COMPUTERS
and AUTOMATION

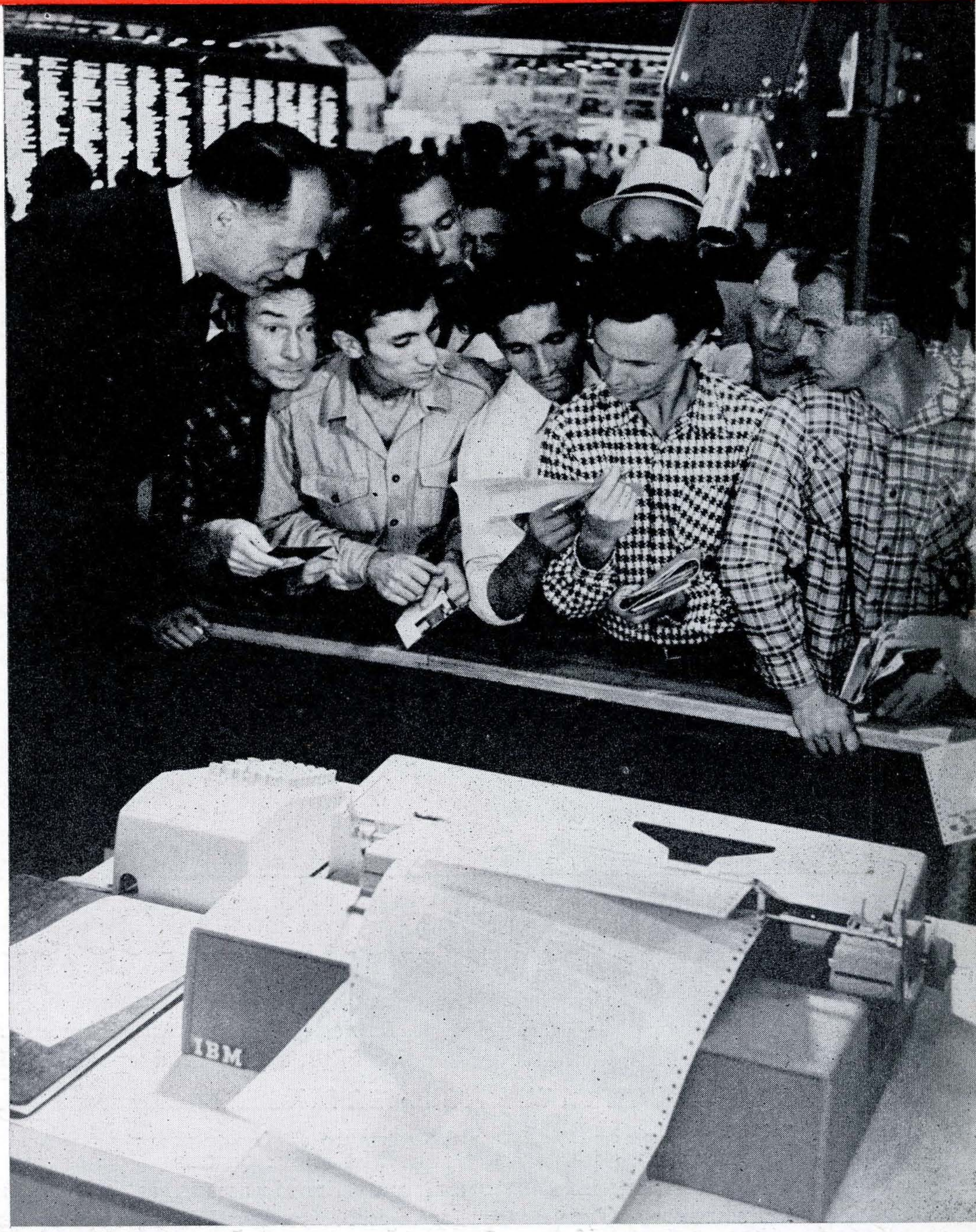
DATA PROCESSING • CYBERNETICS • ROBOTS

Computer Market Survey

The British Computer Society Conference, Cambridge, England

A Scientific Application of Digital Computers: The 3-Dimensional Structure of the Protein Myoglobin

Bufferin' is Aspirin for EDP Headaches



SEPTEMBER
1959
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VOL. 8 - NO. 9

COMPUTERS
and AUTOMATION

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Volume 8
Number 9

SEPTEMBER, 1959

Established
September 1951

COMPUTERS and AUTOMATION is published monthly at 160 Warren St., Roxbury 19, Mass., by Berkeley Enterprises, Inc. Printed in U.S.A.

SUBSCRIPTION RATES: (United States) $5.50 for 1 year, $10.50 for 2 years; (Canada) $6.00 for 1 year, $11.50 for 2 years; (Foreign) $6.50 for 1 year, $12.50 for 2 years.

Address all Editorial and Subscription Mail to Berkeley Enterprises, Inc., 815 Washington St., Newtonville 60, Mass.

ENTERED AS SECOND CLASS MATTER at the Post Office at Boston 19, Mass.

POSTMASTER: Please send all Forms 3579 to Berkeley Enterprises, Inc., 160 Warren St., Roxbury 19, Mass.

