus attention and interest on what is happening today and may happen tomorrow in the political jungle of the United States of America.

(Condensed from the magazine *Aurora*, Leningrad. Translated by Monica Whyte. Reprinted from *Sputnik*, published by Novosti Press Agency, Moscow, USSR.)

Why? Because if the forces which declared themselves in November, 1963, in Dallas should ever manage to gain ascendancy in the struggle for power in America, the country may be in for truly grim times. The history of the 20th century already has one example of what it meant for the world when in one European country the extreme forces of imperialism took power.

I know: there are still quite a few honest people in the world and particularly in America who will find such an analogy excessive. The basis for such doubts lies in the completely different external face presented by the extremist wing of American reaction. It steps forth under the banner of defence of the American Constitution and legacy of their forefathers — the founders of the republic — in other words, for everything that made America the "promised land" in the eyes of the people. This masquerade, combined with material and technical progress, still deceives many.

And another thing. Any partially unsolved mystery, especially if it concerns a major political event, leads to unflagging interest in possible solutions — on New York's Broadway the play Who Assassinated Abraham Lincoln? is still produced. On the other hand, anyone dealing with such a subject faces the constant temptation of being unjustifiably categorical in his opinions. I have done my best to avoid such an outcome. In any case, in order to find out whether the author has succeeded or not, the book has to be read. For those who intend to do so, a last word of warning: I did not set myself the task of exhaustively examining all the circumstances connected with the killing in Dallas. Hundreds of books, including the most detailed and publicised of all — William Manchester's Death of a President — have been devoted to the subject.

I set myself a more modest task: to write about what I have seen and heard, experienced and thought and to add to my story that which happened later and helped, in my view, to evolve well-founded answers to the questions on the title-page.

'They Finally Got Him ... '

"Hell, that bastard will drive me nuts!" Fred said and glanced at the cage standing beside the entrance to the main dining-room.

"The bastard" — a huge black bird of a species unfamiliar to me — was a present to the owner of Blackie's House of Beef restaurant either from a high-ranking Latin American guest or from somebody important in the State Department. The strange creature from the banks of the Amazon did not afford any pleasure to customers. Every two or three minutes the bird would open its hooked yellow beak and the restaurant would resound to an unearthly sound. It was such a chilling combination of the hiss of a snake, the howl of a human and an ear-shattering whistle, that I, for one, gagged when I first heard it.

Blackie's House of Beef, or simply "Blackie's", was quite a popular restaurant. The steaks were excellent and the cheesecake was the most famous in Washington. Blackie's is not far from the State Department and so quite often American and foreign diplomats and journalists would drop in. The enterprising owner had even installed a United Press International teletype which was very convenient and handy for his steady customers.

The first journalistic reactions to many international events were often arrived at right there, at one of Blackie's tables. Trial balloons were floated, soundings were taken, rumours were started and scotched. All these mental fireworks and battles had no reflection in appearances. Well-dressed people sipped their drinks, chewed on the freshest of beef and talked in even-toned, moderate voices. From time to time someone would stroll over to the teletype and skim through the news.

That day, November 22, 1963, Fred and I discussed the forthcoming visit of the new West German chancellor, Ludwig Erhard (he was expected in Washington on November 24). Lunch was unhurried; it had been a quiet, uneventful day. Hardly anyone of importance in the Administration remained in the capital. The President and the Vice-President were in Texas for the second day running on some party business which at the time did not overly interest foreign correspondents.

Six members of the cabinet, headed by Secretary of State Dean Rusk, had left for Japan for trade talks the day before. Together with them, both Washington "information bosses", Pierre Salinger, White House Press Secretary, and Robert Manning, Assistant Secretary of State for Public Affairs, had also gone.

The TASS office was quiet, too. One of us had gone off with the newly arrived Izvestia correspondent in search of a suitable apartment. The second one was in Congress, as usual. I was left to "mind the shop". After going through the morning papers and sending off a couple of despatches, I sat down to write a commentary on Erhard's forthcoming visit and that took me till noon, when it was time to start out for Blackie's.

Fred worked for the State Department. He was an intelligent and experienced diplomat who had received his education in Europe, which as a rule reflected favourably on such diplomats in comparison with their American-educated colleagues. In general, both of us did our jobs. Fred explained the purposes of the forthcoming visit according to the official line, while I tried to probe deeper and get something more interesting than that.

Irritating both of us, interrupting our train of thought every few minutes, came the raucous squawks of the bird in the cage by the teletype. Later Fred maintained they were particularly ill-omened that day.

Our conversation was coming to an end; we had already turned to the weather. On that topic we had no disagreement: the late fall, even for the mild Washington climate, was exceptionally sunny, warm and dry.

"Nature is good to us," Fred said. "Americans have been damn lucky, in general, in this little world of ours. Take for instance — "

At that moment the teletype warning bell began to ring shrilly which signified that an announcement of such importance would be relayed in a moment that all other business should be dropped. Usually the bell would ring two or three times, a maximum of five. Now it rang and rang.

Along with me, several others leaped for the teletype. Impatiently tapping out its message, correcting its own misprints, the teletype spelled out letter by letter:

"K-e-n-n-e-d-y s-e-r-i-o-u-s-l-y w-o-u-n-d-e-d, p-o-s-s-i-b-l-y s-e-r-i-o-u-s-l-y, p-o-s-s-i-b-l-y f-a-t-a-l-l-y b-y a-s-s-a-s-s-i-n'-s b-u-l-l-e-t i-n D-a-l-l-a-s."[1]

I looked at my watch: it was 1:39 p.m. Someone beside me groaned: "Oh, God, they finally got him!" Whom does he have in mind? I wondered. Our eyes met and the speaker hastily lowered his gaze to the teletype. Seeing my face, Fred jumped up and met me halfway with an unspoken question.

"Someone shot at the President in Dallas," I said.

Fred seemed to shrink, as though the air had been let out of him. He began to blink rapidly and for no reason muttered:

"That means Erhard's visit will be postponed ... "

He was obviously going to say something else when the bird screeched again. Fred's face twisted and he suddenly yelled:

"You goddam bastards, take that lousy creature away! Can't you hear? The President is killed! Kennedy's killed, you stupid apes! Oh Lord, how I hate your stupid kissers!"

The dining-room filled with an anxious hum. I threw some money on the table, ran into the street, grabbed a passing taxi and headed for the White House.

On the way I tried to concentrate. I couldn't. Complete chaos reigned in my head. Scattered, unfinished thoughts chased each other round and round.

How many inhabitants in Dallas? Will Kennedy live? Dallas, that's the capital of Texas, isn't it? Who shot him — a local or an outsider? A month ago the mob closed in on Adlai Stevenson in that city and spat on him. No, the capital of Texas is Austin ... Is Jackie alive? UPI didn't say anything about her ... If Kennedy dies, Johnson will become President ... So what's the population of that damned Dallas? Six hundred thousand, I think ... What should I send first to Moscow? Here we are at last ... In Dallas, wiping the spit from his face, Stevenson had said: "Are these human beings or are these animals?"

Reporters were running towards the north-west gate of the White House. Two cameramen, kneeling, were filming them. The guard checking our press passes was surprised by the rush and essayed a joke:

"What's the rush, fellows, making your get-away after a bank robbery?"

Nobody replied. Everyone was in a hurry to reach the West Wing of the White House where the press section was located. Alas, there was nothing to hurry for: the staff had just learned of the shooting in Dallas themselves.

The senior man in the section, Lee White, Salinger's technical assistant, was completely lost and to all questions repeated:

"Can't tell you anything. We ourselves know only what's been reported by the agencies, radio and television ... "

In the centre of the hall where journalists usually waited for the beginning of Salinger's daily press conferences, or for the exit of the President's important visitors, stood two TV sets. Credit must be given to the American TV networks for the professionalism and promptness with which they covered the events following the killing in Dallas. But that first hour after the shots were fired, nothing basically new was reported, even though the stations did not go off the air. Therefore the attention of those present kept switching to the teletypes of the press agencies. Secretaries with faces red and swollen from weeping, hung out their latest despatches in the narrow corridor leading past Salinger's office, the conference room of the National Security Council and Kennedy's office.

But for that matter, the agencies could not boast of an abundance of information out of Dallas either.

There was nothing definite about Kennedy's condition for a long time. At last, at 2:02 p.m. the agencies carried a statement by a representative of the Texas Democratic Party that the President's condition was "very grave". At 2:11 p.m. it was announced from the hospital that two Catholic priests had been summoned to the President's bedside. At 2:21 it was reported that rumours were circulating in the hospital that Kennedy was dead. At 2:31 a priest leaving the hospital (not one of the two called in) told reporters: "I don't believe that President Kennedy will die."

At 2:32 p.m. the chief correspondent of the Associated Press accredited to the White House, reported from Dallas: "Two priests who were with Kennedy say he is dead of bullet wounds." Four minutes later, this was officially confirmed to those of us who were in the White House.

And so, another assassinated president was added to the history of America, the fourth one in the 188 years of its existence. Reporting this sorrowful statistic in its first extra edition, the Washington Post noted as though in passing: "An assassin's bullet has catapulted Lyndon Baines Johnson into the White House."

Depression and bewilderment reigned in the press section of the White House. All those Americans, all those newsmen that I had known over some years, showed a totally unexpected aspect to me for the first time: they were ashamed. They were ashamed before each other, before their foreign colleagues and finally, before the world.

The same feeling could be read in the faces of the hundreds of Washingtonians who gathered behind the White House fence in the very first hour after the assassination. People stood in crushed silence, unwillingly replied to the questions of reporters. I also asked questions. The replies were different in words, but the same in content. One elderly man, instead of answering, silently pointed to a shabby black car that was cruising along Pennsylvania Avenue with a sign on the top: "The wrath of God is upon us unless we turn from our sinful ways." A newspaper published the comment of a postal employee: "It seems to me that each one of us is guilty. Where does all the hate in America come from?"

The 17-year-old daughter of a leading figure in the "New Frontier" asked her father when she learned of the murder: "Daddy, what has happened to our country? If this is the kind of country we have, I don't want to live here."

Such questions arose in all their magnitude before thousands of Americans, precisely in those few hours after the killing. As though attempting to

drive away with words the inexorably advancing era of political assassinations, The Washington Post adjured its readers in its first extra edition:

> No one will be willing to believe that this act could have been committed by anyone governed by a normal mind in a rational state. Our politics, our differences and our divisions are not those out of which so foul a deed could arise. It must be put down to madness.

At the time it was still possible for some Americans, and non-Americans, to accept such an explanation.

However, other newspapers across the country had a much more realistic appraisal of the meaning and significance of the shooting in Dallas. I have kept a thick file of clippings of the first editorials published by the local press in America. Here is a sample of a few of the more noteworthy ones:

Richmond Times-Dispatch: The assassination, coming as it does as the latest in a series of violent deaths of heads of state, is a disgrace to the United States and a blot on the good name of this country.

St. Louis Post-Dispatch:
A national tragedy of incalculable proportions ... What is wrong with the United States that it can provide the environment for such an act? There is a sickness in the Nation when political differences cannot be accepted and settled in the democratic way. Our democracy itself is in hazard.

Philadelphia Bulletin:
We pride ourselves that we are a people who have accepted the law of democracy; that we thrash out our differences through open discussion and accept the verdict of the ballot. But in our pride, we forget perhaps that there are those among us who do not accept this law: People who cannot accept honest debate and who resort to the gun as the final arbiter. We have had a bitter lesson.

San Francisco Chronicle:
Who are we Americans, who claim the leadership of the free world, that we should have allowed this kind of violence and insensate thing to happen to our national leaders four times within a century? The question is an accusation: let us hope that others will be too charitable to hurl it at us.

Salt Lake City Tribune:
Only by chance did this horrible crime blacken the name of Dallas. It could have happened almost anywhere.

Jackson (Mich.) Citizen-Patriot:
Look in the mirror, America! Is this what you want — a society so sick that our President isn't safe — that he should die?

Seattle Times:
Mr. Kennedy, who regarded the preservation of peace as the supreme duty of his administration, has fallen victim to the spirit of unreasoned violence he worked so hard to quell.

Nearly 150 journalists had gathered in the West Wing of the White House. All of us were immediately faced with three inevitable and main questions: Who? How? Why?

The whole world awaited the answers, above all from our American colleagues, who had accompanied the President on his fatal journey, and from us, who were in the centre of political power in the United States. For the second time since October 1962 the weight of professional responsibility lay heavily on the shoulder of journalists accredited to the White House. At that time an anxious world awaited word from us that the Caribbean missile crisis was settled. Now they wanted an explanation of what had happened in Texas.

At this point I must mention another peculiarity of those first few hours following the tragedy. Immeasurably more than anywhere else, political journalism in the United States is based on the principle of "brain-washing". On November 22, 1963, this rule was cardinally violated. For the period of one hour and sixteen minutes that elapsed between the shooting of Kennedy and the apprehension of Oswald, the American information media were denied any official version whatsoever. No one "brainwashed" editors, commentators, reporters. They were left to their own resources in the first feverish searchings for reasons and perpetrators, in their first analysis of the crime. It was unthinkable to wait for an official version: the reader, TV-viewer, radio listener had to be instantly presented with some version of the motives for the assassination, hints on the possible political overtones of the killer or killers. Twenty minutes after the shots rang out in Dallas, over 75 million adult Americans knew about it.

