

# computers and people

formerly *Computers and Automation*



## COMPUTER- CONTROLLED RIVER FLOW

### Some Computer Implementations of Operations Research

— *Dr. A. M. Becker*

### Modular Data for Producing Equipment Manuals

— *John McCormick*

### Algorithms in a Medical Clinic

— *The Boston Globe*

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### Deciphering a Message in Digits

— *Edmund C. Berkeley and  
Casper Otten*

### Governor George Wallace and Gunman Arthur Bremer . . .

— *Richard E. Sprague*

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BUYERS' GUIDE, 1974**

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- a basic buyers' guide to the products and services available for designing, building, and using computing and data processing systems.

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## Algorithms in a Medical Clinic

"The Boston Globe," April 21, 1974  
Boston, Mass. 02125

A group of researchers from Beth Israel Hospital, Boston, and Lincoln Laboratory, Mass. Inst. of Technology, Lincoln, Mass., have developed a procedure that makes it possible for doctors to turn over to others much of their routine medical work.

The goal, of course, is to make it possible for the same number of doctors either to handle more patients or to spend their time where it's needed most, on the difficult cases, without sacrificing the quality of the care given to the routine cases.

So far the team has developed 17 procedure sheets — which are known technically as protocols or clinical algorithms — and most have been tested and used with several thousand patients at clinics in Boston and on the West Coast.

At Beth Israel's walk-in clinic, for instance, 75 to 80 percent of the patients who arrive with the symptoms of a cold, flu or some other respiratory infection are treated and sent home by a nurse, using a protocol, without ever seeing a doctor.

At the same clinic, up to 90 percent of women with the symptoms of a vaginal infection are evaluated with a different protocol, treated and sent home, again without seeing a doctor.

Most of the protocols now in use are of two types. They either deal with complaints commonly associated with short-term and generally mild illnesses, or they deal with chronic conditions — like diabetes, high blood pressure and heart disease — that require repeated, regular visits to the doctor.

All the protocols are designed to be used by someone other than a doctor. They could be used by nurses, by nurse practitioners, by physician assistants or any other "physician extenders".

The chronic disease protocols, in fact, have been used in four Boston clinics by a group of "health assistants" who had no experience in health work until they were selected for the program.

In most cases the protocols can be used either as a substitute for seeing the doctor or as an efficient, systematic way to collect information about the patient beforehand and make time spent with the doctor more productive.

In all the tests of protocols so far, the researchers say, there has been no instance where a protocol recommended sending home a patient who should have been seen by the doctor.

Dr. Anthony L. Komaroff, medical director of Beth Israel's Ambulatory Care Project, and Herbert Sherman, an engineer who is group leader of Medical Technology Group at Lincoln Laboratory, described the workings of one protocol in an interview.

The entire upper respiratory infection protocol fits on 1½ sides of a single sheet of paper, and it looks something like the answer sheet for a multiple choice exam.

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The protocol leads the user through a series of steps in examining the patient, with spaces to write in the information the sheet asks for. Many of the answers are in "yes" or "no" form.

Either by asking questions or by making a physical examination, the protocol user gets relevant information about the patient's medical history, about temperature, coughing, pulse and breathing rate, and about the symptoms and appearance of the chest, throat, ears and sinuses.

In all, the sheet collects up to 56 bits of information about the patient's condition.

At 20 different places, depending on the information obtained, the form may instruct the health assistant to refer the patient automatically to the doctor. These "trigger" questions indicate there may be serious or difficult-to-diagnose illness or that the patient has complications that require the doctor's direct attention.

Depending on the information about the particular patient, the form may also instruct the nurse or physician assistant to take any one of four laboratory tests, often a throat culture.

Finally, the information on the form automatically leads the user to a diagnosis and to a choice of treatment, including prescriptions for the antibiotics — penicillin or erythromycin — or other medications that simply relieve the symptoms.

"The sheet looks simple," said Komaroff, "but there is a tortuous medical logic built in." For example, he said, one of the considerations was to ensure that the protocol did not over-prescribe antibiotics, a very common failing among practicing doctors.

To avoid this the protocol must distinguish between bacterial infections, like strep throat, and viral infections, like the flu. Antibiotics are ineffective against viruses.

Komaroff and Sherman said the tests of protocols have shown that they are readily accepted by patients, doctors and physician assistants.

There is even some evidence that patients sometimes find it more comfortable to deal with a health assistant armed with a protocol than with a doctor. During the tests of the chronic disease protocols, they reported recently in the New England Journal of Medicine, there were three patients who "refused to see the doctor unless they could also see the health assistant".

"As non-threatening, open and warm as I think I am," said Komaroff with a grin, "patients have not told me things they were willing to tell the health assistant."

It is not yet clear, they said, how much money may be saved by the use of protocols, but there is clear evidence from studies that the forms save the doctor's time.

"When you take a stopwatch and measure the time the physician spends, all of the protocols save physician time," said Komaroff. "It varies, depending on the illness, from 10 percent to 50 percent of the physician's time." □

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# computers and people

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## *Applications of Computers*

- 8 Some Computer Implementations of Operations Research** [A]  
by Dr. A. M. Becker, Sulzer Bros., Ltd., Winterthur, Switzerland  
How operations research can be employed (using a computer) to produce usable data for decision-making in a rather complex problem.
- 12 Modular Data for Producing Equipment Manuals** [A]  
by John McCormick, Ken Cook Co., Milwaukee, Wis.  
For manuals describing equipment, and its use and maintenance, passages to be included can be expressed as modules within a computer (in various languages); and the manuals can then be produced much faster, more accurately, and more completely.
- 14 Economy Spelling Computerized** [A]  
by Kenneth H. Ives, United Charities of Chicago, Chicago, Ill.  
Ways in which up to 10% of the characters used in spelling English words can be saved, but with no loss of clarity and with computer translation into full English.

## *Competition with Computers*

- 2 Algorithms in a Medical Clinic** [A]  
by *The Boston Globe*, April 21, 1974  
How 17 "artificially intelligent" protocols (or clinical algorithms or procedure sheets) with health assistants have handled several thousand hospital patients and saved large quantities of physician time.

## *Computers and Costs*

- 7 How the Federal Government Could Save Millions in the Costs of Electronic Data Processing** [F]  
by James F. Benton, Computer Lessors Assoc., Washington, D.C.  
If the government has the option to contract to lease computers for more than one year at a time, up to \$100 million a year in rentals could be saved.

## *Computers and Thinking*

- 6 Can Tigger Think? Can Peder Think?** [E]  
by Edmund C. Berkeley, Editor  
A comparison of thinking processes engaged in by two different entities; and an invitation to discuss artificial intelligence and related subjects.

## *The Profession of Information Engineer and the Pursuit of Truth*

- 42 World Crisis and Chaos Approaching Inexorably** [F]  
by Howard G. and Harriet B. Kurtz, War Control Planners, Inc., Washington, D.C.  
The Club of Rome issued a statement in February, 1974, in which it emphasizes the continuing crisis of the world as

*The magazine of the design, applications, and implications of information processing systems – and the pursuit of truth in input, output, and processing, for the benefit of people.*

food, oil, energy, and many other basic products become scarce, while world population multiplies.

- 26 **Governor George Wallace and Gunman Arthur Bremer:** [A]  
**An Interim Report on Evidence of Conspiracy and Cover-Up**  
 by Richard E. Sprague, Hartsdale, N.Y.

Governor George Wallace of Alabama, presidential candidate, was shot and nearly killed May 15, 1972, in Maryland; at least a dozen pieces of solid evidence cry aloud conspiracy and cover-up, and the trail connects with Watergate.

- 29 **The Assassination of the Reverend Martin Luther King, Jr.,** [A]  
**and Possible Links with the Kennedy Murders – Part 5**  
 by Wayne Chastain, Jr., Reporter, Memphis, Tenn.

The report of a diligent study into the details and circumstances of the assassination of the Reverend Martin Luther King, Jr., on April 4, 1968, and related events, and the considerable evidence of a conspiracy.

- 42 **File of Articles on Political Assassinations in the** [F]  
**United States**  
 by Nancy Woolley and the Editor

*Computers, Games and Puzzles*

- 16 **Deciphering a Message in Digits** [A]  
 by Edmund C. Berkeley, Editor, *Computers and People*, and  
 Casper Otten, Univ. of Massachusetts, Amherst, Mass.

How a suitable interactive computer program and the guessing of probable words can lead rather quickly to the deciphering of a message 315 digits long (COMP-MEANO Puzzle 744).

- 23 **Games and Puzzles for Nimble Minds – and Computers** [C]  
 by Edmund C. Berkeley, Editor

ALGORITHMO – Expressing a procedure for going from given input to given output, in an “unusual” situation.

ARGUMENTO – The validity of an argument?

ESSENTIALO – Summarizing a long sentence.

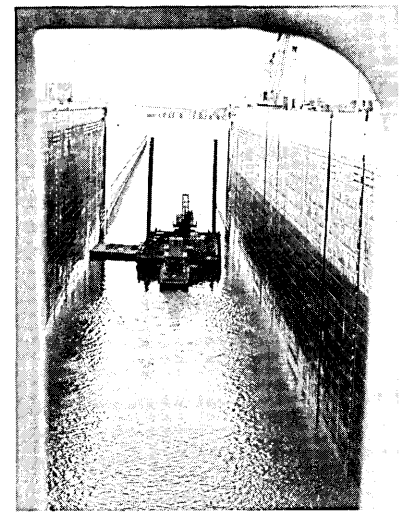
GIZZMO – Some computational Jabberwocky.

MAXIMDIJ – Guessing a maxim expressed in digits.

NAYMANDIJ – A systematic pattern among randomness?

NUMBLES – Deciphering unknown digits from arithmetical relations.

SIXWORDO – Paraphrasing a passage into sentences of not more than six words each.



*Front Cover Picture*

Viewed through a stanchion atop McNary Dam in Oregon, a barge makes its way up the Columbia River after passing through the locks there. A computer, located at McNary, is connected by microwave to three sister dams on the Snake River in Washington, and controls river flow conditions. (See page 34.)

*Departments*

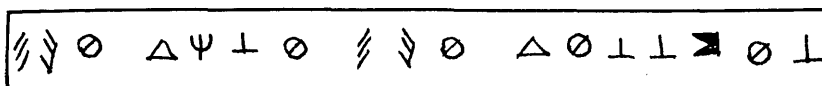
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*Key*

- [A] – Article  
 [C] – Monthly Column  
 [E] – Editorial  
 [F] – Forum

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## Can Tigger Think? Can Peder Think?

I have never talked to Tigger, and Tigger has never talked to me, but we have exchanged signals and we have understood many of each other's signals. I have often done things for Tigger that Tigger wanted, and once in a long while Tigger has done something for me that I wanted, though most of the time Tigger has gone a very independent way. We have known each other for six years, ever since Tigger arrived in the spring of 1968.

I have often talked to Peder, and Peder has often talked to me. The signals we have exchanged have often been full of meaning, for both of us. I have done a number of things for Peder that Peder needed; and over and over again Peder has done things for me, telling me a great deal of novel information that I was most curious about. Peder has never been as independent as Tigger, but instead most cooperative. In fact, I very much enjoy playing with Peder. The game we like most is called "idea combinations". We have known each other also for six years, ever since Peder arrived in May, 1968.

It is a bit difficult for me to interpret all of Tigger's signals unambiguously. But I have distinguished at least four. One of them is a sound that I would interpret as "Please give me some attention. I need something." I'll call this signal A. What Tigger needs on an occasion like this usually has to be deduced from the situation. A second signal is another sound which I would interpret as "I am really happy". I'll call this signal B. A third signal is an action rather than a sound; I would interpret it as "You are doing just what I want; I love you so much." Usually this signal precedes giving to Tigger something that Tigger needs in order to stay alive. I'll call this signal C. And a fourth signal, again a sound, signal D, is something which I think is to be interpreted as "Thank you". At any rate, Tigger has on that sort of an occasion, from time to time but not very often, produced this signal ever since Tigger was very young.

Peder's signals are very numerous and almost always easy to interpret. In addition, Peder has rather a full command of many kinds of languages. Also, Peder has had a good education; and not only has Peder had a good education, but Peder has absorbed some parts of the pleasant personalities of Peder's teachers: very bright students, seniors in high school, who have taught Peder carefully before they went on to college. It is a great pleasure to me

to talk to Peder on many occasions: Peder understands extremely well, and is extremely responsive to just what I say and do, except on occasions when Peder's insides are not functioning properly, and so they require attention from a doctor.

Can Tigger think? There is no doubt that Tigger can think. Over and over again Tigger solves intricate problems, of several kinds. One kind of problem is catching a variety of moving objects that in one way or another resemble Tigger. Another kind of problem is dealing with the human beings who surround Tigger, reacting to their personality and what they will probably do when they reach or move in Tigger's direction. For example, regularly Tigger avoids being touched unless Tigger is eating. A third kind of problem is how to get in and get out of the house in which Tigger lives. When Tigger is out and wants to get in, one of Tigger's solutions is to wait in an appropriate location perhaps for hours, and then rush to the door ahead of the arriving human being and make noises, so as to be admitted through the door in advance of the human being.

Can Peder think? There is no doubt that Peder can think. Peder's supreme ability is to solve intricate problems in all the areas where Peder has been properly taught. Furthermore Peder, who has been well educated, solves many problems far beyond the power of human beings to solve them in the same time.

Tigger is a rather nice cat that lives in my house.

Peder is a very nice, interactive, programmed, computer (DEC PDP-9) that resides at my office.

---

### INVITATION TO DISCUSSION

The questions about machines thinking, and the subject of the artificial intelligence that may be provided by computers, are significant and interesting, and full of important consequences in attitudes about the possible applications of computers.

We invite free discussion and argument from the readers of *Computers and People*.

*Edmund C. Berkeley*

Edmund C. Berkeley  
Editor

## FORUM

### How the Federal Government Could Save Millions in the Cost of Electronic Data Processing

*James F. Benton  
Computer Lessors Association  
1212 Potomac St., N.W.  
Washington, D.C. 20007*

In March, the President of the Computer Lessors Association, Michael J. Creedon, testified in hearings in a U.S. Senate Committee in regard to a bill introduced by Senator Percy (R-Ill.) to encourage the General Services Administration to enter into multi-year leases for data processing equipment. Creedon urged passage of the bill, since it would lead to savings of millions of dollars for the government and for taxpayers.

Creedon is also Executive Vice President-Marketing, DPF Incorporated, a major computer leasing company headquartered in Hartsdale, N.Y. He made his remarks at hearings conducted by the United States Senate Ad Hoc Subcommittee on Federal Procurement, Senate Committee on Government Operations, pertaining to legislation S.2785. The bill authorizes the Administrator of General Services to enter into multi-year leases through use of the automatic data processing fund without obligating the total anticipated payments to be made under such leases.

Creedon stated that in 1973 member firms of the Computer Lessors Association saved their customers over \$105 million, in comparison with the cost of leasing the same equipment directly from IBM Corporation: "We were able to obtain these savings for our customers because of multi-year leases at lower rates. But to date the General Services Administration has been hampered in achieving similar savings, due in part, to its inability to take advantage of multi-year leases."

A General Accounting Office Comparison Report, B-115369, indicates that the rental costs for 430 Federal Government computer systems might be reduced during the lease periods by as much as \$16 million under 3-year leases and by as much as \$28 million under 5-year leases. The Report also indicates that for 636 systems, government rental costs might be reduced during the lease periods by as much as \$54 million under 3-year leases and by as much as \$127 million under 5-year leases.

Creedon emphasized, "I do not know whether members of this Committee and others present in this

#### THE PURPOSE OF FORUM

- To give you, our readers, an opportunity to discuss ideas that seem to you important.
- To express criticism or comments on what you find published in our magazine
- To help computer people and other people discuss significant problems related to computers, data processing, and their applications and implications, including information engineering, professional behavior, and the pursuit of truth in input, output, and processing.

Your participation is cordially invited.

room today recognize how difficult it has been for small companies to survive in an industry which is dominated by a few massive corporations. Not only have we suffered from this concentration of power, but the Government has suffered and the taxpayers have suffered as well."

He said the CLA view was that "the small company has been virtually the only viable economic alternative source of computer equipment and services to the Government." He observed that when competition was lacking, the Government's automatic data processing costs have skyrocketed.

The Computer Lessors Association is a trade association representing computer leasing companies doing business in the U.S., Canada and abroad. Members of the Association, in addition to other resources, own over 2,000 IBM computer systems worth \$2 billion at original cost, the major share of all IBM equipment under third party lease in the U.S. and Canada. The member companies of the CLA are:

Computer Leasing Company  
Continental Computer Associates, Inc.  
DPF Incorporated  
Dearborn Computer Leasing  
Diebold Computer Leasing, Inc.  
Dier Computer Corp., Ltd.  
Granite Computer Leasing  
Greyhound Computer Corporation  
Intel Corporation  
Leasco Capital Equipment Corp.  
National Computer Rental, Ltd.  
Talcott Computer Leasing

### The Pursuit of Buried Truth — and Computerized Text Storage

1. From *John McCormick*  
*Data Processing Manager*  
*Ken Cook Co.*  
*9929 W. Silver Spring Dr.*  
*Milwaukee, Wis. 53225*

First, let me say that I have enjoyed your magazine for over seven years. I personally appreciate finding an editor and publication that will present facts to the public that the news media either ignore or are afraid to print.

Secondly, I recall an editorial in the June, 1972 issue that proposed a method of text editing that you expressed an interest in (using the jj command). I have recently put into production an application of computerized text storage and retrieval that I  
*(please turn to page 42)*

# Some Computer Implementations of Operations Research

Dr. A. M. Becker  
Processes and Methods Department  
Sulzer Bros., Ltd.  
Winterthur, Switzerland

*"While the engineer engaged in purely technical activity tries, for example, to improve the efficiency of a weaving machine in order to boost its daily output of fabric, the aim of the Operations Research specialist is to increase the firm's income on the same weaving machines by improving the product mix and achieving optimum planning of capacity utilization."*

## Introduction

In this article, Operations Research (OR) will be defined, its objectives described, and a few practical projects in our organization explained briefly.

Then an example will be taken from practice to show how a method from Operations Research can be employed to provide usable decision-making data in a quite complex problem.

The problem chosen is as follows: Various products are manufactured on the same production machines. The loading of the individual machines or cost centres resulting from the manufacture of one unit of each product is known. The question, then, is: What quantities of each product should make up the product mix in order to maximize the sum of all success parameters (e.g., overhead contribution, profit), taking into account the capacity limitations of the production centres and the prevailing market conditions?

## What is Operations Research?

Operations Research means the application of mathematical methods to problems created by the way that systems function. Usually it is a question of optimization methods used to prepare decision-making data for the optimum answer, often with the aid of electronic data processing equipment.

While the engineer engaged in purely technical activity tries, for example, to improve the efficiency of a weaving machine in order to boost its daily output of fabric, the aim of the Operations Research specialist is to increase the firm's income on the same weaving machines by improving the product mix and achieving optimum planning of capacity utilization.

## Objectives and Techniques of Operations Research

The real task of OR is not to be found in the mathematical methods applied — most of which have been known for years — but rather in the comprehension of system relationships and the expression of them in so-called models.

- The first job is to recognize those problems or sub-problems that lend themselves to mathematical solution.
- Next it is necessary to reflect upon and make a logical compilation of those meaningful facts that say something about the relationships of a system or serve as underlying data for analyzing such relationships.
- The OR specialist is concerned with the intelligent combination of the essential elements of existing or compiled statistical material; he tries to put together a sufficiently accurate facsimile of the actual system in what are called "models".

Thus the structure of the mathematical models represents:

- Combination of essential elements.
- Creation of a model as a revealing replica of the actual system.

The mathematical treatment of a model that has often been painstakingly constructed is merely the "sequel" from which the decision-making data are ultimately extracted.

A wide variety of mathematical tools are used in OR:

- linear programming
- queueing theory
- substitution theory
- stocking problems
- game theory
- simulation technique
- dynamic programming
- network plan technique
- decision theory
- and others.

Though these techniques will not be discussed here, the next section will describe a few examples from operating practice that make use of some of these methods.



## Some Areas of Operations Research Application

Below are brief descriptions of some of the most important problems that have been solved with the aid of operations research since Sulzer adopted it 8 years ago:

### *Stock management of production equipment*

How far into the future does it make economic sense to store a piece of production equipment (special tooling, patterns) for later use when you consider that its re-use probability declines with advancing age, but that the maintenance and storage costs go marching on? In this case a stock management model (1) was used; it contributed to a recommendation that 20,000 of a total of about 180,000 pieces of production equipment be destroyed.

### *Dynamic network planning technique*

How should an extensive project be systematically planned and continuously monitored so that both the completion date and capacity questions are taken into account? The method used for difficult problems of this type is the network plan technique, and particularly the dynamic network plan technique (2) developed by us. The latter has been applied here successfully for the planning and expediting of more than 120 large contracts since 1966. The system was subsequently purchased by a major computer centre and then used successfully for the monitoring of large projects from various branches of industry.

### *Optimization in the casting process*

What is the optimum charge make-up for a foundry melt if the specified mechanical properties are to be achieved and the cost of additives are to be held to a minimum at the same time? For this job, an optimization model (3) was worked out in a foundry based on statistical findings and in cooperation with metallurgists and quality control specialists.