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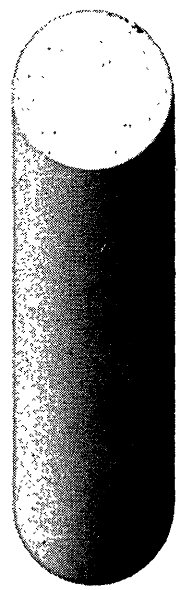
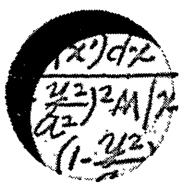


pinboard programming: easy as putting a round peg in a round hole



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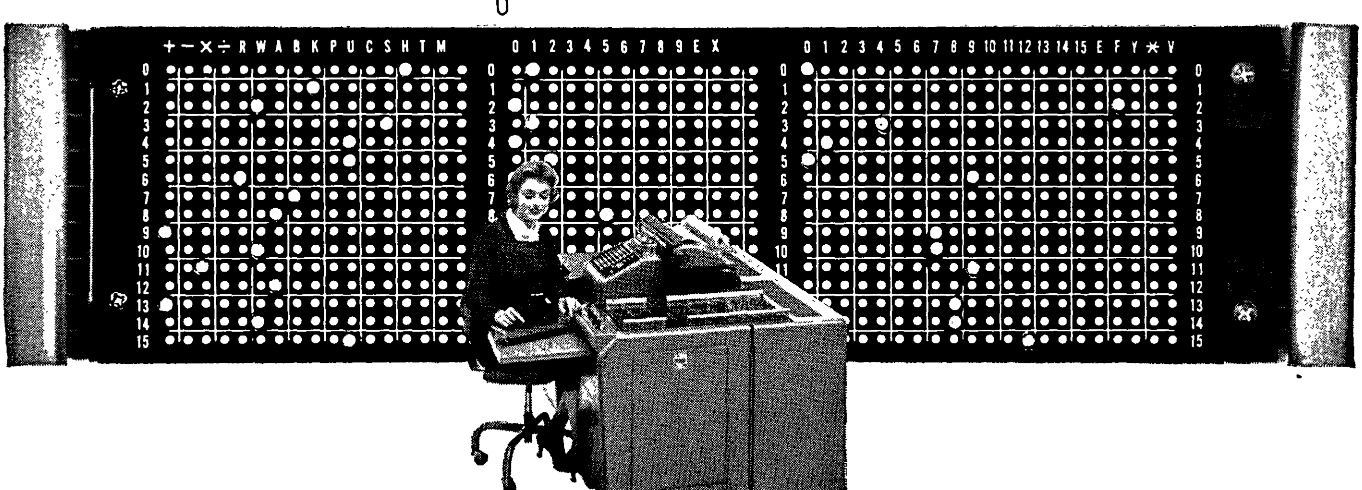


Readers' and Editor's Forum

FRONT COVER: RUSSIAN QUESTIONING OF UNITED STATES COMPUTER

Russian visitors to the United States National Exhibition in Moscow crowd around an "electronic encyclopedia" exhibit to ask questions about life in the United States. An IBM RAMAC 305 computer, foreground, prints out the answers — in Russian — to 4,000 different questions that fairgoers can ask about the way people in the United States live. The RAMAC disk memory contains one million words comprising answers to questions on such subjects as American Science, technology, education, politics, history, and culture.

A SURVEY OF BRITISH COMPUTERS — CORRECTION

Joseph De Kerf

Mortsel, Belgium

To the Editor:

Thank you for the care you spent on the publication of my report "A Survey of British Computers."

As I have seen in the May issue, you added an appendix with a summary of the British computers shipped or on order. I should like to point out the fact that there exist two Ferranti Mark I Computers instead of one. The second is generally called FERUT and is installed at Toronto University. Furthermore, Ferranti Ltd. constructed a commercial version of this computer, the Ferranti Mark IX, and seven machines of this type have been installed. Finally, the quantity 35 for the Powers-Samas P.C.C. Calculator is only approximate, and the number does not include the orders, as no official data are available for this machine.

SOCIAL RESPONSIBILITY OF COMPUTER SCIENTISTS — ARGUMENT

I. From: Mrs. P. Cammer, Huntington, N.Y. To: Mr. Charles H. Johnson, Editor

Journal of Machine Accounting
Melrose Park, Ill.

In the May issue of **Computers and Automation,** I see that your publication and **Computers and Automation** are on opposite sides with regard to the attitude of scientists and technicians towards social responsibility. In "An Attempt to Apply Logic & Common Sense to the Social Responsibility of Computer Scientists" (**Computers and Automation,** May '58), Neil Macdonald, as I remember, advocated the shouldering of special responsibility by computer scientists; you maintain that they have no special responsibility as scientists. To be sure, this is squeezing the whole complicated matter into a tiny nutshell; but, in all honesty, can you deny that it is a close if simplified approximation of the truth?

One may assert unequivocally the position that it is urgently necessary for science to penetrate constructively into **all** areas of human endeavor, in order to control irrationality and destructive knowledge. This necessity is glaringly obvious.

Having read only a relatively few words of yours, I hope I am mistaken in believing that you are on the opposite side.

II. From: Mr. Charles H. Johnson To: Mrs. P. Cammer

Thank you very much for taking the trouble to write me telling me of your concern with the differences in opinion expressed in the Journal of Machine Accounting and Computers and Automation.

Let me say first of all, that Neil Macdonald, through either lack of knowledge or purposefully, is misleading his readers. Certainly all of us, whether or not we are computer scientists, have social responsibilities. However, we also have responsibilities to our country. In other words, we are American citizens first and scientists, mechanics, editors and truck drivers secondly.

The rights and privileges of a citizen transcend the rights and privileges of a scientist. If there is a conflict between the two, the individual civic duty must predominate. In other words, Mrs. Cammer, if we could reach all people in the world and appeal to their social responsibility on a world wide basis, it would then be logical, reasonable, and desirable to ask all people to analyze what they are doing in the light of what effect it would have on other people.