The authors of the first commentaries wrote, in general, what they themselves thought, and quoted the opinions of those people whom they considered authoritative. In my notebook of the time I have the following entry: "Judging by everything, they are saying the same thing in Dallas as here, in the White House. At least The Washington Post reports from there: 'The assumption became quite general very quickly that a right-wing fanatic had done the shooting'."

"Chalmers Roberts noted even more succinctly: 'Yet there are many in the United States who felt Mr. Kennedy was going too far in seeking a rapprochement with the Soviet Union.' In another article Roberts wrote: 'As everyone knows, the Kennedy-Johnson ticket in the successful 1960 Presidential campaign was born of political expediency.' (Roberts was obviously hinting at the white Southern vote which Kennedy would not have received without Johnson.) 'As a part of the Kennedy Administration, Lyndon B. Johnson faithfully echoed his chief. But now he is master alone'."

At the time none of us could fully appreciate the ominous significance for America of that last sentence.

Most Washington journalists were convinced that the assassination was the work of the ultra-Right. As a matter of fact, what's the use of quoting journalists when six members of Kennedy's cabinet reached the same conclusion: Secretary of State, Dean Rusk; Secretary of the Treasury, Douglas Dillon; Secretary of the Interior, Stewart Udall; Secretary of Commerce, Luther Hodges; Secretary of Agriculture, Orville Freeman; and Secretary of Labour, Willard Wirtz. All of them were on their way to Tokyo for the annual trade talks. According to Pierre Salinger who accompanied them, on learning of the death of the President, they concluded that "the killer must be some lunatic from those outrageously militant Dallas right-wingers". Salinger first told the story in his book With Kennedy published in the USA in 1966. Since then

none of the cabinet members quoted by him have repudiated his eye-witness account ...

The same opinion as to the political colouration of the shooting was shared by the top military leaders who were in Washington at the time. General Maxwell Taylor, Chairman of the Joint Chiefs of Staff, after a conference with the Defence Secretary, Robert McNamara, justly considered that the assassination of a government leader is usually accompanied by an attempt to overthrow the government. That is why Taylor's first step was to place all military units in the Washington area on the alert. One of the reasons for such a decision was that Washington telephone communications were almost totally disrupted. The privately-owned network went dead in the first few minutes after the shooting. Later the company tersely explained the extraordinary occurrence as a "simple over-loading of the lines". Neither the company nor the authorities ever returned to the question. But the coincidence of the timing of the assassination and the cut telephone service inevitably led one's thoughts in a certain direction.

Therefore, the fears which arose following the shooting in Dallas that the killing was the opening act of a plot concerned a definite target. The talk was of an internal conspiracy of the Right ...

And suddenly ... At 2:50 p.m. the Dallas police announced that they had arrested 24-year-old Lee Harvey Oswald in connection with the shooting. In making the announcement it was stated that Oswald was "a pro-Castro Marxist". Later came details: at the end of May 1962 Oswald had returned to the United States from the USSR, where he had lived for three years, bringing with him his Russian wife, Marina. He had requested Soviet citizenship but had been refused.

Yes, this really was something to be astounded at. American reporters standing next to me by the teletype kept shaking their heads in disbelief. Ralph Dungan, one of the Kennedy aides who had stayed behind in Washington, exclaimed: "And the hell of it is, they'll blame it all on that 24-year-old boy." Who "they" were, Dungan did not specify.

Thus, the intermission in "brain-washing" was at an end. An official version had made its appearance and everything returned to its rightful place.

The Dallas police, seemingly more interested in feeding the press than with the course of law and justice, made one sensational "revelation" after another. The Dallas district attorney, Henry Wade, and the chief of police, Jess Curry, accused Lee Harvey Oswald of being a member of the Communist Party of the USA, a member of the Fair Play for Cuba Committee, and of belonging to an "international conspiracy for the purpose of assassinating President Kennedy" all at the same time. Oh yes, there was such an accusation, although it is true that it was only maintained for a few hours, until the State Department issued a statement that no proof of such a conspiracy existed.

The majority of the American mass media of information for some reason discarded the slightest tinge of doubt (even though the police investigation was just beginning) and printed, for instance, pictures of the Texas School Book Depository Building with an arrow pointing to a window on the sixth floor and categorically and unequivocally announced that Kennedy had been shot from there. No stipulations or reservations, none of the "it is alleged" or "according to police authorities" formulae so strictly observed by the newspapers in all other criminal cases were on this occasion adopted.

As "evidence" the press and television constantly referred to Oswald's stay in the Soviet Union and to the fact that he had married a Soviet citizen.

And still, in spite of the insistent campaign, I formed the impression even then that Americans in their mass were, to say the least, sceptical in their attitude to this version. I recall one TV broadcast from Rockefeller Plaza in New York, when the interviewer stopped passers-by and asked them their opinion of the reasons for the killing. Of the score or so questioned, they all replied approximately as follows: the crime was perpetrated by ultra-conservatives who spread hate in the South.

"A Marxist from Dallas," one of the White House guards said in my presence. "That's like saying a Martian from Venus! Those Texan bums couldn't even think up a more likely story ..."

As far as the 150 journalists in the White House hall were concerned, many of them never did accept the existence of a "communist conspiracy". Some of them told me so directly face to face. Others preferred to await further development of events. However, at no time after the announcements or in the following days of national mourning did I ever experience hostility, either towards myself or towards my country, from those around me. And the police protection which the new president ordered posted around the Soviet embassy in Washington proved to be quite unnecessary.

To my dying day I will remember the conversation which took place with an American colleague shortly after the police arrested Oswald. I will not give his name — if I did he might lose everything that he has achieved through his talent and years of hard work. I will call him Henry.

Henry, highly tense and nervous, wanted me to go with him to the dead President's office. "It's very, very important," he insisted. We walked down the corridor past Salinger's office and past the National Security Council's conference room. We stopped in front of the open door leading to Kennedy's office. Workers were putting down a new rug of a blood-red colour.

"Remember what you've seen, Mike," Henry muttered, "and what I am going to tell you when we get back to the hall ..."

In the hall, Henry continued:

"I don't want you to get the impression that any of us here, with the exception of fanatics and imbeciles, believe this Texas red plot fairy-tale. Everything is much more ugly ... Two days ago Jackie ordered the rug in the President's office changed — and by chance it has now become a symbol. But you should know, if she could boss here now, then the walls of this office would be painted bloody red ..."

"What are you talking about?"

"Mike," he insisted, "the White House is splashed in blood and the new man won't be able to wash it off. We've had presidents killed before, but such a villainous crime we have not had. Remember what I'm telling you and don't rush to conclusions about who did it and why, whatever you hear today, tomorrow, the day after, in a month or in a year. Wait some

(Please turn to page 34)

QUESTIONS AND ANSWERS

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A: Yes, we plan to. The main subjects so far are: systematic prevention of mistakes; avoiding certain fallacies; important principles; important concepts; illustrative anecdotes; etc.

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Q: Can I receive the 6 free issues (No. 1 to 6 of the Notebook) without subscribing?

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Sagatelyan — *Continued from page 32*

years and you won't be sorry: only then we might come to the truth. Shaky times are coming ..."

My immediate impression was that the incident was a result of the extreme nervous shock Henry had suffered — he was an ardent admirer of Kennedy's "New Frontier".

I first seriously began to ponder over Henry's statements when I read Malcolm Kilduff's account of a conversation with Lyndon Johnson. Kilduff was Salinger's deputy and accompanied Kennedy on the Texas trip. The conversation took place right after the doctors at the Parkland Hospital in Dallas pronounced the President dead at 2 p.m.

Kilduff located the new President near the surgery, in a small room that was heavily guarded, and asked permission to make a statement to the press about Kennedy's death. Johnson disagreed:

"No. Wait. We don't know whether it's a communist conspiracy or not. I'd better get out of here and back to the plane."

To properly evaluate these words of the Vice-President, it must be remembered: They were said almost an hour before the arrest of the "Marxist" Oswald or anyone else.

This means that the first and so far as known, the only member of the government of the United States of America to speak about a "communist conspiracy" before the arrest of anyone on suspicion of murder, was Lyndon B. Johnson. Six members of Kennedy's cabinet, including the Secretary of State and the top leadership of the Pentagon, had reached the opposite conclusion — that it was a plot of the right-wing forces. Lyndon Johnson, who was immeasurably better informed than they as to the mood prevailing in Texan political circles — he is heart and blood one of them, a native son — Lyndon Johnson, who invariably proclaimed that he knew exactly what his fellow-Texans were thinking and feeling; Lyndon Johnson, who knew of the possiblity of incidents being staged in Dallas by the Right; Lyndon Johnson, who insisted that Kennedy make the trip to Texas; this Lyndon Johnson, it seems, was the first government figure in America to put forward the theory of a "communist conspiracy"!

However, in such a serious affair one must not rush to conclusions. After all, everything could be explained simply as an example of the deep effect that 18 years of the "cold war" and prevailing anti-communist hysteria had had even on such a political mind that a Vice-President of the United States could be presumed to possess.

Aboard USAF-1

The personal presidential Boeing, United States Air Force One, with Kennedy's body, Jacqueline Kennedy, Lyndon Johnson and various advisers, secretaries, guards and reporters that had accompanied them on the trip, landed at Washington's Andrews Air Force Base at 6:03 p.m. local time.

It was met by those high-ranking official figures who had remained in Washington or who had managed to return to the capital in time. Besides McNamara, Robert and Edward Kennedy, Under-Secretary of State George Ball, Special Assistant to the President McGeorge Bundy, Congress leaders were present and of course a swarm of reporters. All of us were allowed out on the field. Behind a fence some 3,000 Washingtonians who had made it past the cordons thrown up around the air base, gathered to watch.

Television floodlights and cameras first trained on the huge Boeing 707 which with a thunderous roar rolled up, then focussed on the tail — "the Presidential exit". Instead of the usual ramp, a bright yellow truck with a lifting platform pulled up. A staircase ramp was wheeled up to the front exit. While it was still being moved into position, Robert Kennedy ran up the steps and then stood, shifting from one foot to the other. No sooner did the door open than he dashed inside.

A few minutes later the coffin was lowered to the ground and transferred to a Naval ambulance. Jacqueline, Robert and Edward Kennedy climbed in along with Major General Chester V. Clifton, the dead President's Military Aide. Those who had left the plane by a rear exit got into various waiting cars and the whole cavalcade disappeared into the night.

The reporters began to buzz anxiously: "Where is Johnson? Why hadn't he come out together with Jackie and Bobby? What had happened? Why had the Kennedys gone alone?" No one had any answers. The staff of the White House press department seemed no less bemused than we were.

But then the dazzling floodlights crept over to the staircase ramp leading to the front door and froze there in a drawn-out pause. At last, descending heavily with measured step, as though weighed down by an invisible burden, came Lyndon Baines Johnson. To his left, Lady Bird tripped lightly downwards. The new President appeared calm, gloomy and solemn. On the other hand, Lady Bird was visibly excited. Johnson stopped in front of the TV cameras and the dozens of microphones and prepared to say something. Suddenly, behind him on the runway the roar of helicopters went up and the President's words were drowned out. At the same moment Lady Bird spotted someone in the crowd, opened her thin lips in a smile and began to raise her arm in order to wave. Johnson caught her arm and jerked it down and then as though nothing had occurred, paying no further attention to his now subdued wife, continued to speak words which none of us could make sense of over the noise of the helicopters.

Finishing his speech and taking Lady Bird's arm, Johnson stepped out of the glare of lights into semi-darkness. They were surrounded by McNamara, Ball, various senators and other people. A few minutes later the new President headed for a helicopter which took him and his party to the White House. The reporters ran to their cars and raced back to Washington and the White House. Rumour had it that the Cabinet would meet.

The Press Hall in the West Wing was filled with correspondents. It was obvious that many of our American colleagues had begun to shake free of the shame and shock of the first hours. In its place that special aura of professional sharpness could be scented that usually appears in journalists when they know they are covering events which will later be termed "historical".

The first duty of a White House reporter is to report the activities and actions of the President. Therefore, aspects of the tragedy were now taken over by others: there was the "Oswald" angle in Dallas; the "Kennedy angle" in the Washington suburb of Bethesda where an official post-mortem on the President was being held in the Naval Hospital and where Jacqueline remained.

So far the President had not manifested any signs of his, from that day on, independent political life. Therefore all of us had plenty of time to try

and nab one of the presidential aides who now and then showed up in the press hall and to exchange information and opinions on the meaning and significance of what had happened and was happening.

In the full sense of the word, only the TV people were working. They had set up their cameras on the lawn immediately in front of the door leading to the press department and every 20 or 30 minutes the TV commentators would make a broadcast, even though absolutely nothing was happening in the White House. Everybody was waiting for a possible first statement by Johnson and above all, for John Kennedy's final homecoming to his former residence which had now officially passed to his successor.

What were people talking about then in the press hall of the White House? The "Marxist killer" story — which swept over America from TV screens and over the rest of the world from "Voice of America" transmitters and American news agencies' teletypes — was discussed here, if at all, with reservations and ill-concealed disbelief. I do not wish to be misunderstood: Oswald, as the probably killer, did figure in our discussions, but he figured in another political context.