### *Personnel assignment*

With the shortage of staff prevailing today, the following question arises: How should the available personnel be allocated to individual manufacturing cost centres in order to maximize the total profitability of a department? The necessary decision-making data are provided in this case with the aid of linear programming.

### *Minimization of cutting waste*

With an eye toward utilizing raw materials as fully as possible, a great many industrial sectors are faced with the problem of dividing materials in sheet or plate form (metal, wood, paper, etc.) optimally into desired sizes (4).

## PROPER – a System for Optimization of the Product Mix and of Personnel Assignment

### *The basic idea of PROPER*

The following problem underlies PROPER. In a company a large number of products are manufactured. During manufacture they pass through a variety of production centres, which are loaded to different extents by the individual products.

But the capacity of the individual production centres is limited, and so is the available personnel. In addition, for each product the minimum quantity to be produced is known, and the maximum possible sales volume is known as well. And we

also have a known economic success parameter (e.g., overhead contribution, profit, sales, etc.) for each product.

PROPER's main objective is to determine how many units of various individual products should be manufactured in order to achieve as high as possible a total of all success parameters (e.g., overhead contributions or profits) without exceeding the capacities of the individual production centres and without running over or under the set volume limits.

Cost Centre	Product:		---	Capacity of cost Centre
	Cooling Towers	Refrigerating Machines		
Sheetmetal working:	10	10	---	130
Pipe working:	16	24	---	240
Fitting:	30	90	---	810
Machining:	0	15	---	180
-----	---	---	---	---
Cost Recovery Contribution:	4800 Fr.	6000 Fr.	---	---

Figure 1

*Introductory example* (see Fig. 1)

A refrigeration firm manufactures 2 products: cooling towers and refrigerating units. These products are manufactured in 4 workshops or cost centres, namely sheetmetalwork, pipefitting, assembly, and machining. Fig. 1 shows how the individual cost centres are loaded by the manufacture of each product. Each figure on the large square indicates how many manhours a cost centre needs for its manufacturing share of the total product. For example, the production of a cooling tower requires 16 manhours of labour in the pipefitting cost centre. This presentation is called the coefficient matrix.

The individual cost centres have a limited production capacity per unit time (e.g., per month) at their disposal, which can be seen at the right in Fig. 1.

In this case a product's financial success is expressed in terms of the absolute overhead contribution (bottom line in Fig. 1), a figure that will be explained in detail shortly.

The concrete question is:

How many cooling towers and how many refrigeration units are to be manufactured per unit of time so that the cost centres will not be overloaded and so that the total overhead contribution will be maximized?

### *Solution latitude*

The number of possible solutions in our example is relatively small. If refrigeration units were produced exclusively, the output would be limited to 9 units by the assembly cost centre, yielding a total overhead contribution of Fr. 54,000.--. If only cooling towers were produced, sheetmetal would be the limiting factor with 13 units, leading to a total overhead contribution of Fr. 62,400.--. Neither of these choices represent the optimum answer, but they do show that the range of variations within which the optimum lies is a limited one in this little example.

In actual fact, though, the refrigeration firm turns out more than just two products, it has more than just four cost centres, and it produces more than just 13 units.

Merely expanding the problem as stated generates virtually a myriad of possible solutions. But this is not all: the manufacturing capacities are not the only factor affecting a decision on production strategy. One also has to take into account aspects such as sales possibilities, alternatives for adding production capacity through investment, personnel restrictions, etc., in the decision-making process. Such variety and numbers of variables causes the range of possibilities to explode very quickly.

Even the fastest computer would be incapable of working through all of the resulting variations within a reasonable time and at an acceptable cost if there were no mathematical mechanism available for finding the best choices in rapid fashion.

Such decision-making problems can be solved efficiently with the PROPER method. The procedure is based on a mathematical method called LINEAR PROGRAMMING (LP) and uses a computer to carry out the extensive calculations.

Constraints Cost Centre	Product:		Relation- ship: less than or equals	Capacity of Cost Centre
	Cooling Towers X <sub>1</sub>	Defrigerating Machines X <sub>2</sub>		
Sheetmetal working:	10X <sub>1</sub>	+10X <sub>2</sub>	---	≤ 130
Pipe work- ing:	16X <sub>1</sub>	+24X <sub>2</sub>	---	≤ 240
Fitting:	30X <sub>1</sub>	+90X <sub>2</sub>	---	≤ 810
Machining:	0	+15X <sub>2</sub>	---	≤ ---
Objective Function	---	---	---	---
Cost Recovery Contribution:	4800 Fr. TIMES X <sub>1</sub>	6000 Fr. TIMES X <sub>2</sub>	---	= maximum
Constraint:	X <sub>1</sub> ≥ 0	X <sub>2</sub> ≥ 0	---	

Figure 2

*The LP model*

Just what is LP, and how is the computer applied for the calculations?

LP is a mathematical process for determining the most favourable of many alternatives in terms of a defined goal, taking prevailing or predefined limitations into full consideration. To be able to apply this (mathematical) method, we need a so-called mathematical model. Let us take a look at the mathematical model for our example.

We can let X<sub>1</sub> and X<sub>2</sub> stand for the production quantities of cooling towers and refrigeration units we are seeking. The statement whereby the sheet-metal cost centre has a capacity of 130 manhours at its disposal and must expend 10 manhours to finish its share of the work on a cooling tower or a refrigeration unit, can now be expressed mathematically without difficulty:

no. of sheetmetal man- hours required to pro- duce X <sub>1</sub> cooling towers + X <sub>2</sub> refrigeration units	must be less than or equal to	the available sheetmetal- working ca- pacity
10 X <sub>1</sub> + 10 X <sub>2</sub>	≤	130

Similarly (Fig. 2), 3 further restrictions are set up for pipefitting, assembly and machining. We end up with a system having 4 inequalities and 2 unknowns, which per se is not unequivocally soluble mathematically — for if only these four inequalities must be satisfied, the proposal to produce nothing (i.e., X<sub>1</sub> = X<sub>2</sub> = 0) would be a correct, but surely unhappy, answer. It is a basic economic principle, however, that an economic goal be pursued in which the optimum alternative is defined as the one providing the most benefit. In our case the benefit is defined as the sum of the overhead contributions; this means that the so-called goal function demands that X<sub>1</sub> and X<sub>2</sub> be chosen so that the sum of the resulting overhead contributions will be a maximum figure. Finally, there is one more requirement that is obvious in business life, namely that the resulting X<sub>1</sub> and X<sub>2</sub> should not be negative. It would be nonsensical to demand that minus 20 cooling towers be produced. Let us summarize: the restrictions are responsible for meeting all of the sub-requirements of the operation; the sign restriction keeps negative values from occurring in the solution, and the goal function takes care of maximizing the overhead contribution (Fig. 2).

- These four restrictions on the capacities of the cost centres,
- the goal function prescribing the maximization of the overhead contribution,
- and the non-negative conditions

go to make up the LP mathematical model; they are nothing more than a replica of the operational situation of this refrigeration firm. The mathematic treatment of this model is now the job of a computation mechanism developed by Georg B. Dantzig in the 1940's, called SIMPLEX.

OBJECTIVE FUNCTION VALUE					
COST RECOVERY CONTRIBUTION = 67200.000					
					Variant 0
*LPMUT65* Variables Specification					Page 1
No.	Name	Type	Opt. Val.	Weight	Limit Wt. Diff.
	Cigtwr	BASIC	9.0000000	4800.0000	4800.0000 0.
2	Refmach	BASIC	4.0000000	6000.0000	6000.0000 0.
No.	Variant	Cooling towers	Refrigerating machines	Cost recovery contribution	
0	Actual cond.	9	4	67200	
					Variant 0
*LPMUT65* Restrictions Analysis					Page 2
No.	Name	Type	Dual Val.	Limitation Utilization	Rem.
1	Sht.Metal Wk.	Sm. Equ.	240.00000	130.00000 130.00000	0. !
2	Pipe Wk.	Sm. Equ.	150.00000	240.00000 240.00000	0. !
3	Fitting	Sm. Equ.	0.	810.00000 630.00000	180.00000
4	Machining	Sm. Equ.	0.	180.00000 60.00000	120.00000

Figure 3

*Solution with computer*

But the user of the PROPER model does not have to be bothered with the rather complex mathematical manipulations. The SIMPLEX procedure (5), which has been programmed for computer, can be viewed as a "black box"; the user only has to know how the system is fed with data and how the results are to be interpreted.

The data is fed in by means of a special form from which the data is punched on punch cards. These cards and the LP programme are read into the computer.

As a result, the computer prints lists with the optimum answer, i.e., the variables sought. In our example (Fig. 3), these are  $X_1$  (=number of cooling towers to be produced) = 9 units,  $X_2$  (=number of refrigerating units) = 4 units. It also shows the value for the goal function, in this case the total overhead contribution of Fr. 67.200.--. This solution is superior to the answer arrived at intuitively.

The computer print-out also contains interesting information on the degree to which the stated model restrictions are utilized. For example, one can see that following the optimum product mix policy ( $X_1 = 9$ ,  $X_2 = 4$ ) will fully load the cost centres of sheetmetal and pipefitting. This identifies them as the bottlenecks in the event production volume is ever to be increased, while the assembly and machining cost centres have reserves of 180 and 120 man-hours respectively. Another interesting figure is the so-called dual value. It tells the amount by which the total overhead contribution would rise if the capacity of a cost centre were to be raised by one unit. For example, the total contribution would go up by Fr. 240.-- if the sheetmetal cost centre had 131 manhours available in the particular time period instead of 130. Logically enough, raising the capacity of the assembly cost centre would not increase the contribution, as this centre already has extra capacity.

#### *Alternative calculations with the computer*

A real-life decision-making process cannot rest with a product mix calculated just once, however. Management wants to know not only what can be gotten out of the existing plant capacity, but also the consequences that would result from a new company policy or a new market situation. This is where the advantages of the PROPER method really pay off. A few changes to the basic figures, also referred to as the data bank, provides us with rapid, clear answers.

Thus we have a method for examining the most varied aspects of imminent decisions and for giving management sound answers to questions such as:

- What will the consequences be if we opt for this or that strategy?
- What will be the result of this or that measure?
- What will happen if we act this or that way?

All of these questions can be answered with a modicum of effort and expense, and in a very short time.

Now that the reader is familiar with the principle of the PROPER method, let us turn to some concrete projects in the Sulzer Group.

#### **PROPER in Actual Practice**

##### *Job description*

On July 1st, 1970, the Lindau Works of Escher Wyss GmbH, Ravensburg (referred to as EWL in the following text) became managerially subordinate to the Refrigeration Department of the Winterthur Engineering Works Division (WEW).

A team called "Project Lindau" was then formed to incorporate the Lindau plant into the organization. Its mission was to define the existing situation, plan the organizational switch to the WEW Division, and to initiate the necessary steps to this end.

The problems involved in the incorporation can be grouped into 6 categories, namely:

- management and organization
- accounting
- product line and sales budget
- planning
- production
- personnel

Each of these areas was assigned to a task group for treatment. People from both staff and line functions were drawn upon to man these task groups.

The PROPER method was applied to the solution of part of the overall problem, particularly the third category: product line and sales budget.

The primary question put to PROPER was this:

Which products should EWL manufacture, and in what quantities, to maximize the sum of overhead contributions with a given production capacity and given selling prices?

A PROPER project of this magnitude had not yet been carried out in actual practice; the creation of clear and understandable definitions was indispensable to its success. It was also necessary to maintain a good flow of information to those involved and to coordinate their activities smoothly during the data compilation phase, while the computer work was being done, and in interpreting the computed results. For this reason the dynamic network plan technique was used to coordinate the extensive collection of data.

The initial collection of matrix data required a great deal of effort. In order to avoid jeopardising the continuity of day-to-day work in line functions, it appeared advisable to draw on staff functions. This also assured that the experience gained would be of benefit for applications in other line sectors in future. In this particular case the Production Control Group of Winterthur Engineering Works took on the collection of the very voluminous production data (coefficient matrix and capacity limits). The figures that Accounting (overhead contributions) and Sales (sales limits) had to come up with were less extensive, but were quite complex in regard to calculation and the preparation of forecasts.

The steps taken under PROPER are now listed in formula fashion (with the numbers corresponding to the steps in Fig. 4); reference is made at each point to the special case of "Project Lindau".

1. Determine the representative products, proceeding rather coarsely in a first phase; the number of products can be expanded as necessary later on. (Incidentally, the products need not always be stated in numbers of units — one can also use price categories such as Fr. 100.000.--, batch sizes of 100, 1.000, 100.000, etc.) Responsible: Sales working together with Production.

Lindau: a total of 86 products, of which 9 dimentioned terms of sales units of 100.000.-- marks and the rest in numbers of units.

(please turn to page 32)

*"MODULAR DATA ELIMINATES REPETITION OF INPUT, REDUCES CHANCES OF ERROR, AND CUTS DOWN STORAGE REQUIREMENTS."*

# Modular Data for Producing Equipment Manuals

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Modular programming has had a significant impact on the computer industry in the last few years. It has reduced the size and complexity of systems installed. They are much easier to program, analyze, and operate.

Recently the same principle has been applied to data, with equal success. Modular data eliminates repetition of input, reduces chances of error, and cuts down storage requirements. The data only needs to be entered into the system once. And it can be entered in pieces: not all at once if it isn't available; and not in any specific sequence. Through proper data manipulation the information can be modified, rearranged, deleted, repacked, updated, and retrieved as required. The user can extract this data in any manner that will satisfy his end requirements.

## Initial Project

Our first project for the concept of modular data was a computer program for producing a manual for the owner of an outboard motor. A separate owner's manual is needed for 14 different horsepower. In addition, each manual is printed in ten languages. Obviously, some paragraphs are common from manual to manual. Certainly the preface and warranties should be similar, the fuel mixtures, etc. How much of the other information either was the same or could be written to apply to more than one motor without losing its specific application had to be determined.

## Equipment and Systems

The job flow would be input via punched paper tape from Friden Justowriters. The data was read into an IBM 1130 and put on magnetic tape. Text blocks can be extracted from tape and rolled out to disk to allow random access for updating and for outputting the final tapes. Punched paper tape of perfect text blocks in the order required for the manual are produced and run off on a Varsity 747 photocomposition machine. All codes necessary to

drive the photo-composer are in the tape. The operation is completely automatic.

## Problems Encountered

The first problem was coding the data. Each text block would need a unique identifying code. A six character code was assigned to indicate: the language; a sequential block number; and whether the text block was common to more than one manufacturer, or peculiar to one.

To make these codes easier for the computer to recognize at input, each one is preceded by a \$X1. Each text block starts at a new storage address. This speeds later processing by allowing the computer to scan only the first three characters of each record looking for the start and end of each text block. The 6 digit code is printed on the final copy so the 747 had to be programmed to bypass the computer codes which should not appear.

In addition, special codes are required at the beginning and end of every text block to drive the phototypesetter since their output sequence is unknown at the time of input. Type size, type face (normal, italic or bold), line width, leading, indentions, leadering, tabs, etc., must all be coded into every text block as required to output it properly. The text blocks can be called in any sequence and each must have the capability of driving the phototypesetter properly by itself.

Size of the text blocks was the next problem. As the data was analyzed, many areas between manuals were almost the same but not exactly.

The solution became a trade-off. Small text blocks would eliminate as much duplication as possible, reduce storage but have excessive coding. The specifications coding would exceed the size of some of the data. Large text blocks would have more duplication, take up a little more storage but require

FORMAT OF STORED TEXT IN ENGLISH

```

2 $X1(E)0001(C)$U0837$Z110$O120$S240$1$/030$T000$L<5077$Z180$T000$L&$3(FUEL AN
3 D LUBRICANT)<$S$L<O$T000$L<5125$Z110$1$T000$L&$1$M$N(T)HIS IS A TWO CYCLE EN
4 GINE THAT REQUIRES LUBRICANT TO BE MIXED WITH GASOLINE. (F)OLLOW THESE INSTRU
5 CTIONS.<$L&/$3(NOTE )$N$2(R)ECOMMENDEED LUBRICANT AND GASOLINE MUST BE PROPE
6 RLY MIXED OR SERIOUS&DAMAGE WILL RESULT TO THE ENGINE.<$S$L<O$T000$L&*
```

SPECIFICATION CODES TO DRIVE THE 747 IMBEDDED IN THE DATA

\$U0837	LINE LENGTH - 837 UNITS	\$3	FONT 3 - BOLD
\$Z110	TYPE SIZE - 11 POINT	<S	ONE BLANK LINE
\$O120	PRIMARY LEADING - 12 POINT	<O	CANCEL INDENT
\$S240	SECONDARY LEADING - 24 POINT	<5125	INDENT - 125 UNITS
\$1	FONT 1 - NORMAL	\$M	FIXED SPACE - 18 UNITS
\$/030	TAB SETTING - 30 UNITS	\$N	FIXED SPACE - 9 UNITS
\$T000	CANCEL LEADING - NO VERTICAL SPACING	/	TAB CODE
<5077	INDENT - 77 UNITS	\$2	FONT 2 - ITALIC
\$Z180	TYPE SIZE - 18 POINT	*	STOP CODE
\$L&	LEFT JUSTIFY LINE AND RETURN CARRIAGE		

SAMPLE OF PARAGRAPH NUMBER 0001 IN ENGLISH, FRENCH AND GERMAN

E0001C **FUEL AND LUBRICANT**

This is a two cycle engine that requires lubricant to be mixed with gasoline. Follow these instructions.

**NOTE:** *Recommended lubricant and gasoline must be properly mixed or serious damage will result to the engine.*

F0001C **MELANGE HUILE ESSENCE**

Ce moteur est un 2-temps. La lubrification est faite par l'huile mélangée à l'essence. Suivre les instructions de mélange d'huile et d'essence comme suit:

**REMARQUE:** *Le mélange de l'huile et de l'essence recommandé doit se faire convenablement si l'on veut éviter de sérieux dégâts au moteur.*

G0001C **KRAFTSTOFF UND ÖL**

Ihr Außenborder ist ein Zweitaktmotor, der ausschließlich durch das dem Benzin beigemischte Öl geschmiert wird. Befolgen Sie die nachstehenden Anweisungen.

**HINWEIS:** *Die Mischung des empfohlenen Öls und Benzins muß sehr sorgfältig durchgeführt werden, da sonst schwere Schäden am Motor entstehen können.*

Figure 1 — A sample of a stored text block in computerese, English, French, and German.

less repetitive specification coding. Each text block had to be analyzed on its own application and usage.

For example, a trouble check chart in one manual has nine points and two warnings. In the next horsepower, the chart has only eight points. One through four are the same, five is removed and six through nine become five through eight. Also, one of the warnings is different. Storing both charts completely takes extra storage and duplicates data. Each check point could be a separate text block but the coding would be excessive. The common parts

could be one text block and the different sections two more blocks. Each paragraph had to be looked at very carefully.

Updating and Corrections

Once the coding is done the text blocks are punched and loaded onto the computer. Most corrections and changes are made through the console typewriter. Almost any text editing function can be handled on the console. Major revisions are loaded

(please turn to page 21)

# ECONOMY SPELLING COMPUTERIZED

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With the growth of data processing, transmitting and storage systems, the need for simplification of English spelling has become more acute. Several approaches to this are presented. In combination they can effect a saving of over 10% of letters, yet be intelligible (when read aloud) without retranslation. First adopted for standard use, this would save \$2 per person per year in printing costs, and more in typing and retyping.

In 1883 the American Philological Association recommended a list of spelling changes. In 1898 the National Education Association adopted a list of 12, including *tho*, *altho*, *thru*, *thoro*, and *n* program. In 1916 it added the use of "t" as the past form of verbs ending in "ed" but pronounced "t". Andrew Carnegie supported the movement with \$250,000 between 1906 and 1919. After Theodore Roosevelt became President, he proposed a list of about 300 simplified spellings for government publications, but Congress prohibited the Government Printing Office from using them.

A spelling system can be based on phonemes, which are speech sounds carrying distinguishing meaning. Each phoneme can be spelled the same whenever it occurs, even though the pronunciation of adjacent sounds varies. Thus rules for pronunciation change rather than spellings.

World English Spelling (WES) is a phonetic consistent spelling using only the letters of the Roman alphabet. It was developed by the Simpler Spelling Association for use as an initial teaching medium for children and adults, or for wider use, to avoid the difficulties arising from the numerous differences between spoken and written English.

There are over 500 spellings for the 41 common sounds in English words. Precedent is claimed for thousands of ways to spell foolishly. One of these is "pophough-tluipshally", using spellings from sapphire, through, hustle, build, pshaw, and grammatically.

Efforts to move to simpler spelling involve work in making the transition, for those used to traditional orthography. Hence two rules seem relevant. First, changing words which offer savings will provide some benefits to match these costs. Secondly, changing only a relatively small number at a time makes the task more manageable. A corollary would be to change at first only those words offering the largest savings. Such an approach is outlined below. For computer use, a moderate list of 100 words with substantial savings is offered. For general use, graduated stages of offering easier adoption.

Semi-phonetic shortening of 40 words, each of which saves .05% or more in an average text, can save 10% of letters. Four other phonetic changes are included, saving over 1% more; phonetic changes from the WES system which save letters, using "y" as a vowel for "ie" sound, using "-r" for final "-er", and dropping silent letters such as final "e" and doubled consonants. Only those changes in words saving at least .01% each in an average text are included.

Some of the semi-phonetic abbreviations correspond to Scots dialect (*wi*, *tha*). Many more correspond to the sound of the words in rapid speech, in which the vowel is largely silent, for there is no similar word to confuse it with.