Unfortunately, we cannot appeal to all scientists in the world; we can only appeal to the American scientists; and if we do, the eventual result would be that many scientists would refuse to work on projects vital to the very existence of our country. It could mean the difference between victory or defeat for the United States. Therefore, I feel that this appeal for scientists to realize their social responsibility is unrealistic and very dangerous to the best interest of the United States.

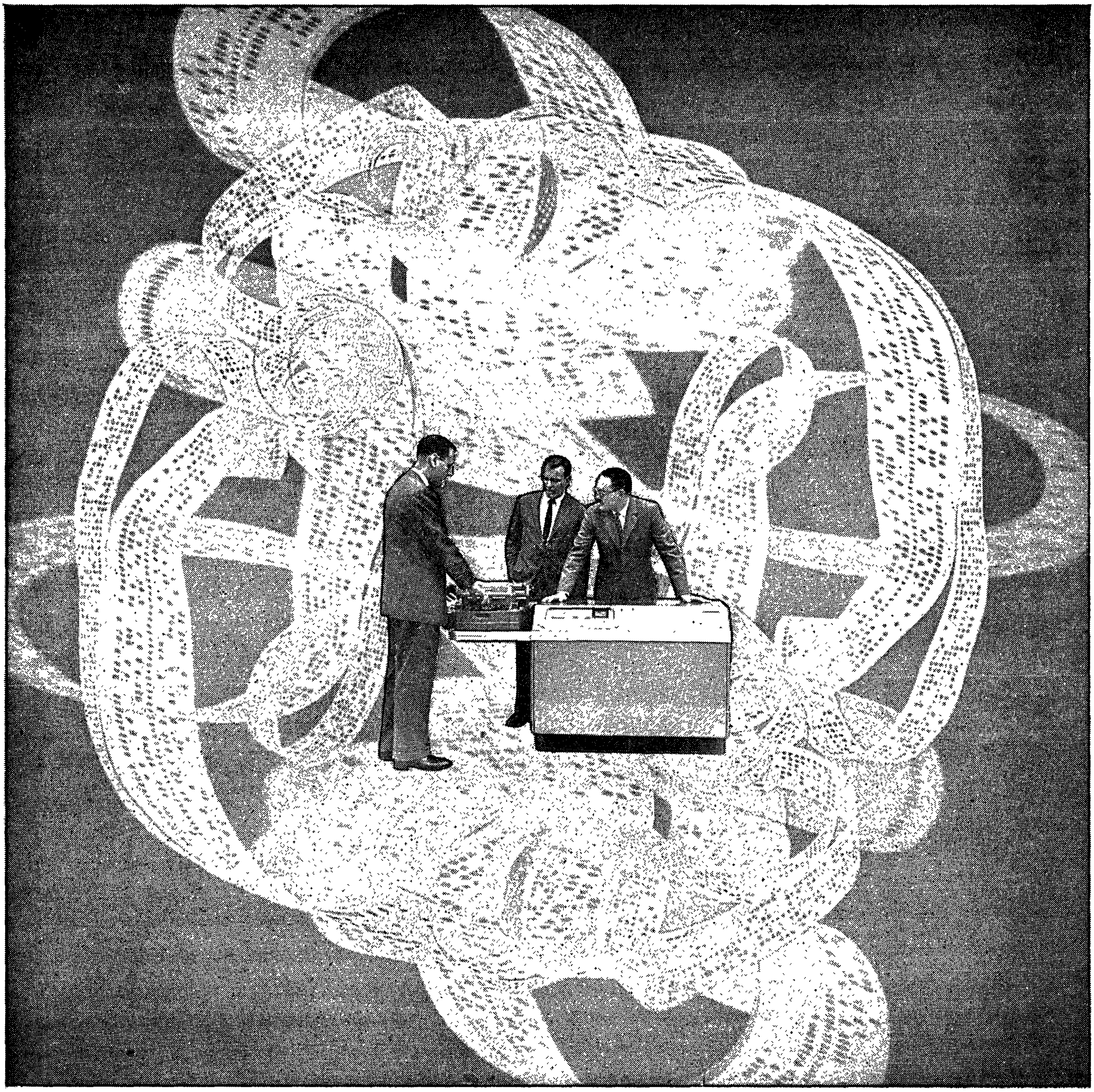
Please understand that I don't believe young Macdonald and his cohorts realize the full impact of what they are doing I am only trying to open their eyes and the eyes of the readers of their magazine to the other side of the picture.

In all truthfulness, I wish it were possible for all of us to accept the social responsibility for all our activities. but then I am not the first one to want this for the entire world. As a matter of fact, aren't we now restating a rule given to us many years ago which stated "Do unto others as thou wouldst have others do unto thee."

III. From: Mrs. P. Cammer To: Mr. Charles H. Johnson

Thank you for your letter. The differences in opinion between the **Journal of Machine Accounting** and **Computers and Automation** hinge, I believe, on two different views of the world. Those for whom you speak say: "My country, right or wrong — if we are wrong sometimes on some issues, which isn't very likely — against any other country X, Y, or Z." Neil Macdonald and co-

[Please turn to page 34]



The International Conference on Information Processing Held in Paris by Unesco, June 15-20, 1959—Brief Report

M. V. Wilkes, University Mathematical Laboratory,
Cambridge, England

(Based on a somewhat informal talk by Dr. Wilkes at the British Computer Society Conference, Cambridge, England, June 22, 1959; reported by E. C. Berkeley)

The Unesco computer conference in Paris lasted six days, which is an exhausting length of time for a conference. It grew from a start in the United States. I might comment on the technique of arranging an international conference: in the Arranging Committee meetings it is no good to say "we shall have another meeting soon." You have to be shut up in a room for three days, and get it all sorted out in that time.