Perhaps Drew Pearson, the well-known columnist, most clearly expressed in an article the content of our first groping for the answer to "who?" Unlike the majority of his fellow-columnists (including those who only yesterday had proudly proclaimed they were "close to Kennedy") Pearson risked the following:

"If you study the history of American Presidents who have been assassinated, you find that most of these tragedies did not come about through the fanaticism of one man. They came about because powerful influence-molders in the Nation had preached disrespect and hate for the authority of the Government, and the man in the White House who symbolised Government."

Then Pearson went on to describe the now widely-known facts about how the ultra-Right "Dallas City Fathers" had greeted Kennedy and concluded: "The hatred-preachers got their man. They did not shoot him: they inspired the man or men who did it. It was a carefully planned assassination."

I think the following brief incident was typical of the prevailing mood among White House reporters at the time. Mr. Bryson Rash, a Washington television commentator, was conducting broadcasts from the White House. Just before one of his scheduled "five minute spots" he approached me and suggested I go on with him. Without waiting for a reply, he put an arm around my shoulders and began to lightly but firmly propel me in the direction of the cameras which were only some four or five feet away.

For me to have appeared on TV at the height of the anti-Soviet and anti-communist smear campaign could only have played into their hands. My verbal refusal made no impression: Rash continued to push me toward the floodlit area and cameras. While I was trying to figure out how I could extricate myself without creating a scene, an American reporter I hardly knew spotted my predicament. He strode over and took my the sleeve of his coat and in a loud, playful voice said:

"Hey, what's going on here ... I never knew, Bryson, that you were on the same team as our super-patriots from Texas ..."

My would-be interviewer went before the cameras alone.

So, when on November 24, Jack Ruby, operator of a strip-tease club and a man at home in the underworld and in Dallas police circles, shot and killed Oswald before the very eyes of America, belief in an "international factor" in Kennedy's assassination collapsed utterly. On the other hand, the question "who?" became ever more acute. In the Press Club people openly said: "This business stinks ..."

In those stormy days Washington reporters discussed another subject at length besides the murder in Dallas. That subject was Lyndon Baines Johnson, 36th President of the United States of American. This was perfectly natural — everyone was concerned as to what course the country would now follow and under the American system much depends on the man who occupies the President's chair. However, such discussions really got underway later — after Kennedy's funeral. In the first days people compared the personal biographies and characteristics of the dead President and his successor, discussed the future of Kennedy's advisers and aides, talked about how Johnson had behaved after the shots and wondered what Robert Kennedy would do now, seeing that he and Johnson loathed each other (this was widely known in Washington).

As a rule, the former Vice-President did not come out too well in the comparisons. Of course, there were both objective and subjective reasons for this. The Washington press corps (I am referring to Americans) in its vast majority loved and respected John Kennedy.

When she learned of the death of the President, Mary McGrory of the Washington Post said to Arthur Schlesinger Jr., well-known historian and Special Assistant to Kennedy: "We'll never laugh again." Schlesinger replied: "Heavens, Mary. We'll laugh again. It's just that we'll never be young again."

Now, I think, it will be clear that the question: "Why did they leave Air Force One separately?" was not evoked simply by a desire to examine dirty linen, but carried serious political overtones. Well-informed reporter of the Washington jungles had correctly taken note of a seemingly insignificant fact as an indicator of things to come in connection with the "crime of the century" and with the new President.

What had happened on board the Presidential plane in the journey from Dallas to Washington? The first information reached the press hall of the White House late on the night of November 22. It consisted of fragmentary details but the overall picture that emerged was this: The Kennedys and the Johnsons had a bitter quarrel over someone in the Kennedy party calling Johnson's take-over of the Presidential Office "an instantaneous usurpation of power" and his behavior in relation to the dead President and his widow "indecent".

Here I want to describe only two incidents which in my opinion have a direct bearing on our questions: Who? How? Why? Although I must admit, that in the heat of the first days after the assassination, I and many other of my American and foreign colleagues thought that much else that we heard then and that was later factually confirmed also helped to answer these three main questions.

The first episode. Immediately after Lyndon Johnson's conversation with Malcolm Kilduff, when he put forward the "communist conspiracy" interpretation, he left Parkland Hospital and went aboard the AF-1 (and not the Vice-Presidential AF-2 on which he had arrived in Dallas). The widow of the President, his team of advisers and secretaries, arrived much later

at the plane, quite unaware that the new President had already installed himself.

Johnson occupied the Presidential section of the jet and his first step was to try and find out how he could speed up the oath-taking procedure and therefore legally assume the powers of President of the United States. Johnson felt himself master of the situation. Later his aides, secretaries and guards unanimously agreed that his manner was confident and unflustered. Two Congressmen from the State of Texas whose opinions he asked, advised him to take the oath right away. Two others thought it would be better to wait until he arrived in Washington.

The new President decided on immediate action and gave orders that the Attorney General of the United States Robert Kennedy, was to be reached.[2] Lyndon Johnson talked to Robert Kennedy by telephone from the bedroom of the assassinated President on board AF-1. The only one present at Johnson's end was Rufus Youngblood, his guard. Later Youngblood neither denied nor confirmed Johnson's version of the conversation — he pleaded "failing memory" and the fact that he had heard only one side of the talk.

The Attorney General spoke to Johnson in the presence of Edwin Guthman, a leading assistant in the Department of Justice. Guthman confirmed Robert Kennedy's version of the conversation. It went like this: After expressing the condolences appropriate to the occasion, Johnson passed on to the matter that interested him. The assassination, he said, "might be part of a world-wide plot".[3] Kennedy did not respond, as according to Manchester, "he was not among those who suspected a grand conspiracy, and he didn't understand what Johnson was talking about". Nevertheless, in his written statement to the Warren Commission, Johnson maintained that Robert Kennedy agreed with this interpretation and that they "discussed the practical problems at hand, problems of special urgency because we did not at that time have any information as to the motivations of the assassination or its possible implications."

Further Johnson said: "A lot of people down here think I should be sworn in right away. Do you have any objections to that?" ("A lot" — in fact, two out of the four that Johnson asked.)

Robert Kennedy said nothing.

"Congressman Albert Thomas," Johnson persisted, "thinks I should take the oath here."

Robert Kennedy still did not respond.

Then Johnson began to talk again about a "world-wide plot" and again silence was his only answer ...

Only the following facts remain to be added to the story: in giving the necessary orders to make it possible to take the oath of office immediately (to summon a judge, invite reporters, hold up the plane departure) Johnson invariably mentioned that the "Attorney General advised me to take the oath here". However, when AF-1 landed at Andrews Air Force Base and Robert Kennedy went on board, someone queried him on the matter. He was extremely surprised and replied that he had said nothing of the kind to Johnson ...

The second episode. The Presidential plane, with its four powerful jet engines, rapidly ate up the miles and approached the U.S. capital. Lyndon Johnson had successfully organised the swearing-in ceremony and now he had to handle one other piece of business: he had to talk to Rose Kennedy, mother of the dead President, and express his condolences. It was impossible to avoid: to have refused would have looked more than odd. He couldn't excuse himself on the basis of nervous exhaustion or anything else and most of all, it might have led to "all kinds of ideas". Besides which, all the passengers on board that Boeing-707 had already noted that Johnson showed no visible signs of stress or nervousness.

So, there was no way out; he had to talk to Rose Kennedy. The President was handed the telephone receiver, and at the other end of the line waited the mother of John Kennedy. Lyndon Johnson covered the receiver with his big, fleshy palm. Now the President looked unnerved and extremely disconcerted. Without raising the instrument he said in a low voice: "What can I say to her?" At last, he forced himself and with difficulty pronounced: "I wish to God there was something I could do ..."

Rose Kennedy's reply was significant by virtue of its double meaning. "We know," she said, "how much you loved Jack, and how much Jack loved you."

"Here is Lady Bird," the new President hurriedly replied, and according to eye-witness accounts, thrust the telephone at his wife as though it was burning his hands unbearably. Lady Bird also spoke only one sentence and also a double-edged one: "Oh Mrs. Kennedy, we must all realize how fortunate the country was to have your son as long as it did."

Thus, two incidents on board AF-1. Each of them in my opinion significant, because they illuminate the main protagonists through their own actions and words which in such moments and circumstances as described can most frankly reveal the inner man — the one who is usually hidden from the gaze of others, and sometimes even from oneself.

What have we learned?

First of all, that Lyndon Johnson continued to spread the "communist plot" story put forward by himself before Oswald's arrest and even attempted to mislead the Warren Commission by depicting Robert Kennedy as holding the same views.

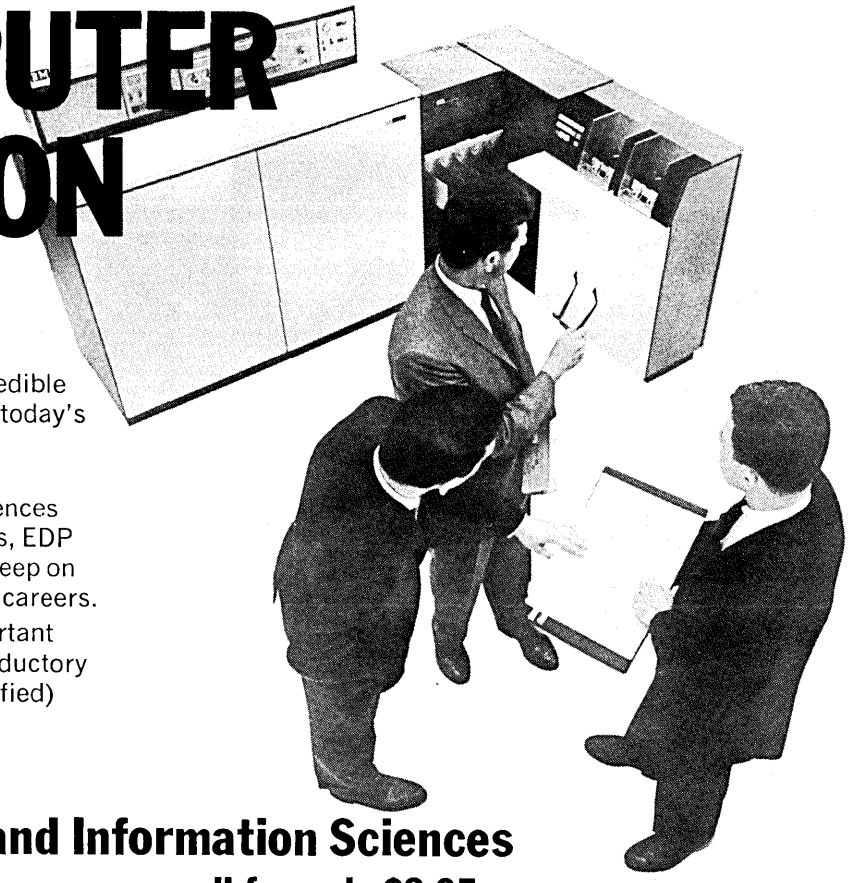
Secondly, for some reason, Johnson found conversation with the mother of the dead President unbearable, a conversation filled with double meanings. Why it was so double-edged will, I think, become clear when the real relations which had developed between Kennedy and Johnson by November 1963 are explored. □

Footnotes

1. The first UPI announcement, sent out five minutes earlier, read: "Three shots were fired at President Kennedy's motorcade in downtown Dallas."
2. According to U.S. procedure, the Attorney General must approve the oath-taking ceremony before it takes place.
3. It must be remembered that this talk took place before Oswald's arrest.

(To be continued in the next issue.)

THE COMPUTER REVOLUTION



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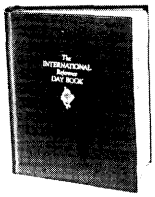

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Sprague et al — *Continued from page 21*

The major thrust of your letter is a concern that IBM will use this information to perfect a "data bank" of detailed proprietary information. As you know, information submitted pursuant to the census questionnaire is covered by protective order. Moreover, this issue is considered in Pre-Trial Order No. 9, where the Court orders responses from the various deponents since the information requested is relevant to the issues in this litigation.

With respect to the burden of answering, IBM has no desire to cause disruption to the business of any respondent, but in defense of the suits brought against it, certain evidence must be obtained. The census method was designed to obtain this information in the most expeditious and economical way both for the parties and the respondent. The alternative would be to take depositions which would disrupt a business to a much greater extent than answering the census questions. Depositions would tie up working documents and personnel for a period of time much greater than that involved in preparation of the necessary response.

Your request for a copy of "some 700 additional companies covered by the Court Order of December 13, 1971" cannot be honored as the names of the 700 additional companies are not a matter of public record.

Many companies compete in the electronic data processing market, both large and small. The services which Metroprocessing Corporation of America provides are considered an integral part of the EDP industry. Therefore, you should respond to the census questions.

Very truly yours,

Norman R. Carpenter (signed)

13. "A Mountainous Defense by IBM — A Court Clerk's Error Gives a Reporter A Peek at the Records of 1500 Companies"

from a December, 1971, issue of *Business Week*

For a few hours last week, the most complete, confidential financial history ever assembled of companies in the computer industry lay exposed to public view in U.S. District Court in St. Paul, Minn.