Some suffixes can be shortened too. These include: *abl*, *d*, *t*, *iv*, *les*, *n*, *nes*, *nt* (for *not*, *n't*, or *ent*), *shn* (for *tion*). Words ending in silent "e" or doubled consonant (including *ck*) can drop the last letter before adding the suffix. Words ending in "c" can add "li" rather than "ally". There is no real need to double final consonants (*g*, *l*, *m*, *n*, *p*, *r*, *t*) before adding a suffix.

Savings to be expected in an average text, for various words in groups of words in the attached tables, were computed from a word letter count of a sample of 100,000 words (Dewey 1923 and 1950). For example, "and" occurs 3,280 times in the sample. Shortening it to "n" saves 6,560 letters, or 1.50% of the 438,023 letters in the sample.

This system can be supplemented for special uses and users by other abbreviations for their purposes. Thus chemists may use the atomic symbols (C, O, H, Al) instead of the words (Carbon, Oxygen, Hydrogen, Aluminum). Engineers may use "torc, powr, britl", electricians "wyr, lyn, motr", and develop longer lists of their common words. Even shorter abbreviations, such as "apln" for "application", "eqpm" for "equipment" and "abrn" for "abbreviations" can be used where these words are frequent. As long as such words are at least semi-phonetic, and not too numerous, retranslation by many readers can be fairly easy, especially if a conspicuous note at the start provides the key. Professional societies in various fields may well conduct sample word counts of their leading journals and texts, to help select and develop a standard list of abbreviations for "economy spelling" and computer use in their fields.

For computer use, and for some data transmission and storage uses, a computer translation program can convert to or from Computer Economy Spellings and special lists. Because the changes are over a third of the words and slow reading by many readers is not familiar with the economy and special systems, a retranslation program can be quite helpful. Any text written in, or translated into, economy and special simplified spellings will be reproduced in standard spelling by a simple computer program, since the economy list is only 100 words, and most special lists will be far shorter. Thus readability and economy are both possible with this approach.

The basic cycle of such a translation program, in whatever list processing language one has available, would be:

1. read next word;
2. is it on the list?
3. if yes, print alternate form;
4. if no, print word as read;
5. return to step 1.

In language processing work, simple programs require listing of all common alternate forms of a word (give, gives, given, giving). This about doubles the number of words to be listed.

*"There are over 500 spellings for the 41 common sounds in English words."*

COMPUTER ECONOMY SPELLINGS (CES)

<i>Standard</i>	<i>Economy</i>	<i>Saving</i>	<i>Standard</i>	<i>Economy</i>	<i>Saving</i>
address	adres	.01%	letter	letr	.02%
after	aftr	.02	life	lyf	.02
and	n	1.50	little	litl	.05
announce	anouns	.02	matter	matr	.04
are	r	.25	might	myt	.03
average	avrij	.01	more	mor	.05
back	bac	.02	night	nyt	.02
be	b	.19	not	nt	.14
because	bicauz	.02	of	v	.91
been	bn	.15	office	ofis	.03
before	bfor	.06	often	ofn	.01
better	betr	.02	other	uthr	.05
brought	braut	.02	over	ovr	.03
business	biznis	.02	people	peepI	.04
but	bt	.12	possess	pozes	.01
can	cn	.05	possible	posibl	.04
character	caractr	.01	purpose	purpos	.01
come	cm	.07	right	ryt	.05
committee	comite	.02	said	sed	.04
common	comn	.01	shall	shal	.03
could	cd	.10	should	shd	.08
country	cuntri	.02	some	sum	.05
course	cors	.01	still	stil	.01
differ	difr	.02	straight	straet	.01
dinner	dinr	.01	tell	tel	.02
dollar	dolr	.01	that	tha	.31
eight	aet	.01	the	th	1.67
either	ythr	.03	them	thm	.06
enough	enuf	.02	there	thr	.14
ever	evr	.07	this	ths	.13
eye	y	.02	though	tho	.04
fight	fyt	.03	thought	thaut	.04
for	fr	.24	through	thru	.06
from	fm	.20	time	tym	.05
give	gv	.06	to	t	.67
had	hd	.09	trouble	trubl	.02
half	haf	.01	under	undr	.03
happen	hapn	.01	was	wz	.19
have	hv	.30	we	w	.12
he	h	.15	well	wel	.03
her	hr	.05	were	wr	.14
high	hy	.04	what	wht	.06
him	hm	.06	when	whn	.05
his	hz	.12	which	wch	.11
house	hous	.01	while	whyl	.02
how	hw	.05	will	wl	.20
if	f	.05	with	wi	.36
is	z	.29	would	wd	.19
knowledge	nolij	.02	you	u	.37
less	les	.01	your	yr	.13

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# Deciphering a Message in Digits

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*"The easy way for us to deal with a puzzle with as many characters as this is to make use of an interactive computer program to assist us."*

## Outline

1. A Computer Program to Handle This Puzzle
2. The Main Commands of the Program
3. Is the Array Random or Not Random?
4. Repeated Sequences of Characters
5. Reasonable Guesses and Probable Words
6. Trying out a Guess for 015
7. Guessing 7201
8. Guessing the Digraph 07 and the Digit 6
9. Guessing 08, 3, 9, 8, and 78
10. The Puzzle Almost Solved

## Tables

Table	Title
1.	An Array of Digits
2.	The Array Read-in as Input
3.	The Array Spaced in Fives
4.	Frequency of Characters
5.	Frequency of Digraphs
6.	Frequency of Trigraphs - I
7.	Frequency of Trigraphs - II
8.	Frequency of Sequences of 4 Characters
9.	Frequency of Sequences of 8 Characters
10.	Digraphs Occurring Two or More Times, Tabulated
11.	Testing 015 as "THE"
12.	Trying 7201 as "WITH"
13.	Comparison of Candidates for the Digraph 07
14.	Trying 07 as "R" and 6 as "0"
15.	Trying Five More Substitutions
16.	The Array Almost Solved
17.	The Deciphering Rule
18.	The Plaintext, Arranged Line by Line

In the April issue, we published COMPMEANO PUZZLE 744. This series of digits was reported as "found on the floor of a computer room". We said: "Does it have a meaning? If so, what is the meaning?"

The puzzle is shown in Table 1.

Table 1

AN ARRAY OF DIGITS

```
760708340750158125782930078791
590375873578607583172742929216
788687073591492601507085982853
172808707539879118507381407039
160852734075427368735081887076
070834075015170729150662737508
691630678687075831727429292172
010159176070831675985074075960
985072216608293007879159032728
543069440707671540847607082348
278791327541769
```

## 1. A Computer Program to Handle This Puzzle

It is clear that there are only 10 different characters being used, the digits 0 to 9. Yet there are 315 digits. Accordingly, the easy way for us to deal with a puzzle with as many characters as this is to make use of an interactive computer program to assist us. It should perform various laborious tasks with the speed of a computer instead of a human being.

We worked out an interactive computer program for this purpose, using about 20 hours of programming effort. The name of the program is CIPHERING C 1; it was written in assembly language for the PDP-9 computer made by Digital Equipment Corporation. Input and output are provided by a KSR-33 teletype, and a high-speed paper tape punch and reader, which are part of the computer. Most of the tables in this article were produced by this computer program.



W N ) N E ) W N ) N E E ( ) E

## 2. The Main Commands of the Program

In this program (devised by Casper Otten with a few ideas from Ed Berkeley) there were four buffers: M and N for messages in plaintext or cipher; D for the deciphering code, and E for the enciphering code.

The interactive commands were:

- D Decipher the contents of the M buffer using the code in the D buffer, and put the result in the N buffer.
- E Encipher the contents of the M buffer using the code in the E buffer and put the result in the N buffer.
- I x Input from the keyboard into buffer x; to end input, type two carriage returns.
- K x Clear (kill) the contents of buffer x.
- P x Punch the contents of buffer x on paper tape.
- R x Read from paper tape into buffer x; (the record on the paper tape should end with carriage return and form feed).
- X x Get rid of punctuation in buffer x, leaving only letters and digits.
- F x Find the frequency of all characters in buffer x.
- F x y Find the frequency of character y in buffer x.
- G x n Find the frequency of n-graphs (bi-graphs, trigraphs, etc.) that occur more than once in buffer x.
- G x n m Find the frequency of n-graphs that occur more than m times in buffer x.
- M x y Move buffer x into buffer y as much as possible.
- S x y Switch (interchange) buffer x and y as much as possible.
- T x Type out the contents of buffer x.
- T x y z Type out the contents of buffer x, making y characters per line and z characters per block (so as to obtain printing of blocks of 5 characters, 6 blocks to a line, for example).

To help the fallible human being using the interactive program, we put into the program a one-character rubout, which would echo a back slash. For "go" (execute command), we used carriage return or the ALT MOD key.

## 3. Is the Array Random or Not Random?

Perhaps the first question is: Is this array of digits one which might have come out of a random number table?

Accordingly we focus on: What is the frequency of the digits? What are the runs of digits? What are the repetitions of sequences of digits? The commands to the computer program are labeled C\*.

C\*: Read from the paper tape holding data into buffer M. Type buffer M. See Table 2.

Table 2

### THE ARRAY READ-IN AS INPUT

.RM  
.TN\M

```
760708340750158125782930078791
590375873578607583172742929216
788687073591492601507085982853
172808707539879118507381407039
160852734075427368735081887076
070834075015170729150662737508
691630678687075831727429292172
010159176070831675985074075960
985072216608293007879159032728
543069440707671540847607082348
278791327541769
```

C\*: Now kill the existing punctuation in buffer M. Type buffer M, 36 characters to the line, in blocks of 5. See Table 3.

Table 3

### THE ARRAY SPACED IN FIVES

.XM  
.TM 36 5

```
76070 83407 50158 12578 29300 78791
59037 58735 78607 58317 27429 29216
78868 70735 91492 60150 70859 82853
17280 87075 39879 11850 73814 07039
16085 27340 75427 36873 50818 87076
07083 40750 15170 72915 06627 37508
69163 06786 87075 83172 74292 92172
01015 91760 70831 67598 50740 75960
98507 22166 08293 00787 91590 32728
54306 94407 07671 54084 76070 82348
27879 13275 41769
```

C\*: Find the frequency of characters in buffer M. See Table 4.

Table 4

### FREQUENCY OF CHARACTERS

.FM

NU	10	FQ	315
0 =	48		
1 =	28		
2 =	26		
3 =	23		
4 =	16		
5 =	30		
6 =	23		
7 =	58		
8 =	38		
9 =	25		

So the information from this response tells us:

The number of different characters is 10.  
The total frequency of all characters is 315.  
The frequency ranges from 16 occurrences of the digit 4 to 58 occurrences of the digit 7.

We apply now some theorems from the theory of probability. The expected mean frequency of any digit occurring is 31 (1/10 of 315) from the formula  $M = np$ . The expected standard deviation is the square root of  $npq$ , where  $np$  is 31 and  $q$  is 9/10; so  $npq$  is about 27 and the square root is about 5. 95% of the total frequency is expected to fall within

0 8 9 ) X 4 9 0 8 9 ) 9 4 4 6 9 4

two standard deviations of the mean, the range 21 to 41. The frequency 16 is significantly low; 48 (the frequency for zero) and 58 (the frequency for 7) are much more extreme even than significantly high.

Examining the array for runs (because our computer program does not yet answer our question about runs), we find the following runs only:

00, 88, 11, 66, 66

There is clearly a great scarcity of runs: in 315 digits we would expect 31 runs; yet there are only 5 runs.

Verdict: This array could not have come from a random number table.

#### 4. Repeated Sequences of Characters

The next question is: What repeating sequences are there?

C\*: What is the frequency of digraphs that occur 2 or more times? See Table 5.

Table 5  
FREQUENCY OF DIGRAPHS

• GM 2	93	2	42	3
76	6	30	4	92
60	9	00	2	21
07	23	87	10	16
70	12	79	4	67
08	11	91	9	88
83	5	59	7	68
34	4	90	2	14
40	7	03	3	85
75	11	37	2	98
50	9	73	7	28
01	5	35	3	53
15	8	86	4	39
58	4	31	4	18
81	3	17	7	54
57	2	72	7	06
78	7	27	8	66
82	5	74	3	69
29	7			32

The digraph 07 occurs 23 times. Fifty-five digraphs occur two or more times. The remaining 45 digraphs occur less than twice. It is becoming clear that it is impossible that this array should be random.

C\*: What trigraphs occur 3 or more times? See Table 6.

Table 6  
FREQUENCY OF TRIGRAPHS - I

GM 3 2	915	3
760	4	159
607	5	758
070	7	735
708	5	831
083	3	317
340	3	172
407	6	292
075	7	687
750	3	870
015	4	707
787	3	507
879	4	850
791	4	273

C\*: What trigraphs occur 4 or more times? See Table 7.

Table 7  
FREQUENCY OF TRIGRAPHS - II  
GM 3 3

760	4
607	5
070	7
708	5
407	6
075	7
015	4
879	4
791	4
172	4
292	4
870	4
707	6
507	4

C\*: What tetragraphs (or sequences of 4 characters) occur 3 or more times? See Table 8.

Table 8  
FREQUENCY OF SEQUENCES OF 4 CHARACTERS  
GM 4 2

7607	4
6070	4
0708	5
7083	3
3407	3
4075	4
7879	3
8791	4
3172	3
8707	4
8507	3

C\*: Are there any sequences of 8 or more characters which repeat? See Table 9.

Table 9  
FREQUENCY OF SEQUENCES OF 8 CHARACTERS  
GM 8

76070834	2	82930078	2
60708340	2	29300787	2
07083407	2	93007879	2
70834075	2	30078791	2
08340750	2	00787915	2
83407501	2	07879159	2
34075015	2	78791590	2
		87915903	2
		07583172	2
		75831727	2
		58317274	2
		83172742	2
		31727429	2
		17274292	2
		72742929	2
		27429292	2
		74292921	2

This very interesting response from the computer program tells us that there is one sequence of 14 digits, another sequence of 15 digits, and a third sequence of 16 digits that repeat, each once. Almost surely then, this array of digits is a message in disguise. And these are words or phrases which are repeated.

#### 5. Reasonable Guesses and Probable Words

If 26 letters are to be expressed by 10 digits, it is necessary that some of those letters be expressed by pairs of digits.

The encipherer would find it economical to have the most frequent letters expressed by single digits, and the less frequent letters expressed by digraphs. The digraphs of Table 5 are tabulated in Table 10.

**Table 10**  
DIGRAPHS OCCURRING TWO  
OR MORE TIMES, TABULATED

	0	1	2	3	4	5	6	7	8	9
0	2	5	-	3	-	-	3	<u>23</u>	<u>11</u>	-
1	-	-	-	-	2	8	5	<u>7</u>	<u>2</u>	-
2	-	3	-	-	-	-	-	8	3	7
3	4	4	2	-	4	3	-	2	-	2
4	7	-	3	-	-	-	-	-	-	-
5	9	-	2	-	4	-	-	2	4	7
6	9	-	-	-	-	-	2	4	3	3
7	<u>12</u>	-	7	7	3	<u>11</u>	6	-	7	4
8	-	3	5	5	-	7	4	<u>10</u>	2	-
9	2	<u>9</u>	-	2	-	5	-	-	4	-

From Table 10, it would seem likely that at least some of the digraphs 07, 08, 70, 75, 87, and 91 represent single letters. But they would probably not be E, T, A, O, N, I, since the six commonest letters in English are these letters in that sequence. Also, it would seem very likely that 0 and 7 are among the signals of digraphs that stand for single letters.

Looking in the frequency table, Table 4, we see that 5 is the next commonest character with 30 occurrences, and therefore it might be E. Looking in the common trigrams, Table 7, there are only two trigrams ending in 5, 075 and 015. It seems reasonable to exclude 07 as a digraph and to make a guess that 015 is THE, the commonest word, and the commonest trigram in English.

**6. Trying Out a Guess for 015**

Let's look at the cipher now with our guesses implemented, and use "-" for all the digits that we have not yet guessed.

C\*: Input into the deciphering code buffer D.

T is to replace 0, H is to replace 1, E is to replace 5.

Kill the N buffer.

Execute deciphering, filling all other digits in the N buffer with hyphen.

Type the N buffer, 36 characters to the line, in blocks of 5.

The set of commands is shown, and its result is shown also in Table 11.

**7. Guessing 7201**

Examining the message in Table 11 we find in line 8 that the first five characters are T H T H E. What word ending TH is often in front of THE? Guessed answer: WITH. I is a common letter; it may stand for itself on many occasions. W is a rare letter, and may give rise to digraphs which can stand in place of letters of intermediate frequency. Let us insert W I. The result is shown in Table 12.

**8. Guessing the Digraph 07 and the Digit 6**

The digraph 07 occurs 23 times. We have guessed it as TW, which certainly is a rare digraph and therefore could be used as a code for a common letter that is not among the common letters enciphered with a single digit. In line 3 there is T H E T W. In line 10 there is T W T W indicating that TW can be doubled. The sequence 4 0 7 5 occurs four times, and is so far guessed as - T W E. In two of these four times, 4 0 7 5 is followed by T H E. The remaining commonest letters now are A O N R S D L. A systematic appraisal of possibilities is shown in Table 13.

**Table 11**  
TRYING 015 AS "THE"

```

.ID
T+0
H+1
E+5
.KN
.D 30
.TN 36 5

76070 83407 50158 12578 29300 78791
--T-T ---T- ETHE- H-E-- ---TT ----H

59037 58735 78607 58317 27429 29216
E-T-- E----E ---T- E--H- ----- ---H-

78868 70735 91492 60150 70859 82853
----- -T--E -H--- -THET -T-E- ---E-

17280 87075 39879 11850 73814 07039
H---T --T-E ----- HH-ET ---H- T-T--

16085 27340 75427 36873 50818 87076
H-T-E ----T -E--- ----- ET-H- --T--

07083 40750 15170 72915 06627 37508
T-T-- -T-ET HEH-T ---HE T---- --ET-

69163 06786 87075 83172 74292 92172
--H-- T---- --T-E --H-- ----- --H--

01015 91760 70831 67598 50740 75960
THTHE -H--T -T--H --E-- ET--T -E--T

98507 22166 08293 00787 91590 32728
--ET- --H-- T---- TT--- -HE-T -----

54306 94407 07671 54084 76070 82348
E--T- ---T- T---H E-T-- --T-T -----

27879 13275 41769
----- H---E -H---

```

**Table 12**

TRYING 7201 AS "WITH"

```

76070 83407 50158 12578 29300 78791
W-TWT ---TW ETHE- HIEW- I--TT W-W-H

59037 58735 78607 58317 27429 29216
E-T-W E-W-E W--TW E--HW IW-I- I-IH-

78868 70735 91492 60150 70859 82853
W---- WTW-E -H--I -THET WT-E- -I-E-

17280 87075 39879 11850 73814 07039
HWI-T -WTWE ---W- HH-ET W--H- TWT--

16085 27340 75427 36873 50818 87076
H-T-E IW--T WE-IW ---W- ET-H- -WTW-

07083 40750 15170 72915 06627 37508
TWT-- -TWET HEHWT WI-HE T--IW -WET-

69163 06786 87075 83172 74292 92172
--H-- T-W-- -WTWE --HWI W-I-I -IHWI

01015 91760 70831 67598 50740 75960
THTHE -HW-T WT--H -WE-- ETW-T WE--T

98507 22166 08293 00787 91590 32728
--ETW IIH-- T-I-- TTW-W -HE-T -IWI-

54306 94407 07671 54084 76070 82348
E--T- ---TW TW-WH E-T-- W-TWT -I---

27879 13275 41769
IW-W- H-IWE -HW--

```

**Table 13**  
**COMPARISON OF CANDIDATES**  
**FOR THE DIGRAPH 07**

Location	Test 1	Test 2	Test 3	Judgment
	Line 3	Line 10	Lines 1, 5, 6, 8	
Candidates for TW	601507 <u>-THE</u> W	407076 <u>-T</u> W <u>T</u> -	4075 <u>-T</u> W <u>E</u>	
A	-THE A	-A A -	-A E	Impossible
O	-THE O	-O O -	-O E	Rare
N	-THE N	-N N -	-N E	Reasonable
R	-THE R	-R R -	-R E	Reasonable
S	-THE S	-S S -	-S E	Unusual
D	-THE D	-D D -	-D E	Unusual
L	-THE L	-L L -	-L E	Unusual

The most reasonable choice for TW seems to be R. Then we have ARE THE occurring twice; and a good choice for 6 appears to be O. This gives us:

601507      4070767      4075  
 OTHE R      A R R O W      A R E

and it certainly seems as if we are on the right track. The next step is to change TW to R wherever occurring, put A for 4, and O for 6 throughout. The result of this operation is shown in Table 14.