The scope of the conference was large: applications, logical design, automatic programming, pattern recognition, and much more. You always start with the idea of no parallel sessions, and then you wind up arranging them.

The symposia, as compared with the sessions, were attended by great crowds. There was simultaneous interpretation a good deal of the time into four languages: English, French, Russian, and Spanish. The interpreters went to a lot of trouble ahead of time to learn the vocabulary, and deserve thanks.

One of the subjects that was discussed fully and at times heatedly in the Unesco Conference was computer languages — international languages for addressing a computer. An example is FORTRAN for IBM machines, which is being adopted by other people as well. A German-Swiss committee with United States representation from the Association for Computing Machinery and later British representation, has been discussing a standard computer language called ALGOL. Feelings run high when questions of standards are being worked on. The many opportunities for discussion and argument helped clear the air, in many areas.

The fact that there were earphones for everyone at every seat, even when you made no use of the interpretation into another language, meant that the whole strain of actually hearing was taken away.

As to high lights of the conference. First, language translation. There was a report from Harvard which gave a clear account of an automatic dictionary of Russian-English, which occupies 6 or 8 reels of Univac tape. This has taken a long time. They are now beginning on the real problem of translation. Other centers of language translation think syntactical or grammatical questions should be settled first. The general impression one gathers is that currently all reports are interim reports. Probably some years from now there will be the first big solid accomplishment.

In logical design, some new techniques were reported.

In the discussion on computer memories, Dr. Edward Teller asked if people really needed very large memories, and remarked that Dr. von Neumann once said that more than 20 thousand registers would not be needed. I feel that perhaps the only limit of appetite for memory is the depth of the organization's pocket.

Dr. Kilburn talked on the University of Manchester computer — which stood out favorably. Dr. Taub of the University of Illinois reported that they were just about going ahead with the building of their new fast computer. Target date is probably 2½ years from now. There was a report of computer activity in Germany, but not very high speed. There were reports on Larc and Stretch, by the people who are concerned in getting them.

The session on digital computer techniques of the future was extremely interesting. Representatives of IBM Switzerland talked on thin magnetic films for memory. They seem to be very useful and a square foot provides a very large quantity of storage. These devices depend on evaporation techniques. A great many very difficult problems are still to be overcome.

The Max Planck Laboratory in Munich reported on speeding up computers with parametrons. This is a device that Dr. Goto of Japan invented a few years ago; it is a special kind of oscillator which can operate either in one phase or another. Apparently it can use a carrier wave of 10,000 megacycles and assign 10 cycles for a digit length. You would then have a millimicrosecond digit time. RCA Camden reported some experiments with parametrons, and the experimental results showed that there was no reason why this should not be feasible.

A progress report from IBM Poughkeepsie on cryogenics gave the impression of many difficult problems still to be solved. There was a paper on an approach to microminiature printed circuits — you would write the necessary printed marks with an electron beam. The joint author, Dr. Dudley Buck of Mass. Inst. of Technology, died suddenly of pneumonia in May; there is a fear therefore that this work will not push on.

The sessions and symposia that were not arranged too far in advance were the best — contained the latest information.

The exhibition contained stands from some 30 exhibitors, including some British exhibits. There were lectures on the machines being shown. There were four exhibitors from Japan, and the exhibit definitely showed the emergence of Japan as a competitor in the computer field. There were a dozen or so Japanese attending the conference. The Russians took part in the conference but not in the exhibition.

One of the formal actions at the Conference was the formation of an international federation of computing societies. The organizing statutes have been drafted. I believe the British Council on Automation and Computers will adhere.

The next international conference is planned for four years from now.

A Scientific Application of Digital Computers: The 3-Dimensional Structure of The Protein Myoglobin

Dr. J. C. Kendrew

Medical Research Council Unit
Cavendish Laboratory
Cambridge, England

(Based on a talk given at the British Computer Society Conference, Cambridge, England, June 24; reported by E. C. Berkeley)

The field we shall talk about is a borderline field: molecular biology. Here we are interested in the structure of the large and complicated molecules that occur in all living organisms. There is a complex system of chemical reactions in cells. Nearly all of them are mediated or catalyzed by enzymes, which are all proteins. They are the keys to what goes on. A familiar example of a protein is hemoglobin — the stuff which makes red blood cells red. But the protein I shall talk about in particular is **myoglobin**; this is the protein which makes lean meat red. It occurs in animal muscle. The more red, the more myoglobin. Myoglobin can hook on one molecule of oxygen. Whales use it in great quantity to store oxygen when they are diving; and the myoglobin we use comes from whale meat from Peru.

In order to understand the chemical behavior of proteins, and their function in living organisms, it is necessary to discover not only their chemical structure, that is to say, the order in which the atoms are linked together to form chains, but also the way in which the atoms are arranged in space — their molecular architecture.

Proteins are synthetic plastics, long chains of amino acids, compounds of carbon, hydrogen, nitrogen, and other elements. In a protein molecule hundreds of amino acids are strung together in what are called polypeptide chains. Nucleic acids are another class of synthetic plastics; they are the constituents of chromosomes, which transmit the coding of information to offspring. There are 20 amino acids; and nucleic acids consist of chains of 4 amino acids, which constitute a 4-character code telling the cell how to construct substances of 20 amino acids. In myoglobin there are 153 amino acids; its molecule has about 1200 atoms, and is one of the simplest convenient proteins. Fred Sanger discovered the order of the amino acids in the chain of insulin, and received a Nobel prize for this.