The fleeting disclosures occurred when a Business Week reporter was routinely checking the progress of the civil antitrust suit filed by Control Data Corp. and the Greyhound Computer Corp. against International Business Machines Corp. A court clerk permitted him to flip through the contents of 30-odd file drawers containing detailed depositions from more than 1,500 companies that are not even directly involved in the suit.

The depositions, ordered by the court at the request of IBM, contain the proprietary records of all of the companies' activities in data processing products and services from 1952 on. The yearly data for individual products are broken down by unit sales, profits, revenues, and even advertising and promotion expenditures.

Last week's look at the records may turn out to be the last by an outsider. Returning with a larger supply of notepaper, the reporter was informed by a clerk that the depositions were no longer available to him.

The mountain of paper had its genesis last September. Urged by IBM lawyers, Federal Judge Philip Neville ordered a poll of 2,700 companies named by IBM as currently or formerly active in data processing products or services.

The order demanded a detailed account from each company of its assets, revenues, research costs, and profits on all its products related to data processing in each year of the company's activity. The original return date was Oct. 20, but when some respondents protested the magnitude of the request, the court extended the deadline to Dec. 20.

By midweek, 1,586 of the 2,700 companies polled had returned notarized replies, from hand-written letters of freelance programmers to a bulging two cartons sent by Wang Industries. Still to come were the replies of the large computer makers and other large corporations, such as RCA, General Electric, and Litton Industries. Some will send truckloads of documents.

So far, no one seems quite sure what will be done with all the raw data spanning the 20-year history of computers. Control Data's suit alleges that IBM's size and market dominance make competition impossible. Norman R. Carpenter, a member of the Minneapolis law firm of Faegre & Benson, which is handling IBM's defense, says that the depositions are meant to establish that the scope of the market makes domination by one firm impossible.

But at this point, a mountain of raw data is accumulating in the clerk of court's office. Carpenter claims it will be analyzed, though he admits that "what form it will eventually take we don't know."

There have been bleats from some deponents. So far, none has refused outright to deliver proprietary information, but their covering letters show annoyance. Says one: "The questions and the vast field of knowledge [covered] leave the company's management somewhat perplexed. ..." Writes another, in part, " ... it has been impossible for us to even begin to analyze sales and rental records."

14. "The Really Basic Issue"

Richard E. Sprague

To the Editor:

The really basic issue is IBM's dominance and the harm it has done and will continue to do. The judge and the courts will not find out the truth about this using these methods.

The issue should be made as public as possible through business, government, and professional channels for dealing with social issues.

The losers in the long run will be the public and business, if the courts stay on this path. □

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 the agency, if any

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APPLICATIONS

IMAGE ANALYSIS — EVEN FOR ABRAHAM LINCOLN

University of Missouri-Columbia
Columbia, Mo. 65201

Although his image probably needs less enhancement than many Presidents, Abraham Lincoln's photographs have been less fortunate. Taken more than a century ago, Lincoln photographs viewed today sometimes lack the clarity they probably had when made by famed Civil War photographer Matthew Brady. However, researchers at the University of Missouri-Columbia College of Engineering (Professors Samuel Dwyer III, Ernest Hall, and Charles Harlow) have teamed two computers and a specially-designed optical scanner in a system that has demonstrated promise for visual information processing ranging from X-ray analysis to industrial quality control. By converting visual information to computer-usable form, and by analyzing the information through a series of complex computer programs, it has been shown that the errors associated with 'naked eye' examination can be eliminated.

The scanner examines a given image, converts what is there to numerical values and feeds the data to a small, fast computer, such as an IBM System/7, used for data collection. The digital information then is fed into a larger, IBM System/360 Model 50 for enhancement and evaluation. As a first step, quadrants in the image are assigned and the computer concentrates on one-fourth of the image at one time. This eases and speeds processing. Next, the computer filters and sharpens the image to whatever specifications a researcher desires. If filtering is not needed, the image can be analyzed in a variety of ways, one of which involves minimum redundancy — examining the image from the perspective of seeking a rough estimation of the overall image for purposes of identifying differences in tones.

After an image is enhanced, it can be compared with fixed criteria, such as X-ray diagnostic rules or industrial quality control standards, and results can be computer-printed in seconds. This automatic pattern recognition technique eliminates the need for human intervention in the analysis step.

"The technique already has been used to aid in diagnosing rheumatic heart condition from a single X-ray," Dr. Dwyer reported. "In a comparative test with a panel of 10 trained radiologists, the computer-based system was correct in its diagnosis 68% of the time while the panel was correct 63%." Prof. Harlow reported that in another use, a large corporation is considering adapting the technique to inspect solid-state circuitry boards. Because of the repetition and precision involved, human inspectors often approve faulty circuitry because they see what they want to see, not what actually is there. In using their technique to analyze photographs, Prof. Hall said the potential for aerial mapping, aerial reconnaissance, remote analysis of crops and other resources is limitless. For more information contact Dr. Samuel Dwyer III.

SCIENTISTS OBTAIN FIRST THREE-DIMENSIONAL LOOK AT GLACIERS WITH HELP OF COMPUTER

Concept:Communications
445 Cambridge Avenue
Palo Alto, Calif. 94306

Rolm Corporation, manufacturer of the Ruggednova computer, recently announced that the minicomputer is at the heart of an electronic system which will provide the first three-dimensional look at glaciers. Operating in an environment where commercial-type computers would fail, the Ruggednova controls a mobile information gathering system designed by Canadian scientists of the Department of Energy, Mines and Resources. The program, called Radio-Echo Sounding Project, is now exploring the Columbia Icefields located on the boundary of Alberta and British Columbia.

Mounted on a snow-cat type vehicle, the highly complex electronic system sounds the depths of the glacier with a radar device and navigates its course with a second radar system. The computer controls the

operation of the entire electronics system, logs all data received and provides real time instructions to the machine's operator to guide accurate plotting runs along the top of the glacier. Information gathered by the unit is stored on magnetic tape for later computer study. Sub-surface contour maps are produced from the data to give scientists their first comprehensive look beneath the glacier.

Dr. R. H. Goodman, project leader said, "We need to answer such questions as what causes a glacier, what determines its speed, are glaciers growing or shrinking, are we headed for a new Ice Age? The information obtained with the new equipment will help us find the answers." Future plans for the research project call for the computer to be carried aloft in a helicopter. The Ruggednova is designed to operate in severe airborne environments as well as ground and shipborne applications. For more information contact Dave Leonard.

COMPUTER KEEPS "RAILROAD" RUNNING SMOOTHLY

Athearn, Inc.
11929 South Western Ave.
Los Angeles, Calif. 90047

Irvin Athearn's company builds and sells half a million railroad cars and engines every year, from traditional red cabooses to sleek gray diesels. Business is so good, in fact, that Athearn, Inc., has installed a computer to keep its "railroad" running smoothly. While business is big, the product is tiny — miniature, in fact — because Athearn, Inc., manufactures model trains, all built precisely to scale 1/87th actual size. The computer, an IBM System/3 Model 6, helps the company determine how many of 800 different models it should build every day — and when and where to ship them.

The Athearn line of models includes steam and diesel locomotives, each with up to 100 different parts. They are exact replicas of those used by 30 different railroads. The variety of freight cars offered hobbyists ranges from refrigerated box cars to a caboose with a bay window.

With the new computer just two persons can handle all the office work associated with the firm's $1 million annual sales volume. Reports that used to take hours now take just a few minutes. The system is used to record all details of incoming customer orders as well as daily figures on each model produced in the shop. As orders are filled, inventory records are adjusted and the computer-produced reports tell shipping department employees where to ship the models and to whom. If an order is not filled completely, another report is generated so models missing in the shipment are sent to the right customers as soon as they are manufactured.

Planning the design for each new model means obtaining blueprints and photographs of real cars from the railroads and manufacturers. Skilled machinists then build dies which will be used to stamp out the plastic parts. Athearn designers even obtain specifications and color swatches from paint manufacturers to assure that when paint and lettering are applied to the models they will be faithful reproductions. "Tooling costs for each one may reach $60,000," Mr. Athearn pointed out, "so it's important for us to choose models that will sell. We expect the computer reports, showing hobbyists' past preferences for certain models, to guide us in introducing new cars to our line." For more information contact I.R. Athearn

EDUCATION NEWS

COMPUTER SCIENCE IS ADDED TO COLLEGE'S ART CURRICULUM

The University of New Mexico
Department of Art
Albuquerque, N.M. 87106

To improve their creative talents, art students at the University of New Mexico are working with a computer as well as with brushes and canvas. They're participating in a program developed by Charles Mattox, a professor of sculpture and proponent of experimental approaches to art education. (Professor Mattox's own collection of computer-produced art has been exhibited throughout the world.) Professor Mattox introduced his students to a computer to help them concentrate on the intellectual effort — rather than the execution — of design.

"Preparing a computer program to instruct the machine helps the student understand some of the factors involved in an artistic creation," said Professor Mattox. "The student must concentrate on the form and other characteristics of the design, rather than on how well the design is drawn," he explained. Using the computer also prepares the artist — whose education in the sciences is limited — for today's technological world, Professor Mattox believes.

Professor Mattox's students experiment with two computer programs — ART I and DART I — which he wrote with collegues. Using ART I, the students can create designs, composed of numerals and letters, with the computer's printer-keyboard. Under instructions from the student, the computer draws lines, triangles, circles and various curves. (The computer used in the course is an IBM System/360 Model 67.)

With DART I, the computer codes the student's design into numbers and records them on magnetic tape which is then run on a plotting machine to produce the design. DART I is used to create art containing lines, squares, circles and mathematical functions such as sine and tangent waves. Students observe that slight mathematical changes in the program cause the computer to produce an entirely different piece of art.

This experimental approach to art has worked so well that the School of Art's traditional curriculum now includes computer science and computer graphics courses. For example, art students now may take FORTRAN, a computer programming language, to satisfy the school's conventional foreign language requirement. For more information, contact: Professor Charles Mattox

MERIT COMPUTER NETWORK LINKS MICHIGAN'S LARGEST UNIVERSITIES

Michigan State University
Department of Information Services
East Lansing, Mich. 48823

The state of Michigan reached a milestone in higher education last Dec. 14 when a computer at the University of Michigan in Ann Arbor ordered a computer at Wayne State University in Detroit to perform a computational task. A computer at Michigan State University in East Lansing could just as easily have ordered either the WSU or U of M computers to perform the historic task, for the transmission realized a five-year

effort to connect the computer facilities of the state's three largest universities. The three-way computer hookup is called MERIT (Michigan Educational Research Information Triad) computer network.

MERIT was formally created in the fall of 1966 by the Michigan Inter-university Committee on Information Systems (MICIS). Backed by matching funds from the state and the National Science Foundation, MERIT began to move from the drawing board to the construction phase in July 1969. Each university had a large — and different — computer. With only minor changes to the three computers, integration was accomplished by installing small, general purpose communications computers. The small computers translate the differences of each system into an interlocking communication network that permits immediate access to any of the programs and data bases on any of the campuses. Additionally, MERIT provides a capability of expansion to serve other educational institutions in Michigan.

The director of MERIT, Bertram Herzog, U of M professor of industrial engineering, said, "While there are a few similar computer networks in the country, Michigan's is the first to be built around different production computers which supply the daily computing needs of the universities. The principal benefit of the MERIT computer network is that it allows interaction of complementary resources, both programs and data, by utilizing the special features of the different computers. ... We don't feel that the system should be restricted to computer experts or others who are technically oriented. In order to use the network to its maximum effectiveness, we hope to encourage virtually every discipline to find germane applications for the computer." (For more information contact Mike Morrison.)

RESEARCH FRONTIER

HARBOR SURVEILLANCE SYSTEM FORESEES COLLISIONS, SURFACE TRAFFIC PROBLEMS

The John Hopkins University
Applied Physics Laboratory
Silver Spring, Md. 20902

Initial prototype testing has begun on data processing techniques which could greatly reduce ship collision in U.S. harbors. The Johns Hopkins University Applied Physics Laboratory, long engaged in improving radar and data processing equipment and techniques for Navy ship defenses, is applying this technology as part of the Coast Guard's San Francisco Experimental Marine Traffic System (MTS). Initial hardware shipments to the site are scheduled for late next summer. J. B. Oakes, APL project engineer, explained that equipment specifically designed to process echos from marine radars will be integrated with three computers and electronic display consoles to provide a unique approach to the monitoring of ship traffic in a harbor environment.

Each of the system's two radars, will send data to its own Radar Video Preprocessor which operates in conjunction with a Radar Computer. The two units will combine to automatically detect ships entering the radar's surveillance area and follow their progress as they move, keeping track of their location, speed, and course. This information will be relayed to a Traffic Computer that will analyze and display the traffic conditions for consideration by the MTS operators. This computer will automatically alert the operators to potential collision situations, anticipated traffic congestion in critical areas, departures of vessels from established traffic lanes, possible ship groundings, and indicate when buoys or anchored ships have drifted from their assigned positions.