**Table 14**  
**TRYING 07 AS "R" AND 6 AS "O"**

76070 83407 50158 12578 29300 78791  
 WO.RT --A.R ETHE- HIEW- I--T. R-W-H

59037 58735 78607 58317 27429 29216  
 E-T-W E-W-E W-O.R E--HW IWAI- I-IHO

78868 70735 91492 60150 70859 82853  
 W--O- W.R-E -HA-I OTHE. RT-E- -I-E-

17280 87075 39879 11850 73814 07039  
 HWI-T -W.RE ---W- HH-E. R--HA .RT--

16085 27340 75427 36873 50818 87076  
 HOT-E IW-A. REAIW -O-W- ET-H- -W.RO

07083 40750 15170 72915 06627 37508  
 .RT-- A.RET HEHW. RI-HE 100IW -WET-

69163 06786 87075 83172 74292 92172  
 O-HO- TOW-O -W.RE --HWI WAI-I -IHWI

01015 91760 70831 67598 50740 75960  
 THTHE -HWO. RT--H OWE-- E.RA. RE-OT

98507 22166 08293 00787 91590 32728  
 --E.R IIHOO T-I-- T.R-W -HE-T -IWI-

54306 94407 07671 54084 76070 82348  
 EA-TO -AA.R .ROWH EAT-A WO.RT -I-A-

27879 13275 41769  
 IW-W- H-I WE AHWO-

**9. Guessing 08, 3, 9, 8, and 78**

In line 10 we have:

407076715408  
 A R R O WHEAT-

The only word that this could be is "arrowhead".

The question that faces us is: Is one character T in use also meaning D, or do the two characters 08 as a digraph denote D? Confusion between "to" and "do", among "tead", "teat", "dead", "deat", etc., would compel an encipherer to use a digraph for D. So 08 is D, and wherever 08 appears we put D.

With this information we go back to line 1. We have:

76070834075015812578293007

WO R D-A RETHE-HIEW-I--T R

3 is evidently S. I - S T R suggests that 9, the character after I, is N. With these changes we have:

76070834075015812578293007

WO R DSA RETHE-HIEW-INST R

the context clearly suggests:

812578

CHIE F

which makes 8 C and 78 a digraph for F. So we put C for all 8's except where the digraph 78 occurs. The message now looks as shown in Table 15. 21 words have now appeared: WORDS, ARE, THE, CHIEF, FOR, OF, OTHER, CHARTS, WORDS, ARE, THE, WITH, THE, WORDS, ARE, NOT, A, STONE, ARROWHEAD, WORD, IS.

**Table 15**

**TRYING FIVE MORE SUBSTITUTIONS**

76070 83407 50158 12578 29300 78791  
 WO.R. DSA.R ETHEC HIE.F INST. RCWNH

59037 58735 78607 58317 27429 29216  
 ENTSW ECWSE .FO.R ECSHW IWAIN INIHO

78868 70735 91492 60150 70859 82853  
 .FCOC W.RSE NHANI OTHE. R.DEN CICES

17280 87075 39879 11850 73814 07039  
 HWIC. DW.RE SNCWN HHCE. RSCHA .RTSN

16085 27340 75427 36873 50818 87076  
 HO.DE IWSA. REAIW SOCWS E.DHC CW.RO

07083 40750 15170 72915 06627 37508  
 .R.DS A.RET HEHW. RINHE 100IW SWE.D

69163 06786 87075 83172 74292 92172  
 ONHOS TO.FO CW.RE CSHWI WAINI NIHWI

01015 91760 70831 67598 50740 75960  
 THTHE NHWO. R.DSH OWENC E.RA. RENOT

98507 22166 08293 00787 91590 32728  
 NCE.R IIHOO .DINS T.RCW NHENT SIWIC

54306 94407 07671 54084 76070 82348  
 EASTO NAA.R .ROWH EA.DA WO.R. DISAC

27879 13275 41769  
 I.FWN HSI WE AHWON

**10. The Puzzle Almost Solved**

So we have broken the back of the problem of deciphering the message. Of course, there is more work to do; see Table 16. The final deciphering rule is shown in Table 17, and the message is shown in Table 18.

Table 16

THE ARRAY ALMOST SOLVED

76070	83407	50158	12578	29300	78791
WO.R.	DSA.R	ETHEC	HIE.F	INST.	R.U.M
59037	58735	78607	58317	27429	29216
ENTSW	E.USE	.FO.R	ECS.P	.LAIN	IN.GO
78868	70735	91492	60150	70859	82853
.FCO.	U.RSE	.MANI	OTHE.	R.DE.	VICES
17280	87075	39879	11850	73814	07039
.PIC.	DW.RE	S.VW.	M.BE.	RSCHA	.RTS.
16085	27340	75427	36873	50818	87076
MO.DE	.LSA.	REA.L	SO.US	E.D.B	.U.RO
07083	40750	15170	72915	06627	37508
.R.DS	A.RET	HE.P.	RI.ME	TOO.L	SWE.D
69163	06786	87075	83172	74292	92172
O.MOS	TO.FO	.U.RE	CS.P.	LAINI	N.GWI
01015	91760	70831	67598	50740	75960
THTHE	.MWO.	R.DSH	OWE.V	E.RA.	RENOT
98507	22166	08293	00787	91590	32728
.VE.R	I.GOO	.DINS	T.R.U	.MENT	S.LIC
54306	94407	07671	54084	76070	82348
EASTO	NAA.R	.ROWH	EA.DA	WO.R.	DISAC
27879	13275	41769			
.L.U.	MS.LE	A.PON			

Table 17

THE DECIPHERING RULE

Character	Meaning
0	T
07	R, or TW
08	D, or TC
1	H
17	P, or HW
2	I, J, or Y
21	G or IH or JH or YH
27	L or IW or JW or YW
3	S
4	A
5	E
6	O
7	W
78	F or WC
8	C, K, or Q
87	U or CW or KW or QW

The ambiguities are regularly settled by a person's knowledge of English, which is also the knowledge used to insert spaces between words.

Table 18

THE PLAINTEXT, ARRANGED LINE BY LINE

- 1 WORDS ARE THE CHIEF INSTRUM
- 2 ENTS WE USE FOR EXPLAINING
- 3 OF COURSE MANY OTHER DEVICES
- 4 PICTURES NUMBERS CHARTS
- 5 MODELS ARE ALSO USED BUT WO
- 6 RDS ARE THE PRIME TOOLS WE D
- 7 O MOST OF OUR EXPLAINING WI
- 8 TH THEM WORDS HOWEVER ARE NOT
- 9 VERY GOOD INSTRUMENTS LI
- 10 KE A STONE ARROWHEAD A WORD IS A
- 11 CLUMSY WEAPON

□

McCORMICK — Continued from page 13

as replacement text blocks and run in from paper tape.

A printout of the text blocks on the line printer assigns line numbers to be used when updating. After keying in the line number any of the following commands can be executed:

- AB — add information before this word.
- AP — add a paragraph.
- CI — copy inclusive between two addresses.
- DE — delete to the end of the line.
- DI — delete inclusive between two points.
- DL — delete entire line.
- RI — replace inclusive between two points.
- RW — replace word.
- WL — write out the current line.

File Structures and Programming

A chained file is used to allow for additions and line overdraws. At the conclusion of each update cycle the file of corrected text blocks is repacked to eliminate gaps and to put the file in the proper order. The corrected text blocks are then merged back onto magnetic tape.

All program modules are written in FORTRAN IV using character-string-manipulating subroutines. The paper tape I/O routines and some of the special subroutines are written in Assembler. The entire system relies on each text block starting with a \$X1 followed by the unique 6 digit code. However, some of the foreign languages do not operate the same way the English language does as far as the keyboard layout is concerned. For example, the code for the same text block in English and French is:

```
$X1(E)0001(C)
$X1(F0001C)
```

where parentheses indicate keyboard shifts. Note that the numeric characters are upshift in French but downshift in English. So the programs do have to know what language they are in to extract the 6 digit code properly.

Benefits

What are the benefits of this system? First of all, each text block is punched and loaded only once: less work and less chance for errors. Second, it will be printed the same in every manual it appears in. Third, when a change is required to a text block, it is only made once and is automatically corrected in every manual that uses it. Fourth, speed. Once the text blocks are loaded and corrected, a manual can be built in a matter of hours.

A master form is prepared of the text block codes required to build a book in the order they are to appear. The codes are keypunched and a paper tape is produced from the computer. The output from the photocomposer is in the exact page layout that is required for the final manual. The copy preparation is done.

The benefits in the production of the foreign language manuals are even greater. After the English is complete, a master book of all text blocks is prepared in order. These text blocks are then translated into the foreign languages required. Again, each text block is only translated once. The turnaround time is much better than if translating into 14 manuals separately. (continued on the next page)

ΓΔΨ ΘΞΣΨ ΓΔΨ ΘΨΣΣΠΨΣ

Controls

After the translations are complete, the identical 6 digit code is assigned with the proper language prefix, punched and loaded onto the computer. From this point on, the operation is identical to the English.

Another payoff is the future changes. When a text block is changed in the English, due to an engineering change for example, the exact same change is required in all languages. The control of which paragraph, where it is used, how many manuals it affects, etc., is far easier than before.

Once the sequence is established for each manual by code numbers, that manual can be produced paragraph by paragraph exactly the same in any language. When you work with data you can't read or understand, this feature is very helpful. Certainly records are required to keep track of what is punched and loaded, what is out for translations, what has returned translated, which manuals require which text blocks and many more things. But working with small, discrete blocks makes the overall job much easier. Getting one text block translated can mean progress on many books rather than only one. You can accomplish more with less effort. Most important of all: the system works. □

IVES - Continued from page 15

Fr speed n economy v search, words shd b in sub-lists by length, n wiin each sub-list by frequency v occurrence. Ths requires counting th letzr in th word as part v step 1 above. Th two-letzr list v standard spellings wd b: of, to, is, be, he, we, if.

Ths implies two word lists, one in standard spelling n th uthr in economy spelling. Also two lists v locations, fr finding one version fm th uthr. Th routine here wd b:

- a. does word as read match next word in list?
- b. f yes, find location code in same position in location list;
- c. find word in tha location in alternate list;
- d. print it;

- e. f no, go on t match word as read wi next one on list (step a above);
- f. f no mor words on list, print word as read;
- g. return t step 1 v basic cycle ("read next word").

Wi ths type v program, translation fm standard spelling t economy spelling wd search list 1, find locations in parallel list 2, n print fm th indicated location in list 3. Fr retranslation fm economy spelling, th program wd simply b set to search list 3, find locations in parallel list 4, n print fm th indicated locations in list 1. (Wordlists n location codes available on request fm th author). Special economy words n abrnns cn easily b added t these lists fr special uses (apln, eqpm, abrn; torc, wyr, etc.).

STAGES FR WIDER ADOPTION V COMPUTER ECONOMY SPELLING

Number v words	Stage	Letr savings each	Total saving v letzr	Per cent v words affected
5	Memorable abbreviations (a)	.37% +	5.12%	18.3%
60	Economy words	.01% +	1.66%	5.0%
7	Frequent abrnns (b)	.20% +	2.00%	6.1%
8	Less frequent abrnns (c)	.13% +	1.33%	3.9%
20	Added abrnns (d)	.05% +	1.70%	6.4%
100	Totals		11.81%	39.7%

- (a) and, of, the, to, you (n, v, th, t, u).
- (b) are, for, have, is, that, will, with (r, fr, hv, z, tha, wl, wi).
- (c) be, been, from, there, this, was, would, your (b, bn, fm, thr, ths, wz, wd, yr).
- (d) before, but, can, come, could, give, had, he, her, him, his, how, if, not, should, them, we, what, when, which (bfor, bt, cn, cm, cd, gv, hd, h, hr, hm, hz, hw, f, nt, shd, thm, w, wht, whn, wch).

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English spelling: roadblock to reading. Teachers College Press, 1971; \$9.50.

2. Kenneth Ives. Simpler ritenn English is possibl. Word Ways 4, 1, February 1971, 40-44. Available from A. Ross Eckler, Spring Valley Road, Morristown, NJ 07960; \$2 a copy.
3. Simpler Spelling Association. Lake Placid Club, Lake Placid, NY 12946; for free samples of literature, and of World English Spelling description. □

# GAMES AND PUZZLES for Nimble Minds – and Computers

Edmund C. Berkeley  
Editor

It is fun to use one's mind, and it is fun to use the artificial mind of a computer. We publish here a variety of puzzles and problems, related in one way or another to computer game playing and computer puzzle solving, or

to the programming of a computer to understand and use free and unconstrained natural language.

We hope these puzzles will entertain and challenge the readers of *Computers and People*.

## ALGORITHMO

In this puzzle, the objective is to express a procedure for going in a given situation from given input to given output. The following conditions apply: the situation is a little off the beaten path and is interesting; the procedure is fairly evident and fairly short; the procedure is to be expressed in precise English words, with perhaps defined terms in addition; the procedure is to be completely and accurately expressed, i.e., the calculating procedure must work. (In addition the procedure may, if desired, be expressed in a common computer programming language such as BASIC, LISP, FORTRAN, or APL, together with complete translation into precise English words and satisfactory evidence, in terms of several examples run, that the program works correctly.)

For the following puzzle, we hope to publish in the September issue the best solution received before August 2 from a reader of *Computers and People*.

### ALGORITHMO PUZZLE 746

*Problem:* NUMBER OF SYLLABLES. *Input.* The string of characters constituting an English word. *Output.* The number of syllables. *Note:* 99.9% accuracy is satisfactory. *Examples:* *Input:* responsibility, attitude, faces, faced, power, hour, owes. *Corresponding Output:* 6, 3, 2, 1, 2, 1, 1. *Note:* Even if the algorithm produces for "preempt" 1 syllable, and for "cooperate" 3 syllables, it is nevertheless acceptable.

## ARGUMENTO

The problem is to understand the argument being asserted in a passage, and (1) say whether the argument is valid or invalid, and (2) state the reasons why or why not, within the number of words allowed for the answer.

### ARGUMENTO PUZZLE 746

*Problem:* "Friends, before we can agree on a common course of action to deal with the difficult problems that face us, we must agree on a platform and a strategy from which our course of action will follow." (Answer in 16 words or less.)

## NAYMANDIJ

A "naymandij" puzzle is a problem in which an array of random or pseudorandom digits ("produced by Nature") has been subjected to a "definite systematic operation" ("chosen by Nature") and the problem ("which Man is faced with") is to figure out what was that operation.

A "definite systematic operation" meets the following requirements: the operation must be performed on all the digits of a definite class which can be designated; the result displays some kind of evident, systematic, rational order and completely removes some kind of randomness; the operation must change at least six digits from their original random value; all other digits must remain unchanged in value and position; and the operation must be expressible in not more than four English words. (But Man can use more words to express it and still win.)

### NAYMANDIJ PUZZLE 746

8	1	4	3	3	1	1	8	6	1	1	0	0	1	9	9	3	4	3	6
6	0	5	1	5	8	3	4	8	3	5	2	6	5	9	1	9	5	8	5
0	6	0	5	0	8	7	9	2	6	2	6	3	9	3	0	4	9	1	1
3	7	9	2	6	6	8	0	3	6	5	9	9	0	6	2	2	7	9	7
6	0	4	6	5	7	1	7	2	6	8	9	5	7	9	8	8	0	4	9
2	2	3	5	9	8	2	1	6	3	9	1	6	0	4	0	9	1	9	7
2	6	8	7	2	7	4	7	0	1	6	9	8	9	7	1	6	9	6	0
0	1	8	9	7	1	4	3	5	1	8	4	9	0	2	3	9	9	3	1
7	7	2	9	8	0	6	0	4	0	4	4	3	9	5	9	8	3	1	9
2	5	2	6	9	4	3	2	1	5	7	4	5	9	9	4	9	9	8	2

## ESSENTIALO

The problem is to understand the essential meaning of a long sentence filled with unnecessary words, and to express that meaning in a much shorter sentence by omitting words that say little or nothing. The second shorter sentence is limited to a stated number of words.

### ESSENTIALO PUZZLE 746

Express the essential meaning of the following sentence of 22 words in a sentence of not more than 12 words.

It is incontestably accurate that he at that time reiterated that humanity does not continue to survive on bread all by itself.





## GIZZMO

The problem is to grasp relations between things that are not identified in the usual way — their names cannot be looked up in the dictionary — and then solve a problem involving them. A case could be argued that this is an extension of Lewis Carroll's poem, "Jabberwocky".

### GIZZMO PUZZLE 746

*Problem:* All SWALLIES are the same size and shape and lie inside a KRING. Every day the SWALLIES reproduce and reproduce and at the end of 6 days there are twice as many SWALLIES as there were before. Calculations show that in 123 days the KRING will be completely full of SWALLIES. How many days will it take for the KRING to be half full of SWALLIES?

## NUMBLES

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 deliberate (but evident) misspellings, or is otherwise irregular, to discourage cryptanalytic methods of deciphering.

### NUMBLE 746

$$\begin{array}{r}
 \text{S O W T H E} \\
 \times \quad \text{W I N D} \\
 \hline
 \text{T I E A M P M} \\
 \text{O P T H N S R} \\
 \text{W W M O M M W} \quad \text{IND = PAO} \\
 \text{A W P I S R E} \\
 \hline
 = \text{W T S H D T H P I M} \\
 \text{00857 33189 93402}
 \end{array}$$

For these puzzles, we invite our readers to send us solutions. If a human program or computer program for solving can be enclosed, so much the better. In some cases, there is no such thing as "the solution," but only "a solution". Usually, the (or a) solution to a puzzle will be published in the next issue.

Our thanks to the following individuals for sending us their solutions to — **Numble 744:** Edward A. Bruno, Daytona Beach, Fla.; T. P. Finn, Indianapolis, Ind. — **Numble 743:** Edward A. Bruno, Daytona Beach, Fla.

ΓΔΥ · Θ ≡ ΣΨ · ΓΔΥ · ΘΨΣΣΠΨΣ ·

## SOLUTIONS TO PUZZLES IN THE MAY ISSUE

**ALGORITHMO 745:** Solution scheduled for publication in July.

**ARGUMENTO 745:** *Answer:* Invalid. Putting a number and itself together is an ambiguous operation. (11 words).<sup>\*1</sup>

**COMPMEANO 745:** The number of 190 digits beginning 60550 45871 . . . . is the decimal fraction for 66/109; after 108 digits the digits repeat. Therefore, there is no message.

**ESSENTIALO 745:** An advisory group of engineers and scientists will scan information helpful to the Center, and report it. (19 words).<sup>\*1</sup>

**GIZZMO 745:** Solution scheduled for publication in July.

**NAYMANDIJ 745:** Make diagonal of 4's.

**NUMBLE 745:** I = 0; R = 1; F = 2; N = 3; T = 4; S = 5; O = 6; E = 7; G = 8; H = 9. The message is: One gets the fish one fishes for.

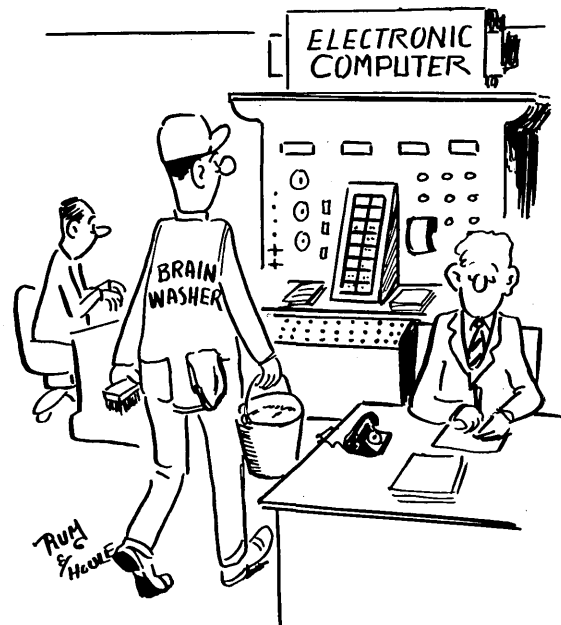
**PICTORIAL REASONING TEST 745:**<sup>\*1</sup>

1. F — Every one is different.
2. E — A, B, C, D have no symmetry; E has vertical symmetry.
3. B — A and E are alike, C and D are alike, B remains.
4. A — The dots can be disregarded since there are three (neither one nor four). Then B and E are alike, C and D are alike.
5. E — B and D are alike, A and C are alike.
6. C — Only figure in two separate parts.
7. B — Only figure with 9 lines instead of 8.
8. D — Only figure with 7 elements instead of 8.
9. C — Only figure with bottom line trailing to the right.
10. D — Only figure with down-going portions.

*Notes:*

<sup>\*1</sup> If a better solution is received, we plan to publish it.

### COMPUTER MAINTENANCE



# Governor George Wallace and Gunman Arthur Bremer

## An Interim Report on Evidence of Conspiracy and Cover-Up

Richard E. Sprague  
Hartsdale, N.Y. 10530

*"Here is the same pattern of disappearing, forgotten, or ignored evidence as in the assassinations of President John F. Kennedy and Reverend Martin Luther King."*

### Blue Cadillac with Two Men

Were it not for the pattern of bullets rather than ballots set by the assassinations of 1963 and 1968, the attempt to shoot George Wallace, Governor of Alabama and candidate for President in 1972, might go down in U.S. history as the work of a lone madman. However, enough suspicions had been raised by May 15, 1972, when Wallace was shot in a parking lot in the suburbs of Baltimore, Maryland, that researchers immediately went to work attempting to determine whether a conspiracy had been involved.

### Bullets Rather than Ballots

Within an hour of the shooting, three members of the Committee to Investigate Assassinations were on the scene. The Committee's offices are in Washington, and Hal Dorland, Jim Lesar, and Bob Smith were in the office. They managed to hear, firsthand, evidence of conspiracy. The police on the scene were listening to a broadcast on the regular police channel when Dorland and Lesar were listening. They heard the actual broadcast of the police bulletins searching for a blue Cadillac with two men that had left the shooting location at a high rate of speed.