Now the chain of amino acids in myoglobin is bundled up in some way. This is the question we want to ask: how is it bundled up? We have a 3-dimensional structure that we desire to discover. How shall be go about it?

We make use of the fact that by X-rays we can analyze the structure of a crystal, and that myoglobin (and also other proteins) will crystallize.

A crystal consists of a lot of identical molecules packed together in a repeating pattern in 3 dimensions. An example of a repeating pattern in one dimension is a musical note on a violin. Its harmonics are sine waves. And these can be analyzed by the mathematical method called Fourier analysis, and can be recombined by Fourier synthesis. Repeating patterns of waves in two dimensions are also possible: you can make illustrations of them by drawing a pattern of squares or lozenges on paper, and then drawing dark criss-cross bands or strips occurring in the same relative position in each square; the dark areas correspond with the big standing waves, and the light areas correspond with little standing waves. And you can have patterns of waves in 3 dimensions also. For example, you can draw a picture of repeating cubes, and you can insert criss-cross arrangements of repeating dark and light planes.

This then is the principle which we use. We build up the density of the crystal by superimposing the pattern of sine curves, and we use X-rays as the waves.

What is the size we shall be dealing with? The dimensions of molecules are on the order of 10 Angstroms across up to 40 Angstroms. An Angstrom is 10^{-8} centimeters. The X-rays we use have a wavelength of 2 to 6 Angstroms.

We direct a beam of X-rays at the crystals of myoglobin, and we obtain on a photographic film a pattern of spots, of various shades of dark, in a regular arrangement. The pattern looks like eggs arranged in a large eggbox, separated by various regular distances, and shaded with various degrees of gray. The spots from the X-rays fired through the crystal correspond to a Fourier analysis. The degree of blackening of the spot corresponds with the amplitude or size of the wave; the darker the spot, the bigger the wave.

But what is the phase, the displacement, of the wave? The X-ray picture of the crystal does not reveal this. So we succeed in measuring directly only one half of the information we want, and we have to calculate the other half. This is the whole mathematical problem of X-ray crystallography. We have to evaluate the following expression:

$$\frac{1}{V}\sum^{h}\sum^{k}\sum^{l} F_{hkl}\, e^{-2\pi i(hx+ky+lz)}$$

which is equal to the density of the crystal at point x, y, z. And not only do we have to do this at one point x, y, z, but for a coarse-grained look at the density we may need 1000 points, and for a fine-grained view of the density we may need 10,000 or 100,000 points. And so we have to calculate often.

By hand methods, you cannot tackle these problems. But nowadays, with a fast automatic computer, you can tackle them. Then after you have made one calculation, there are refinement processes: you improve your phase determination by recalculating.

Now the problem we worked on in regard to myoglobin was to find the way the chains went. We used the heavy atom method. We would hook on a heavy atom in a known place in the chain, and then fire X-rays at the crystal, and see where that atom was. We measured the changes in superposed photographs. We made use of 5 or 6 X-ray pictures from 5 or 6 different labeled molecules.

We stayed with a resolving power of about 6 Angstroms, used about 400 reflections (density spots on the photograph), and computed at 4000 points.

And here is a model of the chains of the myoglobin molecule (demonstrating). You can see it looks like several parts of ordinary paper clips grouped together. The red spot on it is the location of the iron atom to which oxygen may become attached. Because of using X-rays of 6 Angstroms, the side chains do not show. And here (demonstrating) you can see a 3-dimensional contour graph of myoglobin molecule: a set of 16 transparent plastic sheets, each one fastened next to another, each showing the contours of the density of the atoms in that level out of 16 parallel levels through the molecule.

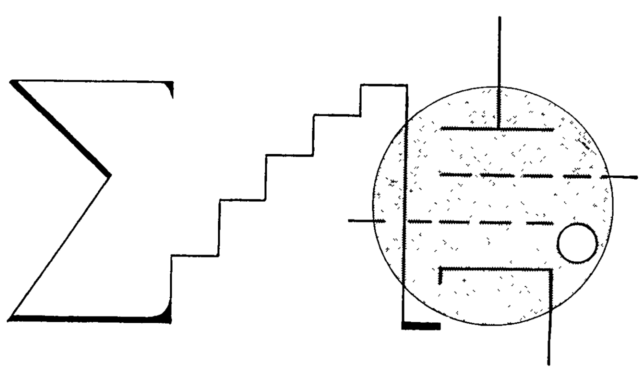
The number of calculating operations needed to solve the structure of myoglobin to the extent of this model and this graph is about 1.5 x 10^9. If we were to double the resolution, that is, look at the molecule of myoglobin with twice as fine an inspection, we would have to do 8 times as much work.

We have many plans for the future. We are proceeding to 27 times 400 reflections; we shall use different heavy atom additions. We shall need more than 20 pictures; we shall have to solve a 23 by 23 matrix to give us the best fit. We shall look at the density with a finer grid, probably 100,000 points in our molecule. And this will require faster and faster computation, on faster and bigger computers in the future.

We also need other machines. To measure the density of the spots on the photographic plate using a densitometer takes 1000 man-hours; we need a mechanical densitometer. Also we want methods of visual display, for displaying density planes on a cathode ray tube, or for plotting by machine.

We feel confident that it will eventually be possible to discover the general principles on which the very complex molecules that are proteins are built, and thus obtain a fuller understanding of the chemical processes taking place in all living cells. Such understanding of the basic nature and functioning of living matter will be of the greatest intrinsic interest, and will also find far-reaching application in the treatment of disease and in the development of industries concerned with the production of food and other natural substances.