If an operator agrees with the computer's evaluation of a potentially hazardous condition, he can advise the affected vessels of the situation by radio. To augment the information supplied by the automatic alerts, an operator can also request the computer to determine the distance between two ships, estimate how close they will pass, or what traffic each might expect to encounter along its particular routes. The emphasis on harbor safety which the Marine Traffic System is intended to enhance is in line with the President's objective of minimizing the possibility of pollution in coastal waters. (For more information contact Cyril J. O'Brien.)

MEETING NEWS

JUSTICE DEPARTMENT INTERESTED IN ADAPSO HEARINGS

Association of Data Processing Service Organizations, Inc.
551 Fifth Avenue
New York, N.Y. 10017

A major part of ADAPSO's program for 1972 will be the development and lawful subsequent implementation of proposals and recommendations on economic matters affecting the computer services industry. The Association has established a Committee on Industry Economics chaired by Wallace Preble, President, United Data Processing, Inc., Cincinnati, Ohio. The Committee will gather data in an effort to formulate sound economic recommendations with regard to such questions as treatment of computer service companies as wholesalers, manufacturer relations, improper trade practices, government purchasing, and governmental legislation and administrative rulings of agencies that shape the industry's future.

As an initial step, ADAPSO held court-like hearings at its 34th Management Conference in Dallas, Texas on February 17-18, 1972. Members of the industry participated in an open forum to offer testimony in helping to develop these recommendations. In addition to bearing witness, participants were cross-examined by the Association's Counsel and responded to questions offered by the Committee.

The import of developing significant industry data has resulted in a request by Justice Department attorneys for an official transcript of the proceedings. One can only speculate on the intended use of this information, stated Bernard Goldstein, President of ADAPSO and President of United Data Centers, Inc., of Greenwich, Conn. Goldstein emphasized the need to fill the apparent void of industry information, since it appeared necessary for a Federal Court to authorize the interrogation of 3,400 companies to supply detailed information in litigation it now is presiding over.

The information gathered and analyzed will serve as a base for possible recommendations with regard to economic matters, as well as providing a total understanding of the complexities of the industry. Full text of the hearings will be made available to the public and may be purchased from ADAPSO.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Texas Instruments Inc., Dallas, Texas	General Services Administration	Advanced Scientific Computer (ASC) for use by Geophysical Fluid Dynamics Laboratory (GFDL) of the National Oceanic Atmospheric Administration which is engaged in fundamental modeling studies for long-range weather prediction; delivery to GFDL's facility of the Forrestal Campus of Princeton University is scheduled for July 1973	$25 million (approximate)
Burroughs Corp., Detroit, Mich.	Highway Safety and Motor Vehicles Department, State of Florida	A B 6700 system, terminal computers and communications devices which will be used to keep detailed records on every motor vehicle registration, driver license, license tag, traffic ticket and driver arrest record in Florida	$4.4 million
Control Data Corp., Minneapolis, Minn.	RBK (Regneanlegget Blindern-Kjeller), Kjeller, Norway	Control Data CYBER Model 74 computer system for a variety of scientific and administrative applications; service firm is jointly owned by 5 Norwegian agencies	$2.6 million
NCR, Dayton, Ohio	Hibernia National Bank, New Orleans, La.	Additional processing ability and data storage capacity for better customer service	$2.5 million
Kearfott Div., The Singer Co., Little Falls, N.J.	Swedish Government's Material Administration of the Armed Forces	Development of a general purpose central degital computer for use on the new JA37 fighter version of the Viggen Aircraft now in early development for the Swedish Air Force; includes option for 250 follow-on production units	$2.5 million
University of Southern California, Los Angeles, Calif.	Advanced Research Projects Agency (ARPA)	Research in electronic image processing; includes enhancing signals sent from Mariner spacecraft to reveal photographic details not easily seen in original pictures	$1.8 million
Conrac Corp., New York, N.Y.	Pan American World Airways New York, N.Y.	Information and passenger control system which begins directing passengers at arrival point of terminal roadway; returning passengers will be similarly guided through baggage claim, Customs Area, and ground transportation	$1.7 million
Computer Automation, Inc., Newport Beach, Calif.	General Computer Systems, Inc., Dallas, Texas	16-bit ALPHA computers to be used as controllers for the System 2100 key-to-disk data entry systems	$1 million (approximate)
Systems Sciences Development Corp., Los Angeles, Calif.	State of Iowa	Implementing computer-based traffic records and criminal justice information system (TRACIS)	$400,000
Data Pathing System, Sunnyvale, Calif.	Bethlehem Steel Corp., Bethlehem, Pa.	Full management and control of all shop floor data	$397,000
Cybermatics Inc., New York, N.Y.	Continental Grain	Implementing firm's FASTNet (Fully Automated Switched Telecommunications Network); also a development effort to handle specific Continental Grain requirements	$213,000
University of Alabama, Birmingham, Ala.	John A. Hartford Foundation, Inc., New York, N. Y.	Research on computer monitoring of women in labor, computer will automatically and constantly monitor uterine activity and fetal heart rate; sound alarm if any abnormalities develop, print diagnosis so labor room personnel may inform physician and take appropriate actions	$154,871
United Telecontrol Electronics, Inc., Asbury Park, N.J.	Varisystems Corp.	Production of several hundred core stacks	$150,000
Decision Sciences Corp., Jenkintown, Pa.	City of Toronto and the Province of Ontario	Implementing the program "PROMUS" which provides city planners with advanced decision-making capabilities	$100,000
Kustom Electronics, Inc., Chanute, Kan.	Kansas City Police Dept., Kansas City, Mo.	Six Mobile Communications Terminals (MCT-10) for installation in squad cars; order also includes a computer interface system to integrate its system into police department's existing IBM 370 computer system	$75,000
Carnegie-Mellon University, Pittsburgh, Pa.	National Science Foundation	Development of computer techniques for architectural design, including new tool development for the architect and planner	$60,000
SYS Computer Corp., Hackensack, N.J.	Compumatics, Inc.	Adaptation of SYS Model 1500 Microprocessor for incorporation in systems emulating IBM Models 1401 and 1410; contract covers potential production deliveries of up to 101 systems if ordered by Compumatics	—
Boeing Computer Services, Inc., Dover, N.J.	City Council of Riverside, Calif.	Implementation of computerized management control system — RAGS (Routine Analysis, Generation and Simulation) — for solid waste collection	—
Howard J. Blender Co., Dallas, Texas	Preston State Bank, Dallas, Texas	Developing and implementing operating control system, and training staff personnel in techniques and philosophies of a bank "Work Management Program"	—

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B 2500 system	City of Huntington Beach, Calif.	Payroll, general accounting, water billing, appropriations and budgeting, and business licenses; future plans for a total city management system (system valued at about $410,000)
Burroughs B 3500 system	California Department of Social Welfare, Sacramento, Calif.	Automating fiscal and personnel management information systems and on-line administrative analysis, case load information and management control
Burroughs B 3500 system	The Data Center, Watertown, Mass.	A cooperative venture by Coolidge Bank and Trust Co. and Moll Associates, Inc. in information handling systems for the bank and customers of both firms (system valued at about $1,000,000)
Control Data 1700 system	Australian Mineral Development Laboratories (AMDEL), Adelaide, Australia	Increased capacity; offers full range of services to mineral industry, from exploration through laboratory/pilot plant processing to process design, installation and commission (system valued at $150,000)
Data General Nova 800	New London Laboratory of the Naval Underwater Systems Center, New London, Conn.	Use in a research project aimed at improving methods of detecting sonar targets
IBM System/3 Model 10	Capezio and Things, Inc. New York, N.Y.	Keeping track of everything from the latest style changes to orders from nearly 300 vendors
IBM System/3 Model 10	Giant Markets, Scranton, Pa.	Unit pricing of groceries and for inventory control; future use includes stock forecasting
IBM System/3 Model 10	Los Alamos Building & Loan Association, Los Alamos, N.M.	Processing savings account transactions and preparing up-to-date reports to investors
IBM System/360 Model 40	Department of Public Safety, City of Knoxville, Knoxville, Ky.	Automating 25,000 records on fugitives, habitual criminals, probation and parole cases, plus traffic offenses and delinquent parking citations
IBM System/370 Model 155	The Brunswick Corporation, Chicago, Ill.	Expanding company-wide information processing network; links 76 division headquarters, plants, warehouses, sales offices handling tasks from sales and manufacturing information to stockholder records
IBM System/370 Model 155	Kansas City Police Department, Kansas City, Mo.	Handling increasing volume of criminal justice information tasks; also for an automated court docketing system for the Kansas City Municipal Court, and automated record keeping function for the Jackson County Juvenile Court and the Prosecuting Attorney
IBM System/370 Model 165	Ohio State University, Columbus, Ohio	Expanded on-campus student and staff use, including instruction programs, research, and administrative needs of the university
ICL 1906A	Institute of High Energy Physics (IOHEP), Serpukhov, USSR (2 systems)	Two 1906A computers (to be included with three 1903As and a Russian BESM 6) to be used for resolving data produced by one of world's largest linear accelerators
NCR Century 50	Meridian Wood Products Co., Nampa, Id.	Process labor distribution charges and prepare payroll
	Colton Unified School District San Bernardino, Calif.	Preparing student schedules, grade and attendance reports, score tests, and handle appropriation accounting
NCR Century 100	Beatson Clark & Company, Ltd., Rotherham, England	Processing firm's sales and purchase records
	University Hospital, University of Arizona, Tucson, Arizona	Administrative data processing, including patients' medical records, billing and payroll
	Westport Public School System, Westport, Conn.	Nucleus of an on-line data terminal system to be used by classes in various schools for instructional purposes; keeping track of the 500,000 school meals served annually; administrative tasks; and a variety of tasks for the town government
	Wheeling Transportation, Inc., Elizabeth, N.J.	Inventory control and a variety of applications
UNIVAC 418-III system	Metropolitan Police Department, Nashville and Davidson County, Tenn.	A real-time information system for the police and sheriffs' departments and the local courts
UNIVAC 1106 system	New York State Department of Taxation and Finance, Albany, N.Y.	Primary task of operating New York State weekly lottery; includes imprinting 50¢ tickets, listing purchased ticket numbers and numerous other functions
UNIVAC 9200 system	Lear Siegler Institute, Indianapolis, Ind.	Providing better instructional facilities to students studying the operation and programming of computers
UNIVAC 9200-II system	The Czechoslovak Society of Cicero, Ill.	Handling dividend payments, policy billing, mailings, certificates, loans, and mortgage processing; supersedes an older UNIVAC 1004 system
UNIVAC 9300 II system	McKee Baking Company, Collegedale, Tenn.	Production and inventory control, general accounting, payroll processing and computation of dealer commissions (replaces a UNIVAC 9200)
UNIVAC 9400	China Airlines, Taipei, Taiwan (2 systems)	Use in maintaining passenger name records and for message switching (system valued at $1.3 million)
	County Courthouse, Union County, Elizabeth, N.J.	Jury selection, includes information storage and printing summons; future use includes criminal, alimony and child support histories
Varian Data 622/i	Technical Advisers Inc., Wayne, Mich.	Firm's third minicomputer; primary application is in surveying and engineering services for land surveyors and geodetic engineers

Macdonald — *Continued from page 25*

Table 3

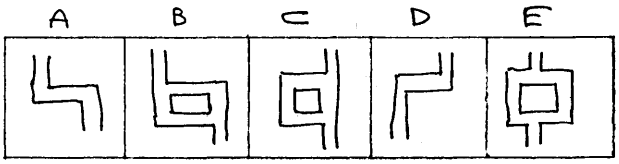
POSSIBLE DESIGNS OF ITEMS

Kind of Item	A	B	C	D	E	The Unlike One:	Logical Answer
1	1	1	1	1	1	-	F
2	1	1	1	1	2	E	E
3	1	1	1	2	2	-	F
4	1	1	1	2	3	-	F
5	1	1	2	2	3	E	E
6	1	1	2	3	4	-	F
7	1	2	3	4	5	-	F

We can recognize two more principles:

> Principle 3: An item has a tendency to become fatally ambiguous as soon as two properties are discovered, each of which is satisfied by one and only one of the five figures, and these two are different; but
>
> Principle 4: If there is a choice of two answers depending on a choice between two properties, and one property P is common and important, and the other property Q is either not common or not important, then the choice according to property P should prevail.

For example, consider Item 20:



These five figures are like portions of a map, showing streets and the presence or absence of a small central part or plaza. A, B, and D are clearly alike. The question reduces to, Should C or E be chosen?

If the top is "north" and the bottom is "south", a motorist passing through would require 2 turns for A, B, and D, 4 turns for E, but no turns for C. A motorist if given a choice, would surely choose C. Therefore, using Principle 4, it would be reasonable to assert that C is the "correct" answer.

Results from Responses

As of present writing, the readers of "Computers and Automation" and their friends have contributed 306 responses to C&A Pictorial Reasoning Test No. 1. The responses are very interesting.

Some of the results of summarizing the responses are shown in Table 4, which shows the frequency of scores. This shows that the top score is 17, and the commonest score is 12. Of course, if the "correct" answers were changed, then these results would be different.

The frequency of answers given and the percent obtaining the "correct" answer is shown in Table 5. The "correct" answer is the most popular answer for all items except Items 8, 13 and 15.

In Item 8, we consider the "correct" answer to be F (74 votes) but more popular answers are A (99 votes) and E (88 votes).