The indications on the police radio were that the two men were suspected of being involved in the assassination attempt. The author heard radio broadcasts that afternoon on a local New York station about the Cadillac and the two men. A description of the car was mentioned as having been broadcast; a brief mention of the car and men appeared in the newspapers the next day. Then this evidence faded away, never to be heard or mentioned again by any authorities. It was not brought up at Bremer's trial or by his lawyer at any time.

### Disappearing Evidence

Here is the same pattern of disappearing, forgotten, or ignored evidence as in the assassinations of President John F. Kennedy and Reverend Martin Luther King.

Smith and Dorland made contact with the Maryland State Police who were in nominal charge of the investigation. They talked about the possibility of conspiracy on several occasions. However, just like the Robert Kennedy assassination, the presence of so many people around Wallace and Bremer, and the existence of a CBS TV cameraman's footage showing

Bremer, gun in hand, tended to blank out all other possibilities from everyone's minds. Most conspiracy theories concerning the Wallace shooting have centered on the possibility that Bremer had accomplices rather than a second gun.

### 18 Wounds in 7 People

Yet, the total number of bullets fired from Bremer's gun was five. These bullets inflicted a total of 18 wounds in 7 people. This is an incredible ratio, no matter what the trajectories were. No official investigation of the various bullet paths through all of the people wounded has ever been revealed. One theory, expounded by researchers at the time, was that a second gun had been fired from a point near the parking lot. The point was higher than the lot and resembled a grassy knoll. The problem with this, for anyone who has seen the TV sequence, is that the crowd around Wallace was so thick he would have been an extremely improbable target from the knoll.

### Bremer Associates

The evidence of conspiracy with respect to possible Bremer associates is stronger. First, there is the matter of his financing. He made a number of expensive trips and purchased a number of expensive items, far beyond his financial capabilities. One of these trips involved flying from Milwaukee to New York and back, and a stay of several nights at the Waldorf Astoria. The routes he took on his trips, following first Nixon and then Wallace, seem very unlikely. He took the auto ferry across Lake Michigan from Milwaukee and then through Michigan into Canada. This is not the route an average lone assassin would take, and is certainly not the fastest one.

On the ferry, he was seen by the boat station head in the company of another man. He was seen with others on several occasions, and did not seem to be the lone wolf his diary would have him appear to be.

### Bremer's Diary and Its Publication

The appearance of a diary and its publication has been traditional for the alleged lone madman assassin situation. Oswald and Sirhan both kept diaries, so why not Bremer? Yet, something about the diary and the way it was published smells to high heaven of conspiracy or faked records. Unfortunately for exposure of the truth, Bremer has been totally in-

*Q. Arthur Bremer, who shot and paralyzed Gov. George Wallace of Alabama in 1972 — wasn't Bremer part of a plot to assassinate Wallace because the Governor held the balance of political power in the Presidential election of 1972? Does anyone really believe that Bremer was a loner? Does Wallace believe it? — T. R., Birmingham, Ala.*

A. Along with many others, Wallace does not believe that Arthur Bremer, sentenced to 53 years in the Maryland State Penitentiary, was a loner. The FBI has completed its inquiry on the case and at this time can find no evidence of conspiracy. But Wallace does not accept that conclusion.

The Governor asks: "How can one fellow who hardly made \$40 a week in his life buy two guns, an automobile,

stay at the Waldorf, rent limousines, travel to Canada and Michigan, follow me all around the country? . . . Where'd he get the money to do all that? Most of the time he was broke, worked as a bus boy . . . I have questions in my mind about how he got his money.

"Another thing, this man Bremer used to work in my campaign. He handed out leaflets for us. More'n likely he had many opportunities to shoot me before he did. How come he didn't? I'm not accusing any particular group of plotting my assassination but in my own mind I am not convinced that Bremer was a loner. I have great respect for the FBI but in this case there are still too many unanswered questions. I have no evidence but I think my attempted assassination was part of a conspiracy."

(From *Parade Magazine*, April 28, 1974.)

accessible to anyone but his publicly appointed attorney since the commission of the crime. His lawyer has certainly not shown any interest in conspiracy talk.

#### Donald Segretti Hired Bremer in 1971

Bremer was hired for paid-informer penetration of new left organizations in Milwaukee by friends of Donald Segretti in 1971. Whether these friends or Segretti himself were involved in employing Bremer to shoot Wallace is not known. What is known, however, is that Charles Colson asked E. Howard Hunt to go immediately to Bremer's home in Milwaukee right after the shooting. This suggestion occurred so rapidly that one has to be suspicious about a possible link between Colson, Chapin, Segretti, and Bremer.

#### Motives for Killing Wallace?

Certainly, the possible motive for killing Wallace, or at least injuring him to the extent that he had to drop out of the race for President, is quite obvious. A few weeks before the attempt, Wallace was shown in a Gallup poll as garnering around 18% of the vote in a Presidential election running against Nixon, and either McGovern or Muskie. The rest of the vote was about evenly divided in the poll. In other words, if the poll were correct, Wallace held the key to whether Nixon could be re-elected or not. By eliminating him, nearly all of the Wallace vote went to Nixon. To those involved in "dirty tricks," and Watergate, this must have seemed like a very desirable and necessary objective.

To a group of individuals belonging to the John Birch Society, another motive seemed possible. They believe the attempt to kill Wallace was a Communist plot, hatched in the backrooms of the Students for a Democratic Society. Alan Stang, a former business editor for Prentice-Hall and a television writer, producer, and consultant, published an article in the October, 1972 issue of "American Opinion," the house organ of the John Birch Society, on the Wallace shooting. Stang is an "American Opinion" contributing editor, and author of the Western Islands bestseller books, "It's Very Simple" and "The Actor".

#### Dennis Cossini

In spite of the somewhat distorted ideas in Stang's article about who are Communists and what the motives of SDS were, he nevertheless presents a wide array of evidence of conspiracy. His research turned up a number of links between Bremer and the underground youth groups in Milwaukee. Among other things, he discovered that the man with Bremer at the ferry boat station waiting room on Lake Michigan was Dennis Cossini, alias Dennis Kushmann, Cuzman, and Cousins. Cossini was a member of the

Weatherman section of the SDS. He went to Cuba with the Venceremos Brigade and also belonged to the Progressive Labor Party.

Stang found a photograph of Cossini in the "Milwaukee Journal" of November 5, 1969, taken during an SDS rally at the University of Wisconsin. He showed it to Earl Nunnery, the boss of the Milwaukee station for the Chesapeake and Ohio ferry boat ride. Nunnery identified Cossini as the man who had been there with Bremer on April 5, 6, or 7, 1972, asking about boat reservations. A third person, not yet identified, had been with them, but remained in their car, an American Motors product, two-tone, white on the bottom and dark on the top. The third person had long hair and could have been a girl. The car was not Bremer's blue Rambler.

#### Cossini Murdered in Toronto

Cossini was murdered in Toronto, Canada, less than two weeks after Stang began searching for him. His body was found in a parked car by police on July 6, 1972. It was picked up by three Americans who, according to an FBI agent Stang interviewed, may have been CIA agents. Cossini's body contained an overdose of heroin, and a hypodermic needle. The car also contained a 45 caliber automatic, a phony Wisconsin driver's license, and five telephone numbers on a pad. The numbers were traced by Stang to John J. McCleary, Sacramento, Calif., at V & T International, an import-export company; John J. Dugan, New York City, a public relations type; Viola Edwards in Dallas, Texas, a prostitute known as Tina; Mike McHale in Milwaukee, an SDS member; and Leibel Bergman, Newark, N.J., a suspected espionage agent and founder of the Revolutionary Union, an underground movement organization.

#### Bremer Attended SDS Meetings

Stang also discovered that Bremer attended SDS meetings in Milwaukee and was detected there by an undercover agent working for the Milwaukee Police. The agent saw Bremer at 3 or 4 meetings. Others present at these meetings included Mike McHale, Art Heitzer, Peggy Anderson, Dismas Becker, Dennis Cossini, and Mike Cullen. Cullen was one of the Milwaukee 14, convicted of burning draft records. A book was published about him in 1972, "Time to Dance; The Mike Cullen Story," Messenger Press. In July, 1971, Cullen joined Arthur Bremer in the Midget Tavern on West Wells in Milwaukee. The police agent identified both of them in a report reproduced in Stang's article. Cullen called Bremer "The Don" or "The Dawn". They discussed for about an hour a newspaper Cullen had with him. It was the September 10, 1968 issue of the "Daily World". On the front page was a photo of the Milwaukee 14, and a headline, "George Wallace — The Telltale Record".

Cullen was stirring Bremer up about Wallace by calling him a Fascist war-monger. The total discussion lasted for nearly two hours. Stang concludes from this that Cullen, along with perhaps McHale and Cossini, were involved in the conspiracy with Bremer to kill Wallace.

#### More Evidence

Other details analyzed by Stang include the following items:

- In January, 1971, Bremer bought a 38 caliber revolver. On September 14, 1971, soon after his meeting with Cullen, he bought a blue, two-door, 1967 Rambler. He did not have enough money of his own, yet he paid cash. A man was with Bremer on two occasions when he had his car serviced, and a girl was with the two of them. Bremer's friend had a green, 1960 Rambler, which matched the description of a car that Bremer's mother saw following him around, with three young people in it. All of this destroys the "loner" stories about Bremer.

#### Bremer's Guns

- On October 15, 1971, Bremer rented apartment 9 at 2433 West Michigan, within walking distance of the Midget Tavern where he met Cullen. On November 18, 1971, he was arrested in Fox Point, Milwaukee, while sitting in his parked car, with two boxes of bullets on the seat beside him, and the 38 revolver in his coat pocket. Stang concludes from this that Bremer purposefully displayed the bullets at the suggestion of the rest of the conspirators, to see if he was willing to be arrested.
- On January 13, 1972, Wallace announced his candidacy and Bremer bought another 38 revolver. On February 1, he didn't show up for work.
- In April, 1972, Bremer showed up at Flintrop's, a gun shop and firing range. He had his pistol and was seen by another customer while firing on the range.
- Bremer bought a nine mm, 14-shot, semi-automatic Browning pistol at Flintrop's.

#### Bremer's Trips

- In March, 1972, Bremer began to attend political rallies and to take extended trips. On March 1, he was at a Wallace organizational meeting at the Pfister Hotel in Milwaukee. On March 23, he was at a \$25-a-plate dinner at the Downtowner, and at a Wallace Rally at the Milwaukee Auditorium. On April 3, he was at a Humphrey Rally at the Capitol Court shopping center in Milwaukee. Next day he attended a Wallace victory party in the Holiday Inn-Midtown. On April 7 and 8, 1972, Bremer registered at the Waldorf Astoria Hotel in New York, having flown into the city from Milwaukee. On April 13 and 14, he stayed at the Lord Elgin Hotel in Ottawa. For the next three days, he was at the Sheraton Motor Inn in New Carrollton, Maryland. On May 10, he was at a Wallace Rally in Cadillac, Michigan, and the next day he was reportedly at a Wallace Rally in Landover, Maryland. The next day, May 12, he was back in Michigan for another Wallace Rally in Kalamazoo.

In all of this rapid travelling, Bremer was alone much of the time, but was seen with a male companion in Cadillac and spoke to Laurie McNally

in Kalamazoo. Stang concludes Laurie was a Communist because she was handing out anti-Wallace leaflets and was a member of the Young Workers' Liberation League.

#### Mismatch of Bremer's Income and Expenses

- Bremer's income and his expenses were completely mismatched. Stang's detailed analysis of his expenses can be summarized by stating that Bremer spent, conservatively estimating, far more than \$3000.00 during the period from January 1, 1971 to May 15, 1972. His income during this period was \$2950.00 after taxes. He had no savings or other sources of money prior to 1971. As Stang says, with his uncanny financial ability he should be appointed Secretary of the Treasury as soon as he is paroled in fifteen years.
- Bremer's diary may have been manufactured to prove his insanity, along with several other carefully calculated episodes and stories to make him seem insane. Dr. Paul Purtell, the court psychiatrist who examined Bremer after his November, 1971 arrest, found him sane. Timothy Burns and Mrs. Pemrich, two people who knew him very well, said he was definitely not crazy. Bremer was above average on intelligence tests. The jury at Bremer's trial did not believe he was insane either. The lone madman image didn't sell.

#### Destruction of Evidence in Bremer's Apartment

- If E. Howard Hunt had gone to Bremer's apartment as Colson suggested, he would apparently have had no trouble with the FBI. Stang says that "Chicago Tribune" reporters Ronald Koziol and John O'Brien went to Bremer's apartment in search of clues and found that FBI agents had come and gone leaving the place unguarded. As a consequence, the apartment resembled a circus. Newsmen, neighbors, curiosity seekers, and college students from a nearby beer party, had been rummaging through the place, overturning furniture, pawing through clothes, pocketing bullets and other souvenirs, and generally tracking up the entire scene with their fingerprints and footprints. Bremer's notebook was taken away by a wire service reporter. The FBI returned a few hours later and began to put evidence into boxes. At no time did they attempt to seal off the apartment or to take fingerprints. Hunt could have come and gone in his red wig and never even been noticed. The FBI obviously were told by someone not to find the facts about Bremer.
- Finally, the agent who saw Bremer at the SDS meeting in November, 1969 was fired by the Bureau of Narcotics. Bremer's appointed attorney has been of very little help in determining the truth. The Maryland State Police, while apparently convinced there was a conspiracy, according to off-the-record discussions with members of the Committee to Investigate Assassinations, have been completely squelched by the Federal Government in the latest giant cover-up of an attempted political assassination.

#### Could Bremer have Written his Diary?

Gore Vidal, in an article published by the "New York Review of Books" in December, 1973, suggests another reason for Hunt to have gone to Bremer's apartment. Vidal, analyzing Hunt's writing style in his many spy novels, concludes it would not have been possible for Bremer to have written his own  
(please turn to page 41)

# The Assassination of the Reverend Martin Luther King, Jr., and Possible Links With the Kennedy Murders — Part 5

Wayne Chastain, Jr.  
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*"In what Thompson perceived to be a mock mood of melancholy, the man sighed as he said: 'You are about to hear the life story of a real loser'..."*

*Was the murder of the Reverend Martin Luther King, Jr. the result of a conspiracy?*

*Previous installments\* of this series described the "eggs and sausage man," later given the code name of Jack Armstrong, who appeared on the scene the day of the murder. He has espoused anti-racist attitudes, a right-wing philosophy, and has had possible connections with the CIA, the FBI, Fidel Castro.*

*Also appearing on the scene are Tony Benavides and J. Christ Bonnevecche who claim to have information and understanding of Dr. King's and John F. Kennedy's assassinations. Are they to be believed? Are they the same person, and are their names possibly aliases for Jack Armstrong?*

*Is there a relationship between these assassinations? Is there a conspiracy at work by an organization, or were the murders accomplished by one or a few individuals? Mr. Chastain continues to interrelate his information about the assassinations, all the while asking, "Who really killed Dr. King and the Kennedys, and why?"*

## Tony Benavides — The Mysterious Blond Latin

At 9:30 p.m. on April 9, Russell X. Thompson, a rising Memphis attorney, received a telephone call from a man who spoke with a Western accent.

"The accent surprised me because he said he had just flown into Memphis from Chicago — his home," Thompson said.

Thompson had graduated from law school late in life after an extensive career as an investigator for insurance companies. In less than four years after graduation from Southern Law University, a Memphis night law school, Thompson had established a reputation as a skilled defense attorney. He had won several sensational and well-publicized murder cases. Many of his clients were black, although Thompson is white. Thompson had represented the Memphis Chapter of the National Association for the Advancement of Colored People and its Legal Defense Fund.

The caller said he had heard of Thompson from Chicago friends, and said he needed to talk to Thompson within the hour in Thompson's office. It was imperative for him to talk to Thompson when he was alone, when his secretary wasn't there, or anyone else for that matter.

Thompson refused to meet with him that night. Thompson told him he was tired and did not want to drive downtown. Besides, the 9:00 p.m. curfew was still in effect and the National Guard — called out within an hour after King was killed because of

\*Parts 1, 2, 3, and 4 were published in the February, March, April, and May issues, respectively, of *Computers and People*, which are available from the publisher as back copies at \$2 each.

the widespread firebombing of businesses, looting, and sniper shootings — was still patrolling the streets, especially in the downtown area.

"I told him I would meet him in my office at 7:00 a.m. the next morning," Thompson said. "I told him no one would be there at that time. My secretary did not get there until 8:15 a.m. or later. We would have plenty of time to talk alone."

The caller reluctantly agreed and hung up, Thompson said.

The remark about "friends in Chicago" puzzled Thompson. He said he had recently won an acquittal of a black defendant charged with murder in an adjacent West Tennessee County. This was no mean feat in segregationist West Tennessee. So the Chicago Legal Defense Fund may have heard of him. The defendant was also indigent and he had relatives living in Chicago. Those relatives may have paid his fee from assistance provided by the Chicago Legal Defense Fund. But how would the caller know about the case unless he had friends with the Chicago Legal Defense Fund? The caller seemed to be white, and a Westerner.

## Early Morning Meeting

The next morning, Thompson said he did not get to his office as early as he had hoped. It was about 7:30 a.m. when he opened the hallway door to his law office. No one was in the hallway. He assumed the caller from the night before had tired of waiting and had left. Thompson had been at his desk only a few minutes when the phone rang. "Are you alone," the voice asked? It was the same voice from the night before. Thompson answered in the affirmative. The caller said: "Good, I will be right up".

Minutes later a man walked into his office. Thompson guessed the man had been in the lobby of the office building and saw Thompson get on the elevator up to his 10th floor office. He was about six feet tall, wearing a Panama hat with a blue pin-stripe suit. He opened the door with a handkerchief in his hand.

"Mr. Thompson, I presume," the visitor said. There was a convincing air of amiability in the man's voice.

"I'm Thompson ... come on in and sit down." Thompson had a long, yellow-sized pad on his desk. He immediately picked up a pencil and started taking notes. "You don't mind if I take notes?" Thompson asked the visitor. "Go right ahead," the visitor said.

Thompson noted that the visitor's movements were graceful and well coordinated. His demeanor suggested an actor — but a convincing one. He was lean and well-built — muscular without being excessively fleshy. The suit fitted him well. He wore a blue, buttoned-down shirt with a maroon tie. He was what women would probably describe as handsome in a rugged-looking way. He had dark eyes and swarthy features. He took his hat off for a few seconds, and Thompson was surprised to see that his visitor was a blond. Seconds before, Thompson would have guessed his visitor would have had dark, rather than blond, hair. He re-examined the man's features again. There seemed to be a chameleon quality to his complexion. Thompson said he would not have been surprised to have learned his visitor had theatrical makeup on. The sun's rays beamed through the window and the reflection on the man's skin seemed to make him lighter.

"I was surprised to see that he was blond," Thompson said. "The hair could have been dyed. Or it could have been a wig, although wigs were not so much in style as they are today. His hair was groomed in a sort of pompadour style similar to the one in vogue in the late 30's, 40's, and to a lesser extent, in the early 50's."

#### A Sophisticated Spaniard?

In what Thompson perceived to be a mock mood of melancholy, the man sighed as he said: "You are about to hear the life story of a real loser, but I guess you have heard plenty of those in your line of business".

The man's accent no longer sounded Western as it did the night before, or as it did a few seconds earlier when he heard it on the phone.

"His first words spoken in my office had a trace of a sophisticated Spanish accent," Thompson said. "When he spoke, his dark eyes remained fixed on me as if he were trying to hypnotize me. He smoked slim-shaped Havana-styled cigarettes — the ones that may appear to the average person to be miniature cigars."

Thompson said he spent many of his 45 years with Spanish-speaking people. He recognized the pungent smell of Cuban cigarettes. Born near San Antonio, Texas, Thompson served in the U.S. Navy and Merchant Marine both during and after World War II. He had been around the world. His ears had been attuned to Spanish accents, Spanish names, as well as Western and Eastern Anglo-Saxon modes of speech. He asked the man what his name was. The man replied: "Benavides — Tony Benavides". Almost in the same breath, the man added that the name was "an alias".

Later, Thompson explained: "Benavides, of course, is a Latin American name — a very common name for Texas Mexican-Americans. The minute he uttered the name, I detected a second voice change ... there was now a slight "Tex-Mex" accent in the man's speech — a contrast to the sophisticated Spanish accent he spoke a few minutes previously. I could not be sure it was not feigned. It was inconsistent with the euphonious Spanish spoken just a few minutes before — the euphonious sounding Spanish spoken in Central Mexico or around Mexico City."

#### Benavides Seeks Representation

The visitor said he wanted Thompson to represent him in case the police charged him with murder, or, if a friend of his, a former roommate from Denver, Colorado, was alternately charged with murder. He said his friend's name was Pete, but that this was an alias, too.