COMPUTER ART



A motif based on: the sign sigma used for "sum" in mathematics; the graph of a step function; and the symbol for a thyratron.

The British Computer Society Conference, Cambridge, England, June 22-25, 1959

(Based on a report by the Society)

Session 1 — Opening Address and Report on the International Conference on Information Processing, Held in Paris by UNESCO, June 15-20, 1959, by M. V. Wilkes, University Mathematical Laboratory, Cambridge, England (see elsewhere in this issue)

Session 2 — Britain's Computers

The flow of new orders for computers for commercial data processing had noticeably slackened over the past few months, said Mr. J. A. Goldsmith, of Robson Morrow & Co., a firm of accounting consultants. Of the 109 large installations delivered or on order at the present time, 76 had been installed at this date compared with 37 at the same time last year and 15 the year before that.

He suggested that, in this field, potential users were waiting to see what success these early installations achieved before ordering their own machine. There was also a feeling that there might be new developments shortly with a crop of new machines on the market.

There was clearly scope for many more machines to be used in industry although a number of firms had decided to enter the field by installing punched card equipment using electronic calculators and then move on to computers in a few years' time. Over 300 such calculators had, in fact, been ordered or installed.

Work so far on the larger machines had been unambitious and the achievements disappointing compared with the amount of effort put into their installation. Users of these machines who have attempted to apply them to routine accounting work had generally found that the cost of installation and of preparing the media for the system was greater than had been forecast some years ago. There was still a large gap between top Management and the people running computers. He felt that it would be 5 or 10 years before computers played a full part in helping Management to control their organizations really effectively rather than being merely an advanced accounting machine.

Reviewing the work of computers in British Universities, Dr. A. S. Douglas, Director of the Electronic Computing Laboratory at the University of Leeds, said that, up to the present, these machines had mostly been engaged on research and that little or no undergraduate teaching had yet been developed. Generally, the machines were operated on the "open shop" principle, carrying out work for any Departments who wished to make use of the computers' facilities. There was also a trend — by those responsible for the computer, often the Mathematical Department, towards taking over the essential training of users in the mathematical techniques which it was essential should be fully understood before proper use could be made of the machine.

At Leeds, for example, his Department had taken over all training in numerical analysis for engineers and scientists in the University.

He gave details of the reliability to be expected from machines working on a service basis and showed that the percentage down-time, once the machine was run in, could be maintained at something in the order of only 1%.

Service work for other Departments was not considerable (except at Manchester) but an increase in this type of work might become necessary if a University was to be able to afford to install a large machine. He felt that only with such a machine could Universities properly combine a wide range of work for research and a proper programme of training.

Session 3 — Selecting and Training Computer Programmers

Both American and British speakers, at a symposium on the selection and training of programmers, expressed it as their opinion that there would be rapid development of automatic programming techniques applicable to a wider range of machines, and that there would emerge a common language for automatic translation to the language of each type of machine. Manufacturers and some large organizations with several computers would need highly skilled programmers to write the "master program"; but the expanding use of autocodes would simplify the user's task so that it might well be unnecessary for many users to train and employ highly skilled programmers such as Mathematics graduates.

Mr. R. W. Bemer, Manager of Programming Systems, IBM Data Processing Division, New York, whose organization needed a very large number of programmers, described the means of selection and training currently used in the United States. Basing the initial selection largely on aptitude tests, he emphasized the need for the potential programmer to have horse-sense. Given this, no particular previous occupation seemed to him to make very much difference although chess-players and puzzle-solvers appeared to have that necessary quality which was the hall-mark of a good programmer.

The use of aptitude tests as any guide at all was warmly contested by Dr. John W. Carr III, Director of Research, Computation Center, University of North Carolina. He did not suggest that this was, in any way, due to the fact that he had flunked both IBM and Remington tests himself, some years ago. As a University user with problems of co-ordinating work on different machines in 3 centers, he was more concerned in devising techniques to avoid training programmers rather than developing logicians as IBM were doing.

In the British field, Mr. H. W. Gearing, Head of Computer Division, The Metal Box Company Ltd., London, described the steps taken by The Metal Box Company to build up their own programming staff. They had found that a mixture of people with some years' experience in organizing the routines on normal accounting machines, with people who came straight from University or mathematical and statistical work in industry, gave the most evenly balanced team.

Mr. B. Richards of the Central Instrument Laboratory, Imperial Chemical Industries Ltd., Reading, stressed that it was important the Management user (be he chemist, engineer or physicist) should appreciate the mathematical ability of the machine and be able to explain to those running it, exactly what he required. In this way jobs might be quickly programmed using an automatic coding technique. He did not require psychologically selected programmers and suggested that, in this country, there had been too much emphasis on machine coding and not enough appreciation of systems, flow diagrams, and mathematical techniques for solving the problems in industry.

Session 4A — Auditing the Computer

Accountant members of The British Computer Society and many designers and scientists, discussed the problems posed to the Accounting profession in carrying out statutory audits when many of the conventional records had been replaced by magnetic tape or other devices.

Outlining the duties of auditors, Mr. A. J. Bray, M.A., A.C.A., drew attention to the requirements of the Companies Act. He questioned whether information held in computer storage could be accepted as "proper books of account" or whether it could be claimed that the permission given by the Act that matters might be recorded "in any other manner" than bound ledgers, might be stretched to cover, for example, a magnetic drum. He drew attention to the limited experience of the profession so far in auditing large data processing systems and suggested that there was a great deal to be done by external auditors in studying a complete integrated data processing system instead of relying on the routine checking of arithmetical accuracy.