In Item 13 we consider the "correct" answer to be E (38 votes), but more popular answers are A (41 votes), D (165 votes), and F (54 votes).

In Item 15 we consider the "correct" answer to be C (89 votes), but D (120 votes) is a more popular answer.

These responses do not include 64 responses by students sent in by Professor Paul T. Moriarty from New York City Community College, New York, N.Y., nor 113 responses by students sent in by Mr. Howard P. Dodge from Wilbraham Academy, Wilbraham, Mass. In general, these 175 scores are lower, and indicate that the student groups are not homogeneous with readers of "Computers and Automation".

Table 4

FREQUENCY OF SCORES — 306 READERS OF C&A AND THEIR FRIENDS

(1) Score	(2) Frequency	(1) Score	(2) Frequency
0	1	11	35
1	0	12	54
2	0	13	49
3	1	14	39
4	5	15	26
5	7		
6	9	16	10
7	8	17	2
8	12	18	0
9	24	19	0
10	24	20	0
		Total	306

Table 5

FREQUENCY OF CHOICE OF ANSWER — 306 READERS OF C&A AND THEIR FRIENDS

Item No.	Answer: A	B	C	D	E	F	X*	Percent Obtaining
1	1	287	3	0	4	11	0	94%
2	8	189	15	12	51	31	0	62
3	11	233	17	2	5	38	0	76
4	4	16	7	28	201	50	0	66
5	2	7	75	121	27	74	0	40
6	0	5	276	1	21	3	0	90
7	26	166	44	19	14	36	1	54
8	99	21	5	19	88	74	0	24
9	63	2	99	18	101	23	0	33
10	11	5	7	220	9	53	1	72
11	6	10	258	21	0	9	2	84
12	2	2	3	264	11	23	1	86
13	41	5	2	165	38	54	1	12
14	9	4	2	36	243	9	3	79
15	8	6	89	120	14	66	3	29
16	9	6	13	237	23	17	1	77
17	1	0	152	104	13	35	1	50
18	28	17	25	53	87	94	2	31
19	4	0	146	46	22	87	1	48
20	2	11	131	16	100	45	1	43

"Correct" answer is underlined.
* Answer not specified.

How Do Programmers Do on the Test?

After making this analysis of all the responses from C&A readers and their friends, we wondered if we had enough data to make any guesses about the use of C&A Test No. 1 to identify persons good at programming. We examined the responses, and we found we had 129 responses from persons who classified themselves as either "good" or "excellent" at programming.

Table 6 shows the distribution of scores of these 129 persons. There is clearly a sharp jump at the score of 12. In fact, the results suggest that approximately 80% of persons who are good or excellent at programming obtain 12 or more as a score on this test.

Table 6

FREQUENCY OF SCORES — 129 READERS OF C&A WHO CLASSIFY THEMSELVES AS "GOOD" OR "EXCELLENT" PROGRAMMERS

(1) Score	(2) Frequency	(1) Score	(2) Frequency
0	0	11	6
1	0	12	31
2	0	13	25
3	0	14	24
4	1	15	13
5	2		
6	1	16	8
7	0	17	2
8	1	18	0
9	7	19	0
10	8	20	0

ADVANCED NUMBLES

Neil Macdonald
Assistant Editor
Computers and Automation

An "advanced numble" is an arithmetical problem in which: digits have been replaced by capital letters; and the numbers are ordinary words. Each capital letter in the arithmetical problem stands for just one digit 0 to 9. Each digit is represented by just one letter (unless an equation, such as M = K, is also given). No easy clues (such as partial products in a multiplication) are ordinarily given. There may be more than one solution.

The word "numble" comes from blending "number" and "nimble", and the phrase "a number problem for a nimble mind".

The grandfather of all "advanced numbles" is

SEND + MORE = MONEY,

which has just one solution and is quite easy to solve. The following are harder.

Advanced Numble No. 72031:

Find two solutions to: BON X BON = CANDY

Advanced Numble No. 72032:

Find one solution to: ONE X TWO = EIGHT.

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

C.a

NUMBLES

Neil Macdonald
Assistant Editor
Computers and Automation

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

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

We invite our readers to send us solutions, together with human programs or computer programs which will produce the solutions. This month's Numble was contributed by:

Andrew M. Langer
Newton High School
Newton, Mass.

NUMBLE 723

```
    E V E R Y
  × M I L E
  -----------
  W T S T R V

  V S T N Y L          0 = W

V R M R L N            M = N

W N R E V M
-----------------------------
Y T Y S Y T L O V   39055  38538  071
```

Solution to Numble 722

In Numble 722 in the February issue, the digits 0 9 are represented by letters as follows:

N = 0	G = 5
T = 1	E,A = 6
I = 2	O = 7
W,R = 3	B,D = 8
S = 4	H = 9

The message is: Whose bread I eat his song I sing.

Our thanks to the following individuals for submitting their solutions — **to Numble 722:** Howard B. Wilson, Richmond, Va. — **to Numble 721:** Ed Balke, Bellwood, N.J.; Marijoe Bestgen, Shawnee Mission, Kans.; T. P. Finn, Indianapolis, Ind.; (Mrs.) Mary Ann Ruppen, Pittsburg, Pa.; and Howard B. Wilson, Richmond, Va.

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND AUTOMATION

The following is a summary made by COMPUTERS AND AUTOMATION of reports and estimates of the number of general purpose electronic digital computers manufactured and installed, or to be manufactured and on order. These figures are mailed to individual computer manufacturers from time to time for their information and review, and for any updating or comments they may care to provide. Please note the variation in dates and reliability of the information. Several important manufacturers refuse to give out, confirm, or comment on any figures.

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

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

The following abbreviations apply:

(A) -- authoritative figures, derived essentially from information sent by the manufacturer directly to COMPUTERS AND AUTOMATION
C -- figure is combined in a total
(D) -- acknowledgment is given to DP Focus, Marlboro, Mass., for their help in estimating many of these figures
E -- figure estimated by COMPUTERS AND AUTOMATION
(N) -- manufacturer refuses to give any figures on number of installations or of orders, and refuses to comment in any way on those numbers stated here
(R) -- figures derived all or in part from information released indirectly by the manufacturer, or from reports by other sources likely to be informed
(S) -- sale only, and sale (not rental) price is stated
X -- no longer in production
- -- information not obtained at press time

SUMMARY AS OF FEBRUARY 15, 1972

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)		NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Part 1. United States Manufacturers								
Autonetics	RECOMP II	11/58	2.5		30	0	30	X
Anaheim, Calif. (R) (1/69)	RECOMP III	6/61	1.5		6	0	6	X
Bailey Meter Co.	Metrotype	10/57	40-2000	(S)	8	0	8	0
Wickliffe, Ohio	Bailey 750	6/60	40-250	(S)	37	15	52	0
(A) (1/72)	Bailey 755	11/61	200-600	(S)	7	6	7	0
	Bailey 756	2/65	60-400	(S)	15	12	27	2
	Bailey 855/15	12/72	50-400	(S)	0	0	0	2
	Bailey 855/25	4/68	100-1000		16	0	16	0
	Bailey 855/50	3/72	100-1000	(S)	0	0	0	9
Bunker-Ramo Corp.	BR-130	10/61	2.0		160	-	-	X
Westlake Village, Calif.	BR-133	5/64	2.4		79	-	-	X
(A)	BR-230	8/63	2.7		15	-	-	X
(1/72)	BR-300	3/59	3.0		18	-	-	X
	BR-330	12/60	4.0		19	-	-	X
	BR-340	12/63	7.0		19	-	-	X
	BR-1018	6/71	23.0	(S)	-	-	-	-
Burroughs	205	1/54	4.6		25-38	2	27-40	X
Detroit, Mich.	220	10/58	14.0		28-31	2	30-33	X
(N)	B100/B500	7/65	2.8-9.0		-	-	-	-
(1/69-5/69)	B2500	2/67	4.0		52-57	12	64-49	117
	B3500	5/67	14.0		44	18	62	190
	B5500	3/63	23.5		65-74	7	72-81	8
	B6500	2/68	33.0		4	-	4	60
	B7500	4/69	44.0		-	-	-	13
	B8500	8/67	200.0		1	-	1	5
Computer Automation, Inc.	108/208/808	6/68	5.0	(S)	165	10	175	110
Newport Beach, Calif.	116/216/816	3/69	8.0	(S)	215	20	235	225
(A) (6/71)								
Control Data Corp	G15	7/55	1.6		-	-	295	X
Minneapolis, Minn.	G20	4/61	15.5		-	-	20	X
(R)	LGP-21	12/62	0.7		-	-	165	X
(7/71)	LGP-30	9/56	1.3		-	-	322	X
	RPC4000	1/61	1.9		-	-	75	X
	636/136/046 Series	-	-		-	-	29	-
	160/8090 Series	5/60	2.1-14.0		-	-	610	X
	924/924-A	8/61	11.0		-	-	29	X
	1604/A/B	1/60	45.0		-	-	59	X
	1700/SC	5/66	3.8		-	-	400-450	0
	3100/3150	5/64	10-16		-	-	83-110	C
	3200	5/64	13.0		-	-	55-60	C
	3300	9/65	20-38		-	-	200	C
	3400	11/64	18.0		-	-	20	C
	3500	8/68	25.0		-	-	15	C
	3600	6/23	52.0		-	-	40	C
	3800	2/66	53.0		-	-	20	C
	6400/6500	8/64	58.0		-	-	105	C
	6600	8/64	115.0		-	-	85	C
	6700	6/67	130.9		-	-	5	C
	7600	12/68	235.0		-	-	5	C
								Total: 160 E
Data General Corp.	NOVA	2/69	8.0 -	(S)	-	-	891	-
Southboro, Mass.	SUPERNOVA	5/70	9.6	(S)	-	-	163	-
(A)(12/71)	NOVA 1200	12/71	5.4	(S)	-	-	950	-
	NOVA 800	3/71	6.9	(S)	-	-	122	-
	SUPERNOVA SC	6/71	11.9	(S)	-	-	15	-
Datacraft Corp.	6024/1	5/69	54-300	(S)	14	0	14	2
Ft. Lauderdale, Fla.	6024/3	2/70	33-200	(S)	88	12	100	55
(A) (1/72)	6024/5	12/71	16-50	(S)	0	0	0	25
Digiac Corp.	Digiac 3060	1/70	9.0	(S)	45	-	-	7
Plainview, N.Y.	Digiac 3080	12/64	19.5	(S)	16	-	-	0
(A) (7/71)	Digiac 3080C	10/67	25.0	(S)	8	-	-	1
Digital Computer Controls, Inc.	D-112	8/70	10.0	(S)	317	74	391	400
Fairfield, N.J.	D-116	1/72	10.0	(S)	5	0	5	169
(A) (2/72)								