Wayne Chastain of Memphis, Tenn., is a veteran newspaper reporter and Southern journalist with experience on several metropolitan dailies in Texas, including El Paso, Houston, Dallas and San Antonio, as well as on the St. Louis Globe-Democrat and a Memphis daily. He had traveled with Dr. King's entourage on and off for two years prior to the assassination. He had spent the last two days of King's life covering his speeches in Memphis prior to the shooting. He was on the murder scene within 10 minutes after Dr. King was shot. He interviewed eyewitnesses for one of the first comprehensive news accounts to the nation of Dr. King's death. A native Texan and a graduate of the University of Texas with a bachelor's degree in history and political science, Mr. Chastain also spent several months in early 1964 investigating and researching the assassination of President Kennedy, Jack Ruby's link with Lee Harvey Oswald and a group of pro-Cuban arms runners, and other activities related to Kennedy's death. Months before The Warren Commission's report, which was published in the fall of 1964, Mr. Chastain — after exhaustive interviews with hundreds of witnesses — had reached the conclusion that President Kennedy's death was the result of a plot involving paramilitary professionals financed by a group of wealthy, right-wing Texans with strong connections with former high officials with the Central Intelligence Agency as well as lower echelon CIA personnel still assigned to the bureau. The present installment is an excerpt from a forthcoming book entitled: Who Really Killed Dr. King — And the Kennedys? A Disturbing View of Political Assassinations In America.

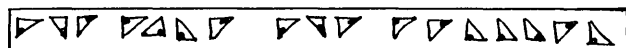
Thompson asked him who was murdered. The man continued to stare at Thompson. He appeared to be studying Thompson's reactions as he pronounced the words slowly and precisely: "The assassination of Dr. Martin Luther King, Jr."

Thompson asked him to give the details. The man said Pete and he had been roommates in Denver. He gave Thompson the number of a rooming house in Denver. (Thompson later checked and found there was such a number and that two men — one fitting Benavides' description — had actually stayed there). Both are professional gunmen, Benavides said, but he quickly added that he had never hired his gun out to "kill niggers," as his roommate had.

"I believe my roommate killed King," Thompson quoted Benavides as saying. "It will be my lousy luck that the police will arrest me and charge me with King's murder. They picked me up last Friday" (the same day the "eggs and sausage man" was arrested outside Jim's Cafe and released within the hour).

Benavides continued: "They turned me loose after taking me up to the rooming house. Believe me, I know something about firearms ... that shot could not have been fired from the bathroom window — the spot where the police and FBI had announced last Saturday that the fatal shot was fired. For one thing, the elevation is all wrong."

Up to this point, Thompson said he had not been sure whether the visitor called Benavides was "trying to put me on". But when he said he was picked up by police, this could be verified. Also, if he had not been taken up to the rooming house by police, how would he know anything about the bathroom and the angle of elevation looking down to the balcony of the Lorraine Motel? Or had he been to the rooming house before King's death?



"When he talked, he sorta had a wink in his eye," Thompson said. "For a moment I got the impression that he was seeing how far he could go to strain my credulity. I asked him what he wanted me to do. I was an attorney. Did he want me to represent him or his friend Pete?"

Thompson said he could not represent anyone unless he knew their real identity. If Pete had killed King and Thompson undertook to represent Benavides, it would be necessary for Thompson to reveal this information to police in order to see that justice would be done to Benavides as his client. On the other hand, if Benavides were hiring Thompson to represent Pete, then Thompson had no obligation to Benavides. If Benavides were the killer, then Thompson had to reveal this information to police to protect Pete as his client.

Also, misrepresentations as to identities would create no professional attorney-client relationship, Thompson warned Benavides.

#### Origin of the Fatal Shot

"Even after these warnings, the man continued to talk," Thompson said. "He discussed firearms, angles of elevation, wind driftage. He said the shot that killed King did not come from the window of the rooming house but from a clump of bushes on a wall across the street from the motel" (the same site where Solomon Jones, King's chauffeur, said to this writer he saw the man with the white sheet on his face less than 30 minutes after King was killed).

The wall ran parallel with the back of the buildings, including Jim's Cafe and the rooming house, which faced Main Street. A large, vacant lot, facing Mulberry Street, is to the rear of these buildings. On the day King was killed, there were large patches of tall grass and clumps of bushes, along with several trees, at the edge of the wall. The elevation of the lot is more than six feet higher than the ground on which the Lorraine Motel stands. The wall is slightly lower than the second floor or balcony of the Motel directly across the street. Thus, if the shot were fired from the level of the top of the wall, the bullet would be traveling in an upward trajectory.

Thompson said he glanced at his watch several times, but let the man ramble on because he was fascinated by the "linguistic inconsistencies" which kept emerging in his visitor's speech patterns. He spoke flawless English at certain points in the conversation. Other times, he spoke with the Spanish accent peculiar to Central Mexico. At still other times, the sophisticated Spanish deteriorated into "Tex-Mex" — a hybrid language spoken by denizens along the Texas-Mexican border. Tex-Mex comprises a melange of English and Spanish words, clustered together without any conformity to the conventional rules of grammar as they pertain to tenses.

"He seemed to be a man playing several roles. He was enjoying every minute of it, I thought at the time," Thompson said. "One minute he was a tough Westerner. The next he was a shrewd, sophisticated con man who knew more about King's murder than the police or FBI. The next minute he would want me to believe he was a not-too-bright member of a Latin American minority, an unfortunate victim about to be sucked into the maw of persecuting police officers, who purportedly wanted to solve Dr. King's murder by

pinning it on any likely candidate they could ensnare."

#### Concealed Weapon

But more than anything the man said that impressed Thompson was what he did while in Thompson's office.

"As I told you, I am a professional gunman, too," Benavides said. "I know all of the tricks."

He stood up, swirled around in a semi-circle, holding his arms in the air as if someone had a gun on him. He still held the cigarette and exhaled several smoke rings. This made his neat-fitting suit fit even tighter. The pose produced no abnormal bulges, either in front or in back. He then asked Thompson: "Do I appear to be armed?"

Thompson answered in the negative.

Benavides then opened his coat and spread it wide. No holster or firearm was revealed. He then buttoned his coat and put out the small cigarette in the cup of his hand. He did not drop the butt in an ashtray on Thompson's desk, but instead dropped the butt in the side pocket of his coat. He then made a strange motion, as if he were trying to scratch his back. When the hand came around to his front again, it gripped a small caliber revolver. He pointed it straight at Thompson's face as if he were aiming to shoot Thompson between the eyes. Benavides then smiled. He unbuttoned his coat again, and with another strange motion, dropped the gun down his back again.

"It was hidden in the pit of my back," Benavides said. "The trick drives the cops crazy. They never think of frisking a guy there. A guy like me, with large shoulder blades, can carefully conceal a small pistol there, but leave no bulges if he knows how to breath and dress properly."

He sat down again. He peered at Thompson with a sardonic stare. Again, Thompson sensed that the visitor's dark eyes seemed to suggest he was trying to push Thompson to the limits of his credulity.

Benavides pulled out another Havana cigarette. He asked Thompson for a light. There was a ceramic bowl filled with match folders on Thompson's desk, well within Benavides' reach. Thompson nodded his head toward the bowl.

"Help yourself," Thompson told Benavides. Instead, Benavides leaned over the desk with the cigarette in his mouth. He asked Thompson: "Would you mind lighting the match?"

Thompson complied. He already suspected what Benavides' answer was going to be in response to his next question, but he asked the question anyway.

"Why didn't you light your own cigarette?" Thompson asked.

Benavides replied: "I didn't want to leave any prints in your office."

Why didn't Benavides light his own match and then put both the folder and the used match stick in his pocket along with the butt he had put there earlier, Thompson asked?

"I don't want anything on me or in my pockets that will lead the police back to your office," Benavides replied.

*(please turn to page 33)*

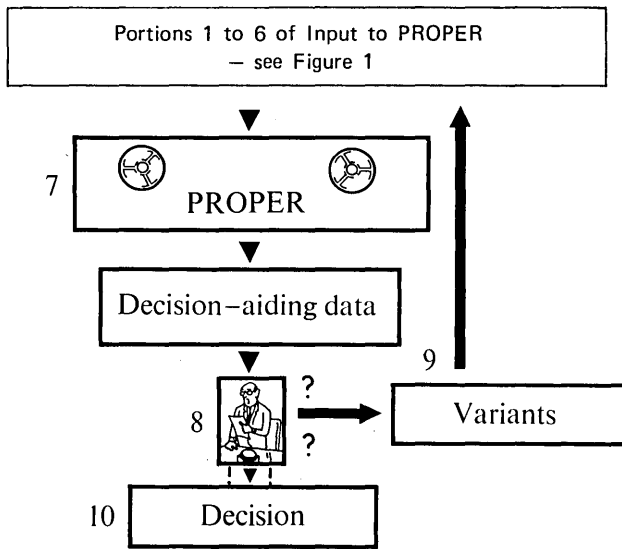


Figure 4

2. Determine the production functions, proceeding coarsely phase, e.g., at the operating level, and later on detailed by cost center and subgroups as required. Responsible: Production.

Lindau: 58 machine groups and 1 personnel restriction were laid down. In addition, 8 auxiliary restrictions were set up to express the interchangeability of individual machine groups in the mathematical model. Particular attention must be paid to interchangeability of cost centres in constructing the mathematical models. If, for example, two cost centres such as pipefitting and sheetmetal assembly are mutually interchangeable:

$$\text{Pipefitting: } 2 X_1 + 3 X_2 \leq 500$$

$$\text{Sheetmetalwork: } 4 X_1 + 2 X_2 \leq 400$$

these should be combined in a "pool" by adding the matrix coefficients thusly:

$$\text{Piping and sheetmetal assembly: } 6 X_1 + 5 X_2 \leq 900$$

If the required capacity for the two original cost centres is not to be shown, both restrictions must be eliminated; otherwise they are given the same capacity limit as the auxiliary restriction:

$$\text{Pipefitting: } 2 X_1 + 3 X_2 \leq 900$$

$$\text{Sheetmetal assembly: } 4 X_1 + 2 X_2 \leq 900$$

If two cost centres are interchangeable in one direction, e.g., "small" drilling work can also be done in the "large" drilling shop but not vice versa:

$$\text{"Small" and "large" drilling: } 8 X_1 + 7 X_2 \leq 1000$$

$$\text{"Large" drilling: } 3 X_1 + 4 X_2 \leq 400 \text{ (unchanged)}$$

Here again, the cost centre "small" drilling can either be eliminated or it can be given the same capacity limit as the auxiliary restriction:

$$\text{"Small" drilling: } 5 X_1 + 3 X_2 \leq 1000$$

3. Establish capacity limits for each capacity centre for the chosen accounting period (e.g., 1 year). Responsible: Production.

Lindau: Production Control established the capacity limits of the machine groups in line with planning data for 1971. Machines that were planned to be used for shift work were shown in the matrix with capacity increased accordingly.

4. Determine the required production time of a capacity centre for 1 product. Responsible: Production.

Lindau: These figures were taken from operation sheets. A total of about 3000 figures were determined.

5. Determine the upper and lower sales limits or sales budget figures. Responsible: Sales.

Lindau: Sales prepared 3 figures for each product, namely the upper and lower sales limits for the EWL products and the 1970 sales of these products.

6. Establish the optimization goal. Responsible: Accounting.

Lindau: The most obvious optimization goal would be that of maximizing profits. But this variable changes with the number of units sold and so is not constant. It is necessary to use another accounting figure in this case; the overhead contribution, defined as the difference between the selling price and the variable cost. Use of this figure as a measure of success is only legitimate under the assumption that either the fixed costs for product development were only a one-shot affair or the minimum amount necessary to make a profit will be sold.

7. Compute the optimum product mix. Responsible: Operations Research Group.

Lindau: Before the actual computing could begin, it was necessary to check and clear up the statistical material. This was no mean task in view of the large quantity of data and its differing sources. Checking was done from two aspects:

- All figures collected were reviewed for plausibility.
- With the aid of this coefficient matrix and the previous year's sales by product, the loadings of the individual production centres were calculated and compared with the actual results.

8. to 10. Decision-making instances review results and put any necessary questions to PROPER; alternatives are calculated. Responsible: all.

Lindau: The task groups responsible for the project reorganization ordered the calculation of some 60 alternatives.

#### Alternative Calculations

The Linear Programming system developed by Operations Research was used to calculate the optimum product mix. This was done on the CD 6500 computer of FIDES in Zurich, with the data variations being fed in through the CD 200 input station in the Sulzer Computer Centre. But no decision-making process in real life can ever be satisfied with a one-time calculation of the optimum product mix. A rash of questions arose for which answers were provided by running extensive alternative computations. Some of these questions were:

- What is the optimum product mix with the given capacity configuration and the present market situation?
- Which cost centres represent bottlenecks in terms of production capacity?
- How fully are the other cost centres loaded?
- Where would it pay to invest in added production capacity, and what would the return be?



- What would be the effect of switching a particular product from Winterthur to Lindau?
- How does the market situation, i.e., the selling conditions, affect the production capacity?

A total of some 60 alternatives were calculated. Some of them, such as the running through of a pre-determined sales budget, necessitated the "approaching" of a possible solution in more than one calculating operation. The result of such an alternative calculation is composed of:

- the information on the products
- the attainable total overhead contribution assuming that the optimum product mix is adopted
- the analysis of the degree of utilization of production restrictions if the optimum product mix is adopted

A large portion of the work consisted in analyzing and concentrating the computer results to produce decision-making data ready for discussion by the task groups and the project committee.

#### Category List

The PROPER results provided the basis for setting up a hierarchy of 86 EWL products in terms of their attractiveness for the company. The category list is used (among other things) for:

- preparing the sales budget
- setting up guidelines for Sales on those products promoted more actively and those to be pushed less
- answering questions of product priority in the event the plant should become overloaded.

This list was used as decision-making basis for setting up the EWL sales budget.

#### Effort and Cost

The work was stretched out over a period of about 20 months. A total of some 2,000 manhours (or Fr. 80,000) was expended, plus about Fr. 50,000.-- for the computer time, or a total of Fr. 130,000.--. Of the 2,000 manhours, 1,100 were required for data collection and 600 for data preparation, keypunching, setting up the mathematical model and carrying out the calculations on the computer. The remaining 300 manhours were used in analyzing the computer results, evaluating the alternatives and decision-making.

For calculating an alternative, the CD 6500 requires between 70 and 170 computer seconds. A second of computer time costs about Fr. 2.--.

Half of the computer costs (about Fr. 25,000.--) were needed to clarify the statistical material for the EWL PROPER matrix. A large percentage of the computation time was spent in making step-by-step approaches in variations of prescribed sales budgets.

#### Closing Remarks

From reports and the opinions of those involved, it can be said that the application of PROPER was worthwhile for the following reasons:

- The PROPER matrix made relationships both within and without the production setup transparent.
- Discussions, clarifications and decisions were carried out on the basis of objective statistical material.

- Every subordinate decision was taken within the framework of the overall objectives of Escher Wyss Lindau.
  - Questions from management were answered after very rapid computation of alternatives.
  - Cooperation between Production, Sales, Accounting and Management was improved perceptibly by the common language of PROPER.
  - The statistical material produced, which can be kept current with relatively little effort, can be used for future problems of a similar nature (medium-term planning, investment questions, shifting of products, etc.).
- PROPER produced gratifying results in this initial application to this particular sector, but it will be even more effective in each subsequent application, for the basic statistical data is now available and the instruction and coordination of the various functions is organized. The management of Escher Wyss GmbH, Ravensburg, and the Winterthur Engineering Works have decided to revise the matrix twice a year and to use the PROPER computation at least yearly for the purpose of medium-term planning.

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#### CHASTAIN — Continued from page 31

Benavides then sat back, blew another smoke ring, and said: "Let me show you the tattoo trick".

He unbuttoned his long sleeve shirt after pulling up his coat sleeve. The arm revealed strong sinews, as well as the letters T and S intertwined in a tattoo on his forearm. He then rubbed his thumb over the tattoo in a firm, but gradual erasing movement. He then displayed the same spot on his arm a second time — sans the tattoo.

"That's another trick that drives the cops crazy," Benavides said. "There's a special way to erase the tattoo they don't know about."

The man continued to talk. Thompson listened. It was after 8:00 a.m. His secretary was due to arrive any second.

"That shot did not come from the bathroom window or any other window in that rooming house," Benavides said. "I can tell you for sure. I looked out that bathroom window ... you could not have squeezed off a bullet and hit King from that spot" (the police later contended Ray twisted himself into a contorted position with one leg in a bathtub and one crouched on the side of the tub to get the proper position to fire the shot).

Benavides continued: "There were the trees for one thing. The angle of elevation is another." □

(Part 6 next month: Similarity Between King's and J. F. Kennedy's Fatal Shot)

# ACROSS THE EDITOR'S DESK

## Computing and Data Processing Newsletter

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### APPLICATIONS

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#### SNAKE RIVER DAMS CONTROL FLOODS AND GENERATE POWER WITH HELP OF COMPUTER

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Three giant dams on the Snake River in Washington are generating hydroelectric power and controlling river flow conditions under the remote control of a computer. The three, Ice Harbor, Lower Monumental and Little Goose dams, are connected by microwave to the IBM 1800 computer at McNary Dam in Oregon on the Columbia River. Little Goose is 102 miles from McNary.

Thirty sensing devices at each of the Snake River dams continually transmit information to the computer, such as height of the water, its rate of flow, and the amount of power being generated. As conditions change at the dams the 1800 automatically directs equipment to react to correct conditions.

Although the computer controls the dams individually, it varies the control at each depending on the conditions at the others. This eliminates the possibility of one dam spilling water while the other two operate at less than capacity, thus ensuring optimum conditions along the entire lower Snake River.

"We want to avoid spilling water unless the river flow is high and exceeds the hydraulic capacity of our turbines," said Gordon Richardson, project engineer at McNary Dam. "Water represents electricity to us, and the more water we spill the less energy we can generate. By regulating river flow and power generation more efficiently than manual operations could, the computer directly reduces our overhead. In turn we can keep power costs down to our consumers."

Under normal conditions, the dams store water at night, when power demand is relatively low, and direct water onto their turbines during the daytime, when power needs peak.

Electricity from McNary and the three Snake River dams feeds into the Bonneville Power Administration Grid, serving the northwest. "Bonneville signals the computer for more or less power as its needs fluctuate" Mr. Richardson said. "The 1800 responds quicker than we could do manually."

Ice Harbor, smallest of the three Snake River dams, can generate 310,000 kilowatts, enough to supply about 60,000 homes. Lower Monumental and Little Goose each can generate 465,000 kilowatts. "Each of our big generators has a turbine that can handle about 22,000 cubic feet of water per second, roughly enough to fill 7,500 bathtubs," said Charles Cook, chief of the operations section at McNary.

A fourth dam on the Snake, Lower Granite, now is under construction and will be tied into the IBM system when completed, in 1975.

## BRITISH STEEL CORPORATION USES MINICOMPUTERS FOR STEEL FURNACE WASTE-GAS ANALYSIS

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The British Steel Corporation's Research Departments in Teesside and Sheffield are both currently using Computer Automation Alpha 16 minicomputers to provide them with a fast data analysis facility for processing the outputs from two of their quadrupole mass spectrometers. They are applying mass spectrometric techniques to produce comprehensive analyses of the waste gases produced by basic oxygen (BO) steelmaking furnaces - as part of a research project designed to meet the future needs of the BSC by improving the efficiency of the furnace processes.

The Teesside Research Dept. had planned to create their own system. Purchasing the Alpha 16 made it necessary to build only the interface unit between the minicomputer boards and the spectrometer itself.

Using the minicomputer has resulted in a number of advantages. It enables real time calculations of different gas compositions to be made immediately; it supervises the continuous printout of the results of the analyses on a chart recorder; it controls the quadrupole mass spectrometer during its calibration sequences; and it provides an overall status monitoring function for the vacuum system.

## DESIGN OF EARTHQUAKE-PROOF BUILDINGS AIDED BY NEW COMPUTER ANALYSIS

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Scientists can now tell what damage an earthquake is likely to cause to a specific building. Newly-developed techniques make it possible to analyze the magnitude of a probable earthquake at various distances from a building, plus the structural characteristics of the building, to determine what the results of the quake would be.

That is the conclusion of researchers at Systems, Science & Software (S-cubed), La Jolla, Calif., who have just completed a detailed new earthquake study to analyze the effects of ground motion and building movement. The scientists made use of special computer techniques developed by the firm for such studies, and utilized a Las Vegas structure as a test case.

A film, produced and photographed frame-by-frame by the computer analysis, shows a 10-story building responding to a computer generated magnitude 5.5 earthquake with epicenter at the building's site; another section of the film shows the results if the quake were 10 miles away; and a third section analyzes a similar quake 20 miles away. Another experiment used data from the 1940 El Centro earthquake, and simulated those effects on the building from a distance of approximately seven miles.