Internal audit matters were outlined by Mr. T. R. Thompson, Director of Leo Computers Ltd., London, who stressed the need for early cooperation between systems planners and the auditors. He felt that a good data processing system gave a more organized procedure which should be easier for the auditor to grasp overall. He suggested that, with the fewer number of people involved in a large system, it might be easier to falsify data. Much had been written about the possibility of fraudulent operation of the machine but, while this was possible in theory, in his opinion it would be extremely difficult in practice.

The question of possible fraud was referred to also by Mrs. F. C. de Paula, T.D., F.C.A. He emphasized the need for the auditor to be satisfied that there was proper internal discipline within the machine-room. There should be proper procedures to ensure that the right programs were used, that the same program had, in fact, been used throughout one machine run, that minor error correction during a machine run was properly recorded. He suggested that machines might need to be equipped with devices which would automatically print out a record of all console switch movements, identification of the program used and, possibly, an automatic record of machine operating times.

A lively discussion was contributed to by many other prominent accountants. The general opinion was that the auditor would need to be intimately associated with the procedure and to evolve techniques of controlling the overall accuracy of the system, instead of relying on detailed checking of individual documents. It was suggested that he should also develop statistical sampling techniques to be able to watch trends in error factors, and possibly run sample tests on other machines.

Session 4B — The Logical Design of Computers

The new MUSE Computer, now under development at Manchester University, will complete the addition of two numbers in one ten-millionth of a second, according to Dr. T. Kilburn, Reader in Electronics in the University.

This high speed is achieved by a transistor circuit invented by Dr. Kilburn, which transmits the carry-over from one digit position to the next at a quarter of the speed of light. The mean rate of obeying instructions from the core store will be about 700,000 per second. An important feature of the computer will be a fixed store of 8,000 words (with an access time of 0.13 microsecond) which will hold many routines concerned with programmed arithmetic and organization of transfers to and from magnetic tape and other input and output media.

Dr. M. Lehman of the Israel Ministry of Defense, explained how he and his colleagues had been able to plan a computer using only $12,000 worth of equipment. He analyzed the cost of commercially available machines, concluding that materials accounted for only about 10% of the price. His computer is intended for general, "open-shop," scientific computing and will have an 8,000-word drum and a 128-word core store.

Dr. N. C. Metropolis, Director of the Institute for Computer Research at the University of Chicago, described a computer being built in his Institute modelled on Maniac II at the Los Alamos Scientific Laboratory. The new machine will have 8,000 or 16,000 words of core store with a cycle time of only 2 microseconds, and four magnetic tape decks. He also described an interesting form of floating point representation of numbers that will be used in the computer. This will avoid the appearance of large numbers of meaningless digits at the end of approximate numbers, whilst retaining a few guarding digits against rounding errors.

In the discussion which followed, Dr. A. R. Edmonds (London University) asked Dr. Kilburn whether the order code of MUSE had been planned bearing in mind that perhaps 80% of the programs would probably use some kind of autocode. Dr. Kilburn replied that this was certainly envisaged, as it had been with Mercury, and that the subroutines in the fixed store, and the large number of index registers (128), were intended to assist in the use of an autocode.

Session 5 — Automatic Computer Programming

Computer programming has now developed from a science into an art, said Dr. S. Gill (of Ferranti Ltd.). Individual techniques no longer matter, but rather the well-chosen combination of facilities embodied in a programming language. The present situation is still one of active development and is difficult to summarize.

Dr. Gill pointed out the various requirements of experts and novices in different situations which had led to a variety of different languages being devised, each capable of being accepted by a computer with the help of processing routines. A vital factor is the provision of well-written manuals describing the language, and a rapidly growing interest is being shown by manufacturers in the development and presentation of languages.

Processing routines now also assist the prson responsible for actually operating the computer, by keeping a log of work done, informing the operator when, for example, a reel of magnetic tape is to be changed, and making it possible to restart the calculation at a suitable point after a breakdown.

There is a trend towards the use of alphabetical coding; this started in scientific work but is now of greatest interest to business users. It is now also often possible to define words for use in a particular program. Dr. Gill saw this as a possible salvation for business users who have difficulty in reaching agreement on the meanings of words.

Finally, he summarized the present situation concerning attempts to standardize a language for international use. There are some who feel that if a common language is not consciously accepted now, some existing language will drift into common use; others feel that the time is not yet ripe to establish more than a few essential features of such a language. The British Computer Society has two committees considering respectively the scientific and business needs; the scientific committee has endorsed the latter view. Workers in various countries of Europe and the U.S.A. are, however, preparing to use a common language called "ALGOL" for scientific programs. The situation is confused by many factors, such as the variations in the range of symbols available on typewriters, key-punches, and printers.

During the discussion, Mr. J. H. Wensley of Computer Developments Ltd., revealed that International Computers and Tabulators had invited other manufacturers of computers to meet together to discuss the formulation of a common language for use in programs for business applications. All the invitations had been accepted.

Session 6 — A Scientific Application of Digital Computers: the 3-Dimensional Structure of the Protein Myoglobin

J. C. Kendrew, (Medical Research Council Unit) Cavendish Laboratory, Cambridge, Mass.

(see elsewhere in this issue)

Session 7 — Magnetic Tape Stores for Computers

Experience in the use of magnetic tape stores in computers for data processing was reported, by four firms who now have installations running.

Mr. C. A. Wilkes, of Imperial Chemical Industries Ltd., detailed the difficulties they had experienced in the early days and gave examples of some of the shortcomings of this medium. He re-assured delegates that, in spite of these difficulties, they had not experienced wrong information being written on to or read from magnetic tapes without the system signalling that an error had been made.