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)		NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Digital Equipment Corp.	PDP-1	11/60	3.4		48	2	50	X
Maynard, Mass.	PDP-4	8/62	1.7		40	5	45	X
(A) (2/72)	PDP-5	9/63	0.9		90	10	100	X
	PDP-6	10/64	10.0		C	C	23	X
	PDP-7	11/64	0.4		C	C	160	X
	PDP-8	4/65	0.3		C	C	1440	C
	PDP-8/1	3/68	0.4		C	C	3698	C
	PDP-8/S	9/66	0.3		C	C	1024	C
	PDP-8/L	11/68	-		C	C	3902	C
	PDP-8IE	-	-		-	-	3200	-
	PDP-9	12/66	1.1		C	C	436	C
	PDP-9L	11/68	-		C	C	48	C
	DECSystem-10	12/67	8.0		C	C	145	C
	PDP-11	3/70	10.5	(S)	C	C	2002	C
	PDP-12	9/69	-		C	C	593	C
	PDP-15	2/61	17.0		6	C	516	C
	LINC-8	9/66	-		C	C	142	C
								Total: 1350 E
Electronic Associates Inc.	640	4/67	1.2		105	60	165	6
Long Branch, N.J. (A) (12/71)	8400	7/67	12.0		21	6	27	2
EMR Computer	EMR 6020	4/65	5.4		C	-	-	C
Minneapolis, Minn.	EMR 6040	7/65	6.6		C	-	-	C
(A)	EMR 6050	2/66	9.0		C	-	-	C
(2/71)	EMR 6070	10/66	15.0		C	-	-	C
	EMR 6130	8/67	5.0		C	-	-	C
	EMR 6135	-	2.6		-	-	-	-
	EMR 6155	-	-		-	-	-	-
								Total: 1350 E
General Automation, Inc.	SPC-12	1/68	-		-	-	945	-
Anaheim, Calif.	SPC-16	5/70	-		-	-	145	-
(A) (2/72)	System 18/30	7/69	-		-	-	100	-
General Electric	GE-PAC 3010	5/70	2.0		5	0	5	22
West Lynn, Mass.	GE-PAC 4010	10/70	6.0		15	3	18	28
(Process Control Computers)	GE-PAC 4020	2/67	6.0		197	59	256	30
(A)	GE-PAC 4040	8/64	3.0		45	20	65	X
(2/72)	GE-PAC 4050	12/66	7.0		23	2	25	1
	GE-PAC 4060	6/65	2.0		18	2	20	X
Hewlett Packard	2114A, 2114B	10/68	0.25		-	-	1182	-
Cupertino, Calif.	2115A	11/67	0.41		-	-	333	-
(A) (8/71)	2116A, 2116B, 2116C	11/66	0.6		-	-	1171	-
Honeywell Information Systems	G58	5/70	1.0		-	-	-	-
Wellesley Hills, Mass.	G105A	6/69	1.3		-	-	-	-
(A) (2/71)	G105B	6/69	1.4		-	-	-	-
	G105RTS	7/69	1.2		-	-	-	-
	G115	4/66	2.2		200-400	420-680	620-1080	-
	G120	3/69	2.9		-	-	-	-
	G130	12/68	4.5		-	-	-	-
	G205	6/64	2.9		11	0	11	-
	G210	7/60	16.0		35	0	35	-
	G215	9/63	6.0		15	1	16	-
	G225	4/61	8.0		145	15	160	-
	G235	4/64	12.0		40-60	17	57-77	-
	G245	11/68	13.0		3	-	3	-
	G255 T/S	10/67	17.0		15-20	-	15-20	-
	G265 T/S	10/65	20.0		45-60	15-30	60-90	-
	G275 T/S	11/68	23.0		-	-	10	-
	G405	2/68	6.8		10-40	5	15-45	-
	G410 T/S	11/69	1.0		-	-	-	-
	G415	5/64	7.3		70-100	240-400	240-400	-
	G425	6/64	9.6		50-100	20-30	70-130	-
	G430 T/S	6/69	17.0		-	-	-	-
	G435	9/65	14.0		20	6	26	-
	G440 T/S	7/69	25.0		-	-	-	-
	G615	3/68	32.0		-	-	-	-
	G625	4/65	43.0		23	3	26	-
	G635	5/65	47.0		20-40	3	23-43	-
	G655	12/70	80.0		-	-	-	-
	H-110	868	2-7		180	7	255	0
	H-115	6/70	3.5		30	-	30	-
	H-120	1/66	4.8		800	160	960	-
	H-125	12/67	7.0		150	220	370	-
	H-200	3/64	7.5		800	275	1075	-
	H-400	12/61	10.5		46	40	86	X
	H-800	12/60	30.0		58	15	73	X
	H-1200	2/66	9.8		230	90	320	-
	H-1250	7/68	12.0		130	55	185	-
	H-1400	1/64	14.0		4	6	10	X
	H-1800	1/64	50.0		15	5	20	X
	H-2200	1/66	18.0		125	60	185	-
	H-3200	2/70	24.0		20	2	22	-
	H-4200	8/68	32.5		18	2	20	-
	H-8200	12/68	50.0		10	3	13	-
	DDP-24	5/63	2.65		-	-	90	X
	DDP-116	4/65	0.9		-	-	250	-
	DDP-124	3/66	2.2		-	-	250	-
	DDP-224	3/65	3.5		-	-	60	-
	DDP-316	6/69	0.6		-	-	450	-
	DDP-416	-	-		-	-	350	-
	DDP-516	9/66	1.2		-	-	900	-
	H112	10/'59	-		-	-	75	-
	H632	12/68	3.2		-	-	12	-
	H1602	-	-		-	-	-	-
	H1642	-	-		-	-	-	-
	H1644	-	-		-	-	-	-

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Honeywell (cont'd)	H1646	-	-	-	-	-	-
	H1648	11/68	12.0	-	-	20	-
	H1648A	-	-	-	-	-	-
IBM	System/Model 6	3/71	1.0	-	-	-	-
White Plains, N.Y.	System/3 Model 10	1/70	1.1	-	-	-	-
(N) (D)	System/7	11/71	0.35 and up	-	-	-	-
(1/69-5/69)	305	12/57	3.6	40	15	55	-
	650	10/67	4.8	50	18	68	-
	1130	2/66	1.5	2580	1227	3807	-
	1401	9/60	5.4	2210	1836	4046	-
	1401-G	5/64	2.3	420	450	870	-
	1401-H	6/67	1.3	180	140	320	-
	1410	11/61	17.0	156	116	272	-
	1440	4/63	4.1	1690	1174	2864	-
	1460	10/63	10.0	194	63	257	-
	1620 I, II	9/60	4.1	285	186	471	-
	1800	1/66	5.1	415	148	563	-
	7010	10/63	26.0	67	17	84	-
	7030	5/61	160.0	4	1	5	-
	704	12/55	32.0	12	1	13	-
	7040	6/63	25.0	35	27	2	-
	7044	6/63	36.5	28	13	41	-
	705	11/55	38.0	18	3	21	-
	7020, 2	3/60	27.0	10	3	13	-
	7074	3/60	35.0	44	26	70	-
	7080	8/61	60.0	13	2	15	-
	7090	11/59	63.5	4	2	6	-
	7094-I	9/62	75.0	10	4	14	-
	7094-II	4/64	83.0	6	4	10	-
	360/20	12/65	2.7	4690	3276	7966	-
	360/25	1/68	5.1	0	4	4	-
	360/30	5/65	10.3	4075	3144	7219	-
	360/40	4/65	19.3	1260	498	1758	-
	360/44	7/66	11.8	65	13	78	-
	360/50	8/65	29.1	480	109	589	-
	360/65	11/65	57.2	175	31	206	-
	360/67	10/65	133.8	9	4	13	-
	360/75	2/66	66.9	14	3	17	-
	360/85	12/69	150.3	-	-	-	-
	360/90	11/67	(S)	5	-	5	-
	370/135	5/72	14.4	-	-	-	-
	370/145	9/71	23.3	-	-	-	-
	370/155	2/71	48.0	-	-	-	-
	370/165	5/71	98.7	-	-	-	-
	360/195	4/71	232.0	-	-	-	-
	360/195	6/73	190.0-270.0	-	-	-	-
Interdata	Model 1	12/70	3.7	150	50	200	50
Oceanport, N.J.	Model 3	5/67	-	N/A	-	200	X
(A) (10/71)	Model 4	8/68	8.5	260	115	375	40
	Model 5	11/70	10.5	70	20	90	10
	Model 15	1/69	20.0	40	24	64	X
	Model 16	5/71	14.7	1	5	6	12
	Model 18	6/71	24.7	2	6	8	8
	Model 70	10/71	6.8	0	0	0	60
Microdata Corp.	Micro 400	12/70	1.8-30	1200	400	1600	-
Santa Ana, Calif.	Micro 800	12/68	1.8-30	1200	400	1600	-
(A) (2/72)	Micro 1600	12/71	1.8-30	1200	400	1600	-
NCR	304	1/60	10.0	5	2	7	X
Dayton, Ohio	310	5/61	2.5	8	0	8	X
(A) (1/72)	315	5/62	7.0	425	300	725	-
	315 RMC	9/65	9.0	125	50	175	-
	390	5/61	0.8	250	375	625	-
	500	10/65	1.0	1000	1700	2700	-
	Century 50	2/71	1.6	200	-	200	-
	Century 100	9/68	2.6	1500	525	2025	-
	Century 200	6/69	7.0	460	215	765	-
	Century 300	2/72	20.0	0	0	0	-
Philco	1000	6/63	7.0	16	-	-	X
Willow Grove, Pa.	200-210,211	10/58	40.0	16	-	-	X
(N) (1/69)	2000-212	1/63	52.0	12	-	-	X
RCA (see UNIVAC - Series 70)							
Raytheon	250	12/60	1.2	115	20	135	X
Santa Ana, Calif.	440	3/64	3.6	20	-	20	X
(A)	520	10/65	3.2	26	1	27	X
(6/71)	703	10/67	12.5 (S)	172	31	203	2
	704	3/70	8.0 (S)	100	35	135	50
	706	5/69	19.0 (S)	60	14	74	0
Scientific Control Corp.	4700	4/69	1.8	18	0	18	-
Dallas, Texas	DCT-132	5/69	0.9	24	35	59	-
(A) (10/71)							
Standard Computer Corp.	IC 4000	12/68	9.0	9	0	9	2
Los Angeles, Calif.	IC 6000-6000/E	5/67	16.0	3	0	3	-
(A) (2/72)	IC 7000	8/70	17.0	3	0	4	1
	IC-9000	5/71	400.0 (S)	1	0	1	-
Systems Engineering Laboratories	SYSTEMS 810B	9/68	2.6	156	7	163	(N)
Ft. Luaderdale, Fla.	SYSTEMS 72	9/71	1.0	12	3	15	(N)
(A)	SYSTEMS 85	7/72	6.0	-	-	-	(N)
(2/72)	SYSTEMS 86	6/70	10.0	23	1	24	(N)
UNIVAC Div. of Sperry Rand	I & II	3/51 & 11/57	25.0	23	-	-	X
New York, N.Y.	III	8/62	21.0	25	6	31	X
(A) (2/71)	File Computers	8/56	15.0	13	-	-	X
	Solid-State 80 I,II, 90, I, II, & Step	8/58	8.0	210	-	-	X
	418	6/63	11.0	76	36	112	20 E
	490 Series	12/61	30.0	75	11	86	35 E

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
UNIVAC Div. of Sperry Rand (contd)	1004	2/63	1.9	1501	628	2129	20 E
	1005	4/66	2.4	637	299	936	90 E
	1050	9/63	8.5	138	62	200	10 E
	1100 Series (except 1107, 1108)	12/50	35.0	9	0	9	X
	1107	10/62	57.0	8	3	11	X
	1108	9/65	68.0	87	114	201	75 E
	9200	6/67	1.5	1051	822	1873	850 E
	9300	9/67	3.4	387	49	436	550 E
	9400	5/69	7.0	8	0	8	60 E
	LARC	5/60	135.0	2	0	2	-
UNIVAC - Series 70	301	2/61	7.0	184	-	-	-
Blue Bell, Pa.	501	6/59	14.0-18.0	16	-	-	-
(A) (1/1/72)	601	11/62	14.0-35.0	3	-	-	-
	3301	7/64	17.0-35.0	60	-	-	-
	Spectra 70/15, 25	9/65	4.3	17	-	-	-
	Spectra 70/35	1/67	9.2	112	-	-	-
	Spectra 70/45	11/65	22.5	330	-	-	-
	Spectra 70/46	-	33.5	30	-	-	-
	Spectra 70/55	11/66	34.0	13	-	-	-
	Spectra 70/60	11/70	32.0	12	-	-	-
	Spectra 70/61	4/70	42.0	9	-	-	-
	70/2	5/71	16.0	51	-	-	-
	70/3	9/71	25.0	3	-	-	-
	70/6	9/71	25.0	11	-	-	-
	70/7	12/71	35.0	1	-	-	-
Varian Data Machines	620	11/65	-	-	-	75	X
Newport Beach, Calif.	620i	6/67	-	-	-	1300	-
(A) (2/72)	R-260i	4/69	-	-	-	80	-
	520/DC, 520i	12/69;10/68	-	-	-	350	-
	620/f	11/70	-	-	-	150	-
	620/L	4/71	-	-	-	330	-
Xerox Data Systems	XDS-92	4/65	1.5	10-60	2	12-62	-
El Segundo, Calif.	XDS-910	8/62	2.0	150-170	7-10	157-180	-
(N)	XDS-920	9/62	2.9	93-120	5-12	98-132	-
(2/72)	XDS-925	12/64	3.0	20	1	21	-
	XDS-930	6/64	3.4	159	14	173	-
	XDS-940	4/66	14.0	28-35	0	28-35	-
	XDS-9300	11/64	8.5	21-25	1	22-26	-
	Sigma 2	12/66	1.8	60-110	10-15	70-125	-
	Sigma 3	12/69	2.0	10	0	10	-
	Sigma 5	8/67	6.0	15-40	6-18	21-58	-
	Sigma 6	6/70	12.0	-	-	-	-
	Sigma 7	12/66	12.0	24-35	5-9	29-44	-
	Sigma 9	-	35.0	-	-	-	-

C.a

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 723: BEHIND THE EIGHT BALL

In every installation there's one wise guy who knows all the answers. Tom had that distinction in the computer center and it was no surprise when he looked over Bill's shoulder and said, "That's an oldie. They're in alphabetical order," pointing to the numbers 8, 8 000 000 000, 8 000 000 0008, 8 000 000 018, and 8 018 000 000 on the sheet Bill was staring at.

"I know", said Bill. "But that's not the question. I'm trying to figure out what the twentieth number in the sequence would be."

"Why in the world do you want to know that?"

"Well, it's the problem this month in the ASEM Newsletter and there's a prize for the first correct solution. I'm thinking of writing a program to do it."

"How would you go about programming something like that? It ought to be simpler just to list the numbers."

"I thought so, but I keep missing some numbers because I'm unconsciously thinking in terms of numerical order. I want to put eighty before eight hundred, for example."

"Well, let's see, what are you going to have when you get through the eights?"

"I don't think I'll ever get through the eights," Bill said. "There's eight billion, eight trillion, eight quadrillion, etc. No limit."

Tom looked a little more closely at the list. "Why don't you have eight billion eighteen hundred for your fifth number? Hundred comes before million."

"Yes, but eighteen hundred should more properly be one thousand, eight hundred. I'm not using numbers in that form."

What number will be twentieth on the list?