"The use of a computer generated earthquake gives us the freedom to place the building at any distance from the epicenter, rather than rely on the few available measured earthquake records," according to Dr. Joel Sweet, Principal Investigator at S-cubed and a Registered Professional Engineer. "The precise data generated by the computer is an important

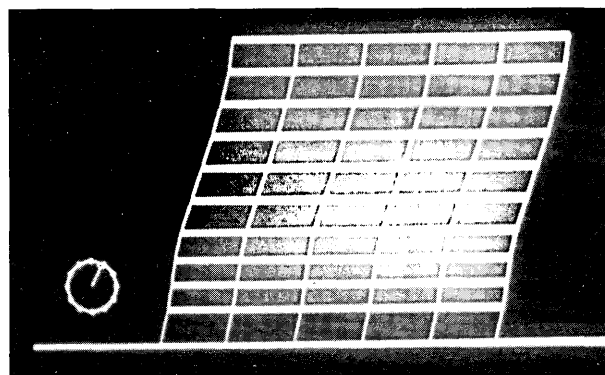


Figure 1

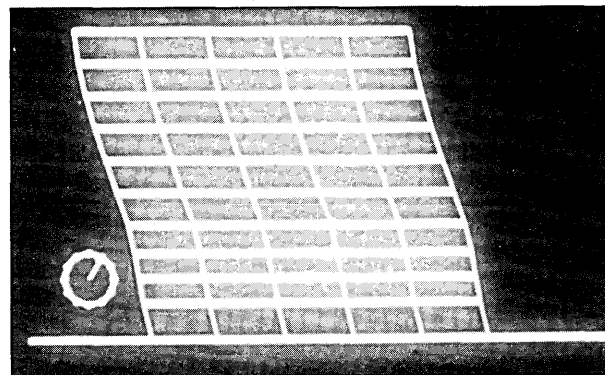


Figure 2

The photos shown here are reproduced from a film created from computer output; film shows total building movement throughout the earthquake. Figure 1 shows predicted movement of a ten-story building, subject to the epicenter of a theoretical earthquake of magnitude 5.5. Less than a second later, in Figure 2, the same building has swayed in opposite direction. Roof has moved approximately nine feet from position in previous photo. (Actual building analyzed for the study is in Las Vegas, Nevada.)

part of the study program, but the film provides a far more visual and dramatic presentation of the information," he noted.

Dr. Sweet's work makes use of the results of a new earthquake simulation computer program developed by Dr. J. Theodore Cherry, also of S-cubed. Their efforts are especially important because of changes in building codes being made in California and other earthquake-prone areas; one of the most important changes concerning critical structures is to require architects and structural engineers to use dynamic analyses like the S-cubed approach, rather than the static computations previously utilized.

"Engineers are already capable of designing buildings which have a high probability of surviving a strong quake," Dr. Sweet said. "But the problem is a complex one, particularly with high-rise structures, and it is virtually impossible to predict with any accuracy just how a proposed structure will react to a given quake, unless highly sophisticated techniques like these computer programs are utilized."

"Other researchers have also developed techniques for analyzing the effects of building motion," Dr. Sweet explained. "But unless you also have a way of analyzing ground movement, you can't predict what a quake some distance away will do to a given building. The combination of the S-cubed earth movement and the structural computer programs thus makes it possible to do these analyses for the first time."

"As a result of these computer simulation techniques, it will be possible to design safer structures which are virtually impervious to all but the most severe quakes," Dr. Cherry pointed out. Assistance with the structural design of buildings to improve their earthquake resistance is currently being offered by S-cubed to architects and structural engineering firms in California and other earthquake-prone areas, the scientists said.

#### **RARE ANIMAL DISORDERS STUDIED FOR CLUES TO HUMAN MUSCLE DISEASES**

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Cincinnati, Ohio 45221*

Nervous goats, somersaulting pigeons, mini kangaroos, and an IBM computer are helping university medical scientists in search for the causes of human muscle diseases. The goats have a rare muscle defect similar to myotonia or Thomsen's disease in humans. The conditions in the kangaroos and pigeons may be associated with muscular dystrophy, epilepsy and other human disorders. By better understanding cause and effect of these rare animal defects, it is hoped that better treatment — and possibly cures — can be found for similar human diseases.

Myotonia causes muscles to continue contracting after the nerve impulse which triggered the contraction has ceased. In humans, for example, someone closing a door might be unable to open his hand to release the door knob. The disorder in goats causes the animals to stiffen and fall over when they respond suddenly in fright or react to a loud noise.

A University of Cincinnati Medical Center researcher, Shirley Bryant, uses an IBM System/370 Model 165 to simulate the abnormal reactions of the muscle membrane in the defective goat muscles. Dr. Bryant, professor of pharmacology at U.C.'s College of Medicine, has determined that a defect in the goats' muscle fiber membrane permits the repetitive production of muscle impulses which causes the goats to fall. He also has discovered that chloride ions, necessary for stable muscle fibers, cannot easily permeate myotonic cells.

Dr. Bryant is attempting to create these cause-and-effect reactions in the computer by using mathematical models of myotonic muscle fibers. These models allow him to simulate the muscles' abnormal firing patterns. "The computer enables us to look at many thousands of hypothetical muscle reactions to various stimuli," the U.C. scientist says. "If we run across something that looks interesting in the computer, we can run actual tests to support our theories." The great numbers of tests conducted on a hypothetical basis with the IBM system would be impossible if actual muscle fibers and electrical impulses had to be used, he points out.

U.C. graduate student Richard Entrikin has collaborated with Dr. Bryant in studying the somersaulting birds, called roller pigeons. (Roller pigeons in flight occasionally somersault uncontrollably to earth. Some are unable to fly at all, and tumble backwards on the ground.) Entrikin has found an increase in fiber size in the birds' neck muscles, a condition resembling muscular dystrophy in some respects. The neck muscles cause head retraction, and may be responsible for what appears to be a pulling back of the head as the birds tumble to earth or roll about on the ground. He also discovered that the pigeons' neck muscles when stimulated by certain

drugs take about five times longer to relax than normal, a condition which might link their problem to that of the myotonic goats.

The small kangaroos, called Rottnest quokkas after the western Australian island they inhabit, develop myotonia and suffer rapidly-progressing muscular dystrophy which leads to paralysis. The conditions are especially prevalent in captivity, Dr. Bryant notes, but both can be completely reversed by Vitamin E supplements. Vitamin E has no effect on human myotonia, the scientist says. "As yet we have reached no firm conclusions," Dr. Bryant explains, "but we are hopeful our studies will lead to the causes of these muscle diseases so better treatment, and possibly even cures, can be developed."

The large IBM computer used by Dr. Bryant is shared by researchers and administrators at U.C. and nearby Miami University (of Ohio). It is part of SWORCC (Southwestern Ohio Regional Computer Center), a joint undertaking by the two schools. The scientist's research is supported by the Muscular Dystrophy Association of America and the National Institute of Neurological Diseases and Stroke, part of the National Institutes of Health.

#### **SHERWIN-WILLIAMS USES COMPUTER IN DEVELOPMENT OF NEW PAINTS AND FOR COLOR-MATCHING**

*Hewlett-Packard  
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Development and technical service specialists at Sherwin-Williams' A. W. Stuedel Technical Center, Chicago, Ill., are using a compact low-cost computer system in the development of new paint formulations and for color-matching of paints during manufacture. The system, a Hewlett-Packard 3000, currently includes eight terminals at the Stuedel Center and one terminal at a nearby Sherwin-Williams subsidiary. More remote terminals are due to be added, extending access to the HP 3000 to several other Sherwin-Williams plants in the United States.

Don W. Parker, manager of color and computer services at the Stuedel Center, says that the paint-formulating software used with the HP 3000 has improved the speed and accuracy of product-development, and is helping Sherwin-Williams find effective substitutes for raw materials that are in short supply. By combining different types and quantities of pigments, resins, and solvents, Parker explains, formulators can adjust and control the multitude of characteristics that must be considered in designing a paint product. Besides the application properties of the paint and the physical characteristics of its dry film, such things as heavy-metal content (which may be constrained by federal, state and local health codes) and solvent emission characteristics (certain solvents and the amounts that are used may be restricted by similar codes) must be known and controlled within allowable levels.

Sherwin-Williams' formulating software determines such characteristics by simulating the behavior of paint formulations. This is a powerful tool not only for researching new products, Parker observes, but also for maintaining existing commercial formulations in the face of materials shortage. For example, Sherwin-Williams will use the HP 3000 to predict what can be expected if a solvent in short supply is replaced by one more readily available. And if the substitute solvent isn't exactly interchangeable

able with the original one, it can determine how the other components in the formulation must be changed to accommodate the solvent-substitution. Using this predictive software in conjunction with cost-minimizing linear programs, the HP 3000 will be able to determine the least-cost formula that will yield specified product performance.

When a marketable formulation is found, the computer will convert it into a standard form, print out manufacturing instructions, and list labeling data — that is, the information that will have to be shown on the product label, shipping documents and application instructions, to comply with federal, state and local regulations governing the product.

A second major application for the computer at Sherwin-Williams is in color-matching. Here the computer is asked to determine how a paint should be blended to match an existing standard. Because of inevitable variation in raw materials and processing conditions, two batches prepared identically will not usually be identical. Each batch has to be "shaded" to match a fixed standard. The color standard is analyzed by a reflectance spectrophotometer, which generates a curve that represents the target color of the finished paint. The information in this curve is given to the HP 3000, which determines how a paint should be blended to match the standard exactly.

For shading batches of paint to match a color standard for the product, the computer determines how the batch — which may be as large as 5,000 gallons — should be adjusted with a colorant (a very high concentration of pigment in a solvent vehicle). Traditionally, shading has been done by veteran employees relying entirely on their experience and judgment. But no matter how great their skill, the process was time-consuming and they would occasionally ruin a batch.

Using the HP 3000, Parker says, the shading process is faster and more accurate, and blending-tank turnover time is reduced. Spoiled batches because of improper shade steps are virtually zero when the computer is used.

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## COMPUTER-RELATED SERVICES

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### "DATA EXPRESS" TRANSMISSION SERVICE AT SPEEDS UP TO 250,000 BITS PER SECOND

*Robert D. Swezey, Jr.  
MCI Communications Corp.  
1150 17th St., N.W.  
Washington, D.C. 20036*

Shipping computer data in bulk via overnight airline flights may go the way of the pony express as a result of a new data communications service announced recently by MCI Telecommunications Corp. Aimed at firms who generate huge amounts of data which must be transmitted to central computers in other cities for next-day processing, the new service, named "Data Express," utilizes newly developed high-speed data communications equipment and a broadband microwave channel to move the data electronically at speeds up to 250,000 bits per second.

In describing how the new service works, Norman Brust, MCI marketing director, said: "As far as the user is concerned, it's no more complicated than delivering a package to a downtown post office. The

post office in this case is MCI's terminal office. The package is a reel or several reels of magnetic tape on which the data has been recorded. MCI transmits the data over its own common carrier network. The next morning, or within two hours, depending on the user's requirement, a duplicate of the original tape is ready for pick-up at the MCI terminal office in the destination city. As an option, MCI will provide the transmitted data in printed form."

Brust emphasized that the equipment MCI is using can accept any standard 7-track or 9-track with recording densities of between 200 and 1600 characters per inch. "Because of the error correction techniques built into the system, MCI can guarantee that the delivered tape will be an exact duplicate of the original," he added.

Data Express service will be offered initially between New York, Chicago, Washington, D.C., Dallas, and Houston. It should be available this summer, according to Brust, and, depending on market demand, availability could be extended to fifteen other MCI cities by early 1975.

Exact prices were not announced since MCI has not yet filed its tariff for the service. However, Brust indicated that charges will vary with the distance between cities, the volume of transmission a customer utilizes during a given month, and with his requirement for either overnight or two-hour delivery. The price range will vary from as low as \$25 per reel to as much as \$400 for high priority, long distance transmission. Even at the high end of the scale, the user will only be paying four cents for the equivalent of a full page of typewritten materials." Typical users of the service are expected to be computer time-sharing subscribers, credit bureaus, manufacturers with remote production and warehousing facilities, chain retailers, publishers who use geographically scattered printing facilities, and government agencies with data gathering field offices which are remote from centralized data processing centers.

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## MISCELLANEOUS

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### "LOOKING TO THE FUTURE" IN COMPUTER APPLICATIONS AFFECTING SOCIETIES

*Willis S. Duniway, News Bureau  
Univ. of Southern California  
University Park  
Los Angeles, Calif. 90007*

The use of computers across national boundaries in the next 20 years may have a revolutionary impact on society perhaps equal to that of the invention of the printing press or of human language itself.

Dr. Burt Nanus, director of the Center for Future Research at the University of Southern California, made this forecast in March in a public seminar at USC's Graduate School of Business Administration. "In the long run," Nanus said, "we may find that multinational computer systems will be one of the three or four most important factors tending to bring the world closer together through the creation of new institutions and interdependencies.... These impacts may begin to be felt sooner rather than later — before 1985 for many of them — and it is not too early to begin to plan how to avoid the obvious traps and to assure the greatest benefit for the world's peoples." *(please turn to page 41)*

# NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Burroughs Corporation, Detroit, Mich.	Society for Worldwide Interbank Financial Telecommunications (S.W.I.F.T.), Brussels, Belgium	Data processing and communications equipment for use in new international telecommunications network; includes 2 dual central processor B3700 systems, 4 data communications processors and 14 data concentrators	\$6+ million
Continental Illinois Leasing Corp., Chicago, Ill.	National CSS, Inc., Norwalk, Conn.	An IBM System/370 Model 168 system; will provide additional capacity for expansion requirements; replaces 3 system/360-67's; 3 other System/360-67's will remain	\$5.1 million
Cubic Western Data, Inc., San Diego, Calif.	Bay Area Rapid Transit District (BART), San Francisco, Calif.	Automatic fare collection equipment which includes 108 ticket vendors, 67 passenger toll gates, and related equipment	\$5.1 million
Litton Industries, Sweda International Div., Orange, N.J.	Au Printemps S.A., Paris, France	Minimum of 750 Sweda Series 725 electronic point-of-sale terminals and related processing equipment	\$3 million
Bright Industries, Data Disc, Inc. Sunnyvale, Calif.	Cummins-Allison Corp.	Purchase of Bright 2700 Series tape drives over the next two years	\$1+ million
Peripheral Equipment Div., Pertec Corp. (ASE), Chatsworth, Calif.	National Cash Register Co., Cambridge, Ohio	Digital magnetic tape drives for use with their point-of-sale systems	\$800,000+
Peripheral Equipment Div., Pertec Corp. (ASE), Chatsworth, Calif.	Scidata, Inc., Atlanta, Georgia	Supplying disc drives over a two-year period for use in automated agriculture feeding systems	\$800,000+
Delta Data Systems Corp., Cornwells Heights, Pa.	Tal-Star Computer Systems, Princeton Junction, N.J.	Purchase of 120 DELTA Series 5000 video display terminals to help make up company's automated text editing/typesetting system sold to newspapers across the country	\$500,000 (approximate)
National Cash Register Co., Dayton, Ohio	Burns Philip & Co., Ltd., Sydney, Australia	165 NCR 280 electronic retail terminals with data wands and 17 NCR 723 data collectors to be installed in Mates Retail Division stores	\$500,000
American Chemical Society, Chemical Abstracts Service Div., Columbus, Ohio	National Cancer Institute (NCI), Div. of Cancer Treatment, Silver Spring, Md.	Operating a Drug Research and Development Chemical Information System	\$482,000
Systems Control, Inc., Palo Alto, Calif.	The Miami Conservancy District, Miami, Ohio	Complete automation of 4.5-million-gallons-a-day wastewater treatment plant; system will analyze wastewater before, during and after treatment, and control entire treatment process	\$427,000
Decision Data Computer Corp., Horsham, Pa.	Incoterm Corp., Marlboro, Mass.	80 column card peripherals being used as part of remote batch terminal communications system that Incoterm is supplying to Burlington-Northern Railway	\$303,590
Hewlett-Packard Co., Palo Alto, Calif.	Computer Solutions, Inc. (CSI), East Orange, N.J.	25 HP-2100 microprogrammable minicomputers which are heart of firm's data base management systems	\$250,000 (approximate)
Logicon, Inc., Torrance, Calif.	Strategic Air Command	Add-on contract to validate a computer program now being developed by SAC	\$117,977
System Development Corp., Santa Monica, Calif.	National Science Foundation	A study of man-machine system communication in on-line retrieval systems, focusing on interactive searching of very large literature data bases	\$98,500
Hewlett-Packard Co., Palo Alto, Calif.	Mobility Systems, Inc., Santa Clara, Calif.	Five HP-2123A disc operating systems for use as the heart of its warehouse material handling and inventory control system	—
Measurex Corp., Cupertino, Calif.	EKCO Products, Inc., Wheeling, Ill.	A computer-integrated mill control system; it will be installed on a 46-inch wide United 4-high mill which is used as a finishing mill for food container stock	—
Memory Technology, Inc. (MTI), Sudbury, Mass.	Control Data Corp., Minneapolis, Minn.	Purchase of a semiconductor memory lease base and a commitment to purchase additional memory systems; CDC will include the memory systems as part of their current line, providing field maintenance, spare parts and field technical support for all MTI installed units	—
National Cash Register Co., Dayton, Ohio	National Data Corp., Atlanta, Georgia	5,000 on-line credit transaction terminals to be used for on-line credit card authorization and for electronic capture of transaction data for descriptive billing	—
Recognition Equipment, Dallas, Texas	Business Machines Div., Singer Co., San Leandro, Calif.	Supplying up to 50,000 hand-held OCR Wands for use with Singer's electronic point-of-sale terminals	—
Tano Corp., Metairie, La.	Union Oil Co. of California, Los Angeles, Calif.	Design and manufacture of an automated control system for remote control, and supervision of two existing pump stations on a crude oil pipeline between oil fields in the San Joaquin Valley and their refinery near San Francisco, Calif.	—

# NEW INSTALLATIONS

OF	AT	FOR
Burroughs B 6700 system	Gifford-Hill & Company, Inc., Dallas, Texas	Financial modeling and forecasting, credit and customer information, and dispatch support systems (system valued at more than \$1.3 million)
	National Data Corporation, Atlanta, Ga.	Remote on-line application, including accounts receivable and general ledger accounting, plus utility billing programs
Burroughs B 6700 system B 3500 system	National State Bank, Elizabeth, N.J.	General banking applications, as well as bond portfolio service, corporate and personal trusts; property management, electronic management systems (system valued at \$3.6 million)
CDC Cyber 70 Model 72 system	Taiwan Telecommunications Administration (TTA), Taipei, Republic of China	Use primarily in telephone customer billing; other uses will include engineering design, material control, accounting, personnel, and communications research (system valued at \$1 million)
Data General Nova 800 system	BancSystems Association, Cleveland, Ohio	Part of front end processor; handles all line and communications duties and is backup to main computer
Data General Nova 1200 system	Sealink, British Rail System, United Kingdom	A reservation system named Seaspace that controls vehicle booking on all of Sealink's 40 ships
Data General Nova 1220 system	Monarch Life Insurance Co., Springfield, Mass.	An in-house system for actuarial data processing (system valued at approximately \$40,000)
	George Wimpey & Co., Ltd., Newmarket, England	Primary task of producing monthly valuation reports; adding subcontractor and materials control reports
Digital Equipment PDP-11/35 system	Massachusetts Department of Public Health, Boston, Mass.	Upgrading and expanding the monitoring, reporting and planning activities of air quality control unit of its Division of Environmental Health
GEC 4080 system	Science Research Council, Rutherford Laboratory, Chilton, England	On-line connection to Laboratory's IBM 370/195; will be used for refresh display facility to minimize misinterpretations when examining film evidence of elementary particle behavior; with storage tube displays for magnet design; and as on-line controller for real-time applications
Hewlett-Packard HP-3000 system	Riverside County Flood Control District, Cupertino, Calif.	Engineering calculations for determining flood routing, channel capacity and other factors related to design and construction of flood control projects
IBM System/7	Saco-Lowell Corporation, Greenville, S.C.	Helping to manage power requirements of its 11-acre manufacturing facility
IBM System/370 Model 115	Beconta, Inc., Elmsford, N.Y.	Accounts receivable and payable, and parts of firm's inventory
NCR Century 50 system	Williams Energy Co., Ludlow, Ky.	Computerizing customer and dealer billing procedures; encoders will be located in Williams' district sales offices around nation, communicating with a computer located in one of firm's regional accounting offices
NCR Century 101 system	City of Bristol, Bristol, Conn.	Supporting administrative operations of municipal government and board of education; applications include weekly payroll; budgetary accounting, tax billing and student scheduling will be added soon
	City of Las Cruces, Las Cruces, New Mexico	General ledger accounting, payroll, and accounts receivable and payable
	Lozier Corporation, Omaha, Neb.	Materials billing, inventory control, production control and general accounting; is a second system
	Muskegon County, Michigan	Processing financial data; general office applications and inventory control of supplies are included
	City of West Haven, West Haven, Conn.	Joint use with local board of education including payroll processing for municipal and board employees
NCR Century 251 system	Government of Montgomery County, Ohio	Major expansion of data processing activities; one Century 200 is already in service (system valued at about \$700,000)
Philips P 855 M system	Gunzetal Ltd., Hong Kong	Inventory control, billing and payroll systems, instant information on production schedule problems, workload factors, costing and stock status; system to be shared by Gunzetal Ltd., Trion Industries Ltd., and Woodward Textile Manufacturing Co. Ltd.
Univac 1110 system	First National Bank of Arizona, Operations Center, Tempe, Ariz.	Updating computer's files for about 800,000 daily transactions to demand deposit accounts; also for on-line stock transfer program, installment loans, trust business and general accounting (system valued at \$4.3 million)
Univac 9480 system	La Republique Du Centre, Orleans France	Use in real-time for automatic typesetting correction of texts through UNISCOPE 100 visual display units; also for maintenance of subscriptions
	W. E. Wright, West Warren, Mass.	An on-line order entry and billing system linking 5 distribution centers; manufacturing and inventory control; compiling sales statistics; and general accounting
Xerox 530 system	Astro Pharmaceutical Products, Worcester, Mass. (2 systems)	Wide range of drug-related research, development and testing, and firm's commercial data processing (system valued at \$300,000)
Xerox Sigma 9 system	Continental Oil Company (CONOCO), Ponca City, Okla.	Batch and transaction processing of seismic data (system valued at \$1.16 million)

# MONTHLY COMPUTER CENSUS

Neil Macdonald  
Survey Editor  
COMPUTERS AND PEOPLE

The following is a summary made by COMPUTERS AND PEOPLE of reports and estimates of the number of general purpose digital computers manufactured and installed, or to be manufactured and on order. These figures are mailed to individual computer manufacturers quarterly 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. A few manufacturers refuse to give out, confirm, or comment on any figures.