Solution to Problem 722: Cleaning Up?

The probability of getting all P pictures in a sample of size n is: $\sum_{i=0}^{P} (-1)^i \binom{P}{i} \left(1-\frac{i}{P}\right)^n$. With P = 10, n = 20, this is approximately = .2147. Hence Sam is in for a big disappointment.

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

CALENDAR OF COMING EVENTS

Mar. 6-8, 1972: 18th Annual Systems Management Conference, Americana Hotel, New York City, N. Y. / contact: Miss G. De Sapio, Conference Information Coordinator, American Management Association, Inc., AMA Bldg., 135 West 50th St., New York, N. Y. 10020

Mar. 7-10, 1972: Computer Graphics in Medicine, ACM SIGGRAPH Symposium, Point Park College, Pittsburgh, Pa. / contact: Dr. John D. Canter, Chmn., Point Park College, 201 Wood St., Pittsburgh, Pa. 15222

Mar. 8-9, 1972: Annual Spring Conference of the Association for Systems Management (Toronto Chapter), Royal York Hotel, Toronto, Ontario, Canada / contact: Mr. Donald T. Laughton, North American Life Assurance Co., 105 Adelaid St. West, Toronto 1, Ontario, Canada

Mar. 8-10, 1972: Fifth Annual Simulation Symposium, Tampa, Fla. / contact: Annual Simulation Symposium, P.O. Box 1155, Tampa, Fla. 33601

Mar. 13-14, 1972: ASM Organization Planning Conference, Pontchartrain Hotel, Detroit, Mich. / contact: John N. Gilbride, Association for Systems Management, 24587 Bagley Rd., Cleveland, Ohio 44138

Mar. 20-23, 1972: IEEE International Convention & Exhibition, Coliseum & N. Y. Hilton Hotel, New York, N. Y. / contact: IEEE Headquarters, 345 E. 47th St., New York, N. Y. 10017

Mar. 26-29, 1972: IEEE International Convention, Coliseum & N.Y. Hilton Hotel, New York, N.Y. / contact: J. H. Schumacher, IEEE, 345 E. 475th St., New York, N.Y. 10017

April 5-8, 1972: "Teaching Systems '72", International Congress, Berlin Congress Hall, Berlin, Germany / contact: AMK Berlin, Ausstellungs-Messe-Kongress-GmbH, Abt. Presse und Public Relations, D 1000 Berlin 19, Messedamm 22, Germany

April 8, 1972: ACM Northwest Regional Conference, Miyako Hotel, San Francisco, Calif. / contact: Robert L. Glass, 3332 Hunter Blvd. S., Seattle, Wash. 98418

April 9-12, 1972: International Business Forms Industries 19th Annual Meeting, El San Juan Hotel, San Juan, Puerto Rico / contact: International Business Forms Industries/PIA, 1730 North Lynn St., Arlington, Va. 22209

April 11-13, 1972: Univac Users Association Spring Conference, Shamrock-Hilton Hotel, Houston, Texas / contact: C. J. Rachel, Executive Secretary, UUA, Univac Div. of Sperry Rand Corp., P.O. Box 500, Blue Bell, Pa. 19422

April 16-19, 1972: Meeting of National Federation of NCR Computer User Groups, National Cash Register Co., Dayton, Ohio / contact: Public Relations Dept., National Cash Register Co., Dayton, Ohio 45409

April 17-19, 1972: Ninth Annual Meeting and Technical Conference of the Numerical Control Society, Palmer House, Chicago, Ill. / contact: William H. White, Numerical Control Society, 44 Nassau St., Princeton, N. J. 08540

April 25-28, 1972: Conference on Computer Aided Design, Univ. of Southampton, Southampton, England / contact: IEE Office, Savoy Place, London W.C. 2, England

May 11-13, 1972: DECUS Spring Symposium, Parker House, Boston, Mass. / contact: Digital Equipment Computer Users Society, 145 Main St., Maynard, Mass. 01754

May 15-18, 1972: 5th Australian Computer Conference, Brisbane, Queensland, Australia / contact: A. W. Goldsworthy, Chmn., Australian Computer Society, Inc., Computer Center, Australian National Univ., P. O. Box 4, Canberra, A.C.T. 2600

May 15-18, 1972: Spring Joint Computer Conference, Convention Ctr., Atlantic City, N.J. / contact: AFIPS Headquarters, 210 Summit Ave., Montvale, N.J. 07645

May 16-17, 1972: IIT Research Institute Second International Symposium on Industrial Robots, Chicago, Ill. / contact: K. G. Johnson, Symposium Chairman, IIT Research Institute, 10 West 35 St., Chicago, Ill. 60616

May 21-24, 1972: 7th Annual Mass Retailers' Convention and Product Exposition, Marriott Motor Hotel, Atlanta, Ga. / contact: MRI Headquarters, 570 Seventh Ave., New York, N. Y. 10018

May 21-24, 1972: 1972 International Systems Meeting, Fontainebleau Hotel, Miami Beach, Fla. / contact: R. B. McCaffrey, Assoc. for Systems Management, 24587 Bagley Rd., Cleveland, Ohio 44138

May 23-25, 1972: Annual Society for Information Display International Symposium. Jack Tar Hotel, San Francisco, Calif. / contact: Mr. J. L. Simonds, Eastman Kodak Co., Rochester, N. Y. 14650

May 24-26, 1972: Second Annual Regulatory Information Systems Conference, Chase-Park Plaza Hotel, St. Louis, Mo. / contact: William R. Clark, Missouri Public Service Commission, Jefferson City, Mo. 65101

June 12-14, 1972: Conference on Computers in the Undergraduate Curricula, Sheraton-Biltmore Hotel and Georgia Institute of Technology, Atlanta, Ga. / contact: Computer Sciences Project, Southern Regional Education Board, 130 Sixth St., N.W., Atlanta, Ga. 30313

June 12-14, 1972: International Conference on Communications, Sheraton Hotel, Philadelphia, Pa. / contact: Stanley Zebrowitz, Philco-Ford Corp., 4700 Wissahickon Ave., Philadelphia, Pa. 19144

June 12-14, 1972: Third International Congress on Advances in Automated Analysis, New York Hilton Hotel, New York, N.Y. / contact: Dept. R 39, Technicon Instruments Corp., Tarrytown, N.Y. 10591

June 15-16, 1972: ACM SIG/CPR Tenth Annual Conference on Computer Personnel Research, Ontario Institute for Studies in Education, Univ. of Toronto. Toronto, Canada / contact: SIGCPR, c/o ACM, 1133 Ave. of the Americas, New York, N.Y. 10036

June 19-21, 1972: International Symposium on Fault-Tolerant Computing, Boston, Mass. / contact: John Kirkley, IEEE Computer Society, 8949 Reseda Blvd., Suite 202, Northridge, Calif. 91324

June 19-21, 1972: Ninth Annual Design Automation Workshop, Statler Hilton Hotel, Dallas, Tex. / contact: R. B. Hitchcock, IBM Watson Research Center, P.O. Box 218, Yorktown Heights, N.Y. 10598

June 27-30, 1972: DPMA 1972 International Data Processing Conference & Business Exposition, New York Hilton at Rockefeller Center, New York, N.Y. / contact: Richard H. Torp, (conference director), or Thomas W. Waters (exposition manager), Data Processing Management Association, 505 Busse Hwy., Park Ridge, Ill. 60068

July 3-6, 1972: First Conference on Management Science and Computer Applications in Developing Countries, Cairo Hilton, Cairo, U.A.R. / contact: Dr. Mostafa El Agizy or Dr. William H. Evers, IBM Corporation, Armonk, N.Y. 10504

Sept. 19-22, 1972: Western Electronic Show & Convention (WESCON), Los Angeles Convention Ctr., Los Angeles, Calif. / contact: WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005

Oct. 3-5, 1972: AFIPS and IPSJ USA-Japan Computer Conference, Tokyo, Japan / contact: Robert B. Steel, Informatics Inc., 21050 Vanowen St., Canoga Park, Calif. 91303

Oct. 8-11, 1972: International Conference on Systems, Man and Cybernetics, Shoreham Hotel, Washington, D.C. / contact: K. S. Nurendra, Yale Univ., 10 Hill House, New Haven, Conn. 06520

Oct. 16-20, 1972: IBI-ICC World Conference on Informatics in Government, Venice, Italy / contact: Intergovernmental Bureau for Informatics (IBI-ICC), 23 Viale Civiltà del Lavoro, 00144 Rome, Italy

Nov. 1-3, 1972: Northeast Electronics Research & Engineering Meeting (NEREM), Boston, Mass. / contact: IEEE Boston Office, 31 Channing St., Newton, Mass. 02158

Nov. 9-10, 1972: Canadian Symposium on Communications, Queen Elizabeth Hotel, Montreal, Quebec, Canada / contact: IEEE Headquarters, Technical Conference Svcs., 345 E. 47th St., New York, N.Y. 10017

Nov. 13-16, 1972: Fall Joint Computer Conference, Convention Center, Las Vegas, Nev. / contact: AFIPS Headquarters, 210 Summit Ave., Montvale, N.J. 07645

Nov. 15-17, 1972: Danish IAG-IFIP International Conference on Data Service Centres, Copenhagen, Denmark / contact: Danish IAG (DIAG), c/o Danish EDP-Council, 58 Bredgade, DK 1260 Copenhagen K, Denmark

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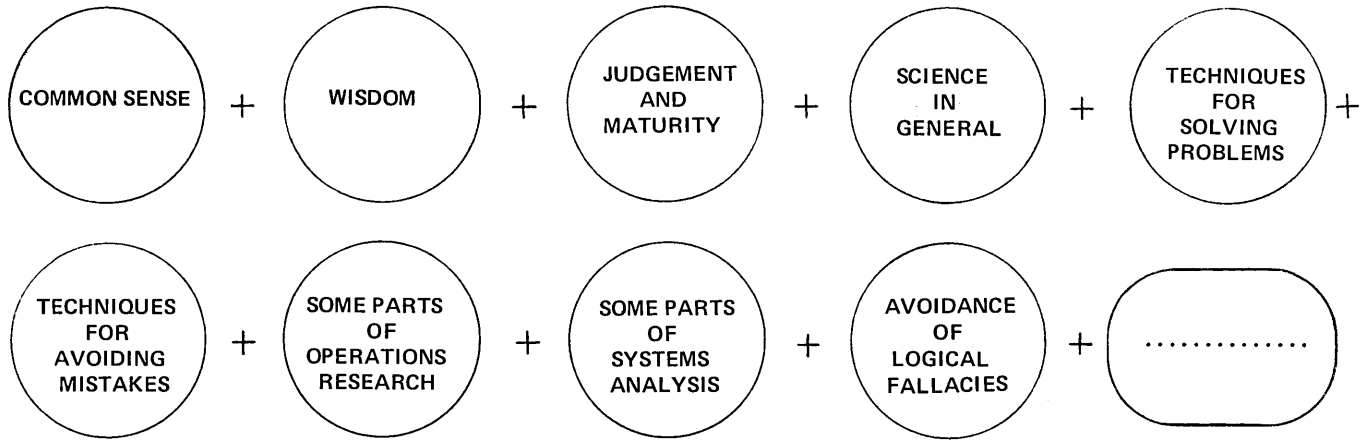

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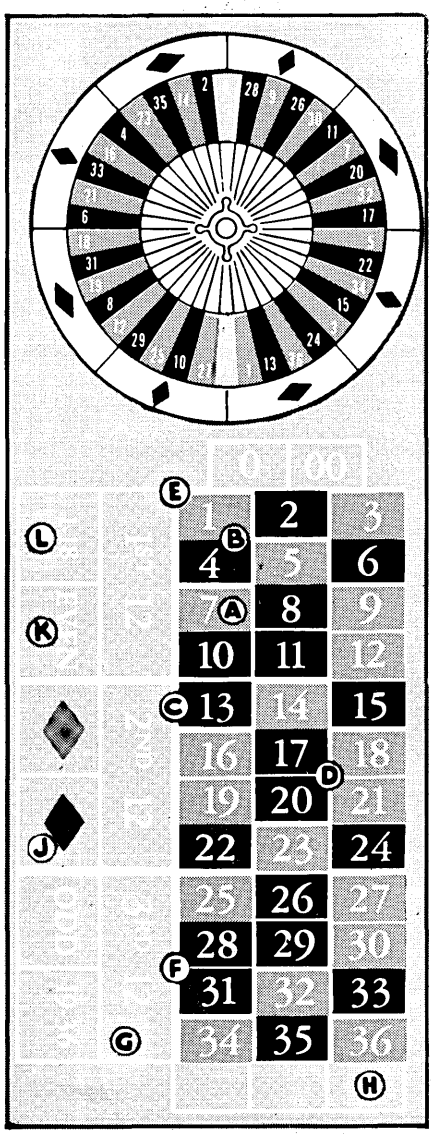

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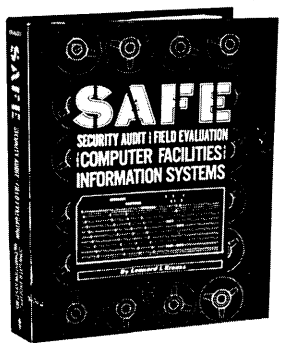

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