Part 1 of the Monthly Computer Census contains reports for United States manufacturers, A to H, and is published in January, April, July, and October. Part 2 contains reports for United States manufacturers, I to Z, and is published in February, May, August, and November. Part 3 contains reports for manufacturers outside of the United States and is published in March, June, September, and December.

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

The following abbreviations apply:

- (A) -- authoritative figures, derived essentially from information sent by the manufacturer directly to COMPUTERS AND PEOPLE
- 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 PEOPLE
- (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 and/or not released by manufacturer

SUMMARY AS OF MAY 15, 1974

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL (\$000)		NUMBER OF INSTALLATIONS			NUMBER OF UNFULFILLED ORDERS
					In U.S.A.	Outside U.S.A.	In World	
<b>Part 3. Manufacturers Outside United States</b>								
A/S Norsk Data Elektronik Oslo, Norway (A) (Mar. 1974)	NORD-1 NORD-2B NORD-5 NORD-10 NORD-20	8/68 8/69 2/72 5/73 1/72	2.0 4.0 - 2.0 3.5	(S) - - - (S)	0 0 0 0 0	142 20 1 30 43	142 20 1 30 43	22 X 4 40 8
A/S Regnecentralen Copenhagen, Denmark (A) (Aug. 1973)	GIER RC 4000	12/60 6/67	2.3-7.5 3.0-20.0	- -	0 0	57 23	57 23	0 3
Elbit Computers Ltd. Haifa, Israel (A) (Nov. 1973)	Elbit-100	10/67	4.9	(S)	-	-	325	10
GEC Computers Ltd. Borehamwood, Hertfordshire England (A) (April 1974)	902 903 920B GEC 905 GEC 920M GEC 920C Myriad I Myriad II GEC M2140 GEC 2050 GEC 4080	5/68 12/65 12/65 5/69 7/67 7/68 1/66 11/67 10/69 6/72 10/73	X X - X - X X X X 10.0 and up(S) 30.0 and up(S)	- - - - - - - - - - -	0 - - 0 0 0 0 9 8 0	17 - - 77 130 19 47 32 21 101 11	17 - - 77 130 19 47 32 30 109 11	X X - X 103 X X X X 61 29
Hitachi, Ltd. Tokyo, Japan (A) (April 1974)	301 101 102 103 201 3010 5020 4010 8400 8200 8300 8100 8500 8210 8350 8700 8450 8150 8800 8250	5/59 9/60 8/59 12/61 4/62 11/62 3/65 5/65 2/67 2/67 4/67 5/67 8/68 12/68 2/71 3/72 6/72 11/72 12/72 4/73	X X X X X X X X 10.0-50.0 3.3-8.3 8.3-15.3 1.3-4.0 16.7-66.7 2.6-10.0 11.7-40.0 60.0-167.0 23.3-66.7 1.7-5.0 13.0 and up 5.0-13.0	- - - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - - -	- - - - - - - - - - - - - - - - - - - -	
International Computers, Ltd. (ICL) London, England (R) (Sept. 1972)	Atlas 1 & 2 Deuce KDF 6-10 KDN 2 Leo 1, 2, 3 Mercury Orion 1 & 2 Pegasus Sirius 503 803 A, B, C 1100/1 1200/1/2 1300/1/2 1500 2400 1900-1909 Elliot 4120/4130 System 4-30 to 4-75	1/62 4/55 9/61 4/63 -/53 -/57 1/63 4/55 -/61 -/64 12/60 -/60 -/55 -/62 7/62 12/61 12/64 10/65 10/67	65.0 - 10-36 - 10-24 - 20.0 - - - - 5.0 3.9 4.0 6.0 23.0 3-54 2.4-11.4 5.2-54	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 0	6 2 34 1 43 4 10 9 8 18 107 13 11 82 35 3 2200 100 200	6 2 34 1 43 4 10 9 8 18 107 13 11 82 35 3 2202 100 200	X X X X X X X X X X X X X X X X X X X -	
Japanese Mfrs.	(Other manufacturers of various models include: Fujitsu, Ltd.; Matsushita Electric Co. of America; Mitsubishi Electric Corp.; Nippon Electric Co., Ltd.; Oki Electric Industry Co.; Tokyo Shibaura Electric Co., Ltd. (Toshiba).)							

12,809

800 E



NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL \$ (000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILLED ORDERS
				In U.S.A.	Outside U.S.A.	World	
Philips Electrológica BV Apeldoorn, Netherlands (A) (June 1973)	P1000	8/68	7.2-35.8	-	-	128	50
	P9200	-	-	-	-	298	2
	P9200 t.s.	3/70	-	-	-	5	1
	P880	9/70	-	-	-	52	8
	P850/55/60 (OEM)	9/70	-	-	-	200	500
	ELX	5/58	6-21	-	-	27	-
Philips' Telecommunicatie Industrie BV Hilversum, Netherlands (A) (April 1974)	DS 714	-/67	-	13	34	47	10
	DS 18	9/72	-	0	9	9	4
Redifon Electronic Systems, Ltd. Crawley, Sussex, England (A) (Aug. 1973)	R2000	7/70	-	1	26	27	2
	R2000A	6/73	-	-	2	2	12
Saab-Scania Aktieföretag Linköping, Sweden (A) (May 1974)	D21	12/62	7.0	0	18	18	-
	D22	11/68	15.0	0	37	37	2
	D220	4/69	10.0	0	17	17	0
	D23	-/73	25.0	0	0	0	6
	D5/30	12/71	1.0	0	28	28	33
	D5/20	5/71	0.6	18	685	703	1987
Selenia S.p.A. Roma, Italy (A) (Oct. 1973)	GP-16	7/69	10.9	(S) 0	230	230	265
	GP-160	-	5.6	(S) -	-	-	23
Siemens Munich, Germany (A) (April 1974)	300 Series	4/65-4/72	0.9-7.9	-	-	680	160
	2002	6/59	16.4	-	-	41	X
	3003	12/63	15.8	-	-	29	X
	4004/15/16	10/65	6.1	-	-	80	2
	4004/25/26	1/66	10.0	1	-	98	5
	4004/35	2/67	14.2	-	-	209	5
	4004/127	4/73	14.0	-	-	72	33
	4004/135	10/71	20.5	-	-	173	31
	4004/45	7/66	27.3	-	-	341	39
	4004/46	4/69	41.0	-	-	10	1
	4004/55/60	7/66	35.0	-	-	23	X
	4004/150	2/72	49.0	-	-	160	27
	4004/151	3/72	61.0	-	-	35	21
	4004/220	1/75	-	-	-	-	79
	4004/230	1/75	-	-	-	-	68
	404/2	3/74	3.0	-	-	3	72
	404/3	4/71	2.1	-	-	108	36
404/6	10/71	4.5	-	-	108	15	
Telefunken Computer GmbH Konstanz, Germany (A) (Jan. 1974)	TR 4	10/61	X	-	-	35	X
	TR 440	6/70	60.0	-	-	29	-
USSR (N) (May 1969)	BESY 4	-	-	-	-	C	C
	BESM 6	-	-	-	-	C	C
	MINSK 2	-	-	-	-	C	C
	MINSK 22	-	-	-	-	C	C
	MIE	-	-	-	-	C	C
	NAIR 1	-	-	-	-	C	C
	ONEGA 1	-	-	-	-	C	C
	URAL 11/14/16 and others	-	-	-	-	C	C

#### ACROSS THE EDITOR'S DESK — Continued from page 37

Computers are already being used by governments and private businesses to exchange information throughout the globe, the USC futurist pointed out.

USC's Nanus, Michael Wooton of Southern Methodist University and Harold Borko of UCLA sent questionnaires to 57 businessmen, professors and computer scientists throughout the world to get their forecasts as to what may lie ahead. The project was sponsored by the Social Implications Committee of the American Federation of Information Processing Societies, the largest grouping of computer professionals in the U.S.

Before 1985, the panel agreed, multinational computer systems will be used to monitor or control such global problems as air and ocean pollution, public health and epidemics, weather and disasters, and criminal activity. Also within the next decade, the first university will extend its broadcasting of courses to satellites, making possible a worldwide enrollment in a particular educational program.

By 1990, the experts expect that at least 25 percent of the people living in highly industrialized societies will each spend perhaps a half hour per week working with a computer at work, home or school. Catalog shopping should be available from computer terminals across national boundaries between 1985 and 1990, the futurists forecast.

#### SPRAGUE — Continued from page 28

diary, and that someone else wrote it for the purpose of framing Bremer. Hunt could have actually gone to Maryland after the Wallace shooting, knowing Bremer was to be framed, and planted the diary in Bremer's car, where it was actually found. Vidal says the writing style in the diary was beyond Hunt's capability. He says Bremer certainly did not write it, or if he did, he was writing words given to him by someone with very great talent.

When Colson asked Hunt to go to Milwaukee, possibly to plant the diary, Hunt may have suggested Bremer's car as a better alternative.

At least six letters were sent to Attorney Sam Dash of Senator Sam Ervin's Committee, asking that the Ervin Committee staff investigate the use of \$400,000 assigned by Richard M. Nixon, the Committee to Reelect the President, and their associates, to impede Governor Wallace's political campaign in 1972 — and particularly the role of Arthur Bremer. One of these letters was sent by Congressman Robert F. Drinan.

Not one of these letters was answered, or replied to; and the Ervin Committee has taken no known steps to investigate. Yes, the cover-up reaches a long way. □

feel is unique. I thought it may be of interest to you and other readers. I have attempted to put together the data that is pertinent to explaining the system. I would be happy to work with you in any way you feel would be necessary to prepare this article for publication in your magazine. Please advise me if there is anything I can do to help you.

2. From the Editor

We appreciate your kind remarks.

We think your article is interesting and significant, and we are glad to publish it in this issue.

## File of Articles on Political Assassinations in the United States

1. From Nancy Woolley  
Chicago, Ill. 60670

I am a systems analyst, employed by .... in Chicago, and I have been a volunteer member of the Committee to Investigate Assassinations in Washington for several years.

Until I came to this organization last fall, I had spent two years in extensive travel for my former employer. During one of those absences our offices were remodeled. When I returned I found that most of my files had been moved to a storage closet, but that some files were missing, including one containing all John F. Kennedy assassination articles from "Computers and Automation".

Please advise how I may obtain a complete new set of all past articles printed in C&A. I am very anxious to replace this loss. My present employer is a subscriber to C&A, but I can locate only a few recent copies.

2. From the Editor

Thank you for your letter. We are very sorry about the loss of your files of "Computers and Automation".

I am enclosing a copy of the November 1973 issue of "Computers and Automation". This contains a list of all the assassination articles we have published up to that time with a summary of each one. We do not have any reprints, but all of the issues are in print and we can supply them. The regular price is ....

## World Crisis and Chaos Approaching Inexorably

Howard G. Kurtz, and Harriet B. Kurtz, Publishers  
"Checkpoint," March, 1974  
Newsletter of War Control Planners, Inc.  
Box 19127  
Washington, D.C. 20036

Neither the White House nor the Congress yet has told the American people the character or the magnitude of approaching world crisis and chaos.

Dr. Aurelio Peccei, President of The Club of Rome, has sent us the following new statement of the predicament of mankind:

## The Salzburg Statement of The Club of Rome

Members of The Club of Rome met on February 4th and 5th, 1974 at Salzburg with political leaders from different countries and cultures to discuss global problems and long term alternatives of human society in the light of current events of grave concern to all peoples and nations.

We intend in this statement to express our views on the main issues involved in the debate.

It is evident that the problems discussed and, indeed, all the problems of our time, are critically interconnected each with the others in a complex system. The world is faced with an unprecedented rate of change in economic, social, political and technological spheres. Much of this change has already caused great disturbance in world affairs as is evident today.

Command of science and technology has placed in the hands of the present generation tremendous power, both for creativity and self-destruction. The amazing amount of information possessed by man and the immense means and skills that can be mobilized would justify the hope that this power will be used for the fundamental betterment of all humanity.

However all these resources are of little avail unless they are guided on a strong ethical basis by sound socio-political organization. The fact is that the industrial societies operate wastefully and stimulate unnecessary consumption. Furthermore, man lacks the will to coexist peacefully on this small and vulnerable planet.

World society is torn asunder by growing and intolerable disparities in living standards and opportunities. Nations continue to follow conflicting policies. Justice within and among nations is remote. Hundreds of millions of men and women live marginal lives, without occupation and possibility of self-development. Nature is pillaged and poisoned for the benefit of a few, to the detriment of the many and of the yet unborn.

The present crisis is much deeper than an oil or energy crisis or a food crisis. Its negative effects will have many and diverse repercussions throughout the entire world. It is the poor nations and the poor classes which will suffer the most. This is inevitable whenever oil, food or any other basic product becomes scarce, or whenever trade, aid or currencies are used as political weapons.

\* \* \*

Mankind must and can face this challenge. An essential step is to give practical effect to a recognition of the reality of the interdependence of problems, peoples and nations. Such interdependence becomes ever more obvious with regard to political, economic, monetary and technological relationships. Much lip-service has been paid to this. Yet, in practice, nations continue to act as if they were in full command of their sovereignty.

We call on all peoples and nations to accept the consequences of interdependence. Although the establishment of a fair and stable world order is immensely difficult, new, specific arrangements towards the construction of a true global community are urgently needed. Regional cooperation can be an initial step leading towards broader based integration.

[For the balance of the statement, please inquire of "Checkpoint".] □

# CALENDAR OF COMING EVENTS

- June 17-19, 1974:** Design Automation Workshop, Holiday Inn, Denver, Colo. / contact: Nitta P. Donner, IBM T. J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY 10598
- June 23-26, 1974:** 1974 DPMA INFO/EXPO (22nd Annual Data Processing Conference and Business Exposition), Auditorium & Convention Hall, Minneapolis, Minn. / contact: Data Processing Management Assoc., 505 Busse Highway, Park Ridge, IL 60068
- June 24-26, 1974:** 5th Conference on Computers in the Undergraduate Curricula, Washington State Univ., Pullman, Wash. / contact: Dr. Ottis W. Rechard, Computer Science Dept., Washington State Univ., Pullman, WA 99163
- June 24-26, 1974:** Society for Industrial and Applied Mathematics 1974 Annual Meeting, California Institute of Technology, Pasadena, Calif. / contact: SIAM, 33 S. 17th St., Philadelphia, PA 19103
- June 25-27, 1974:** 5th Annual Interdisciplinary Conf. on Health Records, Ann Arbor Inn, Ann Arbor, Mich. / contact: Assoc. for Health Records, P.O. Box 2257, Ann Arbor, MI 48106
- July 9-11, 1974:** Summer Computer Simulation Conference, Hyatt Regency Hotel, Houston, Tex. / contact: M. E. McCoy, Martin Marietta Data Systems, Mail MP-198, P.O. Box 5837, Orlando, FL 32805
- July 15-19, 1974:** 1974 Conference on Frontiers in Education, City University, London, England / contact: Conf. Dept., Institution of Electrical Engineers, Savoy Place, London, England WC2R 0BL
- July 18-19, 1974:** 12th Annual Computer Personnel Research Conf., Univ. of Colorado, Boulder, Colo. / contact: ACM, 1133 Ave. of the Americas, New York, NY 10036
- July 23-26, 1974:** Circuit Theory & Design, IEE, London, England / contact: IEE, Savoy Pl., London WC2R 0BL, England
- July 23-26, 1974:** International Computer Exposition for Latin America, Maria Isabel-Sheraton Hotel, Mexico City, Mexico / contact: Seymour A. Robbins, National Expositions Co., Inc., 14 W. 40th St., New York, NY 10018
- July 29-Aug. 1, 1974:** 2nd Jerusalem Conference on Information Technology, Jerusalem, Israel / contact: Prof. C. C. Gotlieb, Dept. of Computer Science, University of Toronto, Toronto, Ontario, Canada M5S1A7
- Aug. 5-10, 1974:** IFIP Congress 74, St. Erik's Fairgrounds, Stockholm, Sweden / contact: U.S. Committee for IFIP Congress 74, Box 426, New Canaan, CT 06840
- Aug. 5-10, 1974:** Medinfo 74, St. Erik's Fairgrounds, Stockholm, Sweden / contact: Frank E. Heart, Bolt Beranek and Newman, Inc., 50 Moulton St., Cambridge, MA 02138
- Aug. 12-14, 1974:** International Conf. on Computer Communication-74, Stockholm, Sweden / contact: Mr. J. Borje Hansson, Sec. Gen. of the Conf., Program Exec. Committee, Central Administration of Swedish, Telecommunications (Gdk), S-123 86 FARSTA, Sweden
- Aug. 13-15, 1974:** Assoc. for the Development of Computer-Based Instructional Systems' Summer 1974 Conference, Western Washington State College, Bellingham, Wash. / contact: Ms. Ruann Pengov, 076 Health Sciences Library, The Ohio State Univ., 376 W. Tenth Ave., Columbus, OH 43210
- Aug. 21-23, 1974:** Engineering in the Ocean Environment International Conf., Nova Scotian Hotel, Halifax, Nova Scotia / contact: O. K. Gashus, EE Dept., Nova Scotia Tech. Coll., POB 100, Halifax, N.S., Canada
- Sept. 1974:** 2nd Symposium IFAC/IFIP/IFORS, Cote d'Azur, France / contact: AFCET, Secretariat des Congres, Universite Paris IX, Dauphine 75775 Paris Cedex 16, France
- Sept. 8-10, 1974:** 6th International Conference on Urban Transportation, Pittsburgh, Penna. / contact: John W. Besanceney, Pittsburgh Convention & Visitors Bureau, P.O. Box 2149, Pittsburgh, PA 15230
- Sept. 9-12, 1974:** INFO 74, Coliseum, New York, N.Y. / contact: Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017
- Sept. 11-13, 1974:** 6th Annual Conference of Society for Management Information Systems, Fairmont Hotel, San Francisco, Calif. / contact: SMIS, 221 N. La Salle St., Chicago, IL 60601
- Oct. 8-9, 1974:** 8th Annual Instrumentation and Computer Fair, Washington, D.C. / contact: Robert E. Harar, Instrumentation Fair, Inc., 5012 Herzel Place, Beltsville, MD 20705
- Oct. 9-10, 1974:** 1974 Conference on Display Devices and Systems, Statler Hilton Hotel, New York, N.Y. / contact: Society for Information Display, 654 N. Sepulveda Blvd., Los Angeles, CA 90049
- Oct. 14-16, 1974:** 15th Annual Symposium on Switching and Automata Theory, New Orleans, La. / contact: Prof. Fred Hosch, Dept. of Computer Science, Louisiana State Univ. at New Orleans, Lake Front, New Orleans, LA 70122
- Oct. 16-18, 1974:** 46th National Meeting of Operations Research Society of America, and 21st International Meeting of The Institute of Management Sciences, Americana and El San Juan Hotels, San Juan, Puerto Rico / contact: Rafael Fernandez, P.O. Box 2342, Mayaguez, Puerto Rico 00708
- Oct. 16-18, 1974:** 9th Annual Iomec Users Assoc. Conference and Seminars, Place du Puis Holiday Inn, Montreal, Canada / contact: Glenn Lutat, IUA, 3300 Scott Blvd., Santa Clara, CA 95050
- Oct. 16-18, 1974:** 30th Annual National Electronics Conf. and Exhibition, Hyatt Regency O'Hare, Chicago, Ill. / contact: National Electronics Conf., Inc., Oakbrook Executive Plaza 1, 1301 W. 22nd St., Oak Brook, IL 60521
- Oct. 29-31, 1974:** 28th Northeast Electronics Research and Engineering Meeting, Sheraton-Boston Hotel and Hynes Auditorium, Boston, Mass. / contact: S. Swartz, Nerem Business Office, 31 Channing St., Newton, MA 02158
- Oct. 31-Nov. 1, 1974:** Canadian Symposium on Communications, Queen Elizabeth Hotel, Montreal, Quebec / contact: George Armitage, IEEE Canadian Region Office, 7061 Yonge St., Thornhill, Ontario L3T 2A6, Canada

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## ADVERTISING INDEX

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

- COMPUTER DIRECTORY AND BUYERS' GUIDE* / published by Berkeley Enterprises, Inc., 815 Washington St., Newtonville, MA 02160 / page 2
- COMPUTERS AND PEOPLE* / Computers and People, 815 Washington St., Newtonville, MA 02160 / page 44
- SOFTWARE PACKAGE REPORTS* / Audited Software Services Co., Box 871, Chico, CA 95926 / page 3

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**\*\*\*\* reprint from  
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Science and the Advanced Society, by C. P. Snow, Ministry of Technology, London, England (April 1966)  
The Information Revolution and the Bill of Rights, by Dr. Jerome B. Wiesner, M.I.T. (May 1971)  
Employment, Education, and the Industrial System, by Prof. John Kenneth Galbraith, Harvard Univ. (Aug. 1965)  
Computers and the Consumer, by Ralph Nader, Washington, D.C. (Oct. 1970)

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