Mr. L. Griffiths of Rolls-Royce Ltd., spoke of his two years' use of tape storage, particularly as a large reference library of data for production control programs on the computer. They had devised a system for controlling the use of tapes so that the computer itself kept its own records and thus ensured that the right tape was used and information was not erased accidentally. While some wear had been experienced on tapes used continuously for engineering calculations, almost all the tapes in use for two years now were still capable of accurate work.

Magnetic film use was described by Mr. P. B. Livesey of Newton, Chambers & Company, Ltd., over a period of one year while work was being put on the computer. In his experience, the general reliability was good and the faults were very few. Mr. C. B. Griffiths of Babcock & Wilcox Ltd., used tape to hold a large number of computer programs covering the many jobs for which the machine was regularly used, so avoiding the need to reset the machine for each separate job. Magnetic tape was faster to read than paper tape input and was less liable to be damaged in handling.

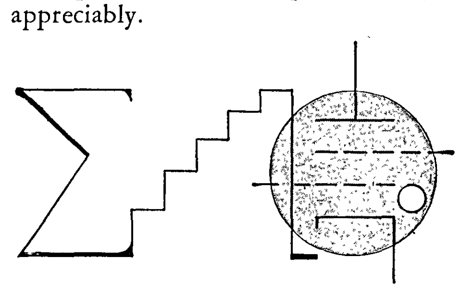
In the discussion which followed, other users indicated that those devices which provided for writing and reading magnetic tape or film without the heads being in contact with it, gave less cause for error and enabled a tape to be used for a great many years.

Session 8A — Computers handling Production Control

Work done in this country and the United States in the field of inventory control and production scheduling was summarized by Mr. J. Harling of Urwick Orr & Partners Ltd. He emphasized the two aspects of the problem, the analysis of orders and the resultant build-up of production schedules.

He gave an account of the application of each in practice and showed how such systems could cope with sequencing, batch frequency, and batch size variations.

A detailed study of a system of production control by a computer in a light engineering factory was given by Mr. Francis Bryen of International Computers and Tabulators Ltd. As a result of the installation of this system, production control in the factory is now significantly improved. For example, the total number of items in short supply has been reduced to about 6% of the former figure, production per man-hour worked has slightly increased, while part-ordering and split-batching have been reduced appreciably.



The system has not been in production long enough for substantial savings to have been made but the results so far are sufficiently encouraging for the Company to be convinced that these will accrue.

Session 8B — Mathematical uses of Computers

Dr. Alston S. Householder of the Oak Ridge National Laboratory, Oak Ridge, Tennessee, described the work he has been doing on the inversion of matrices.

He emphasized that he desired to draw attention to the pitfalls that existed in the hope that mathematicians attempting calculations of this nature on a computer might be saved some trouble and abortive work.

He described an argument which indicated that the method of rotation for inverting a matrix would be more stable than the elimination method, and came to the conclusion that this argument was fallacious.

In the discussion which followed, it was clear that many differing views were held by delegates from the 11 countries represented at the Conference. Some described a similar argument to Dr. Householder's and indicated that conclusions directly opposite to his view would, in fact, appear to be true in practice. The stimulating contributions made by other internationally known mathematicians resulted in a valuable exchange of information on highly technical matters.

Session 9A — Wide Range of Commercial Uses for Computers

Use of a LEO computer for sales invoicing, accounting and analysis for 38,000 customers of The Imperial Tobacco Company was described by Mr. A. G. Wright.

As many as 2,500 orders can be executed on the day received and the computer program containing 6,500 instructions also up-dates the customer's account, tests the credit limit, determines the quantity discount and works out information required by the Packing and Despatch Departments. The computer is also used for comparative sales statistics for the use of the firm's traveling salesmen. Payroll and other statistical programs are being planned for a future operation.

Work in local government was described by Mr. C. W. Mallinson, Deputy County Treasurer of Cheshire County Council. The IBM machine is handling: a payroll of 19,000 with cost analyses; accounting for 11 stores; the payment of 5,000 invoices a week; job costing for a central repair depot; and a highways costing service.

In a parallel session (9B), Dr. D. S. Butler of the Atomic Research and Development Establishment, Fort Halstead, Kent, described a new method of computing solutions of hyperbolic problems in three independent variables. This numerical method has been applied to a problem in fluid dynamics using the AMOS computer at Fort Halstead.

Session 10 — Economic Planning by Computer

Mathematical aids to management are now effectively used in industry through the ability of computers to carry out the complex calculations involved. Mr. G. S. Galer of the Shell Chemical Company Ltd., described the application of these computer methods to the varied activities of the Royal Dutch Shell Group in most parts of the world. Optimization techniques, and especially the technique known as linear programming, are now widely used for the solution of complex economic problems.

A group of petroleum chemical plants, for example, will produce as many as 50 final products from one base material. The plants may be operated in many different ways, and the production of many products is closely related to that of others. The potential market for each product is known. How should the production and marketing plan of the company be drawn up? If there is a shortage of base material or plant capacity, how should this be allocated between the various sales outlets?

The linear programming approach to these problems consists in setting up a large number of equations which express all the possibilities of sales and production, together with an expression describing the profit to be gained from each combination of possibilities. One is then able to choose, by means of a long calculation, that method of running the plant and of selling the products which will yield the largest profit.

This calculation, in practical cases, requires the resources of the largest and fastest computers available if it is to be carried out within a reasonable period of time. One of the Group's plant complexes, however, is now regularly operated on these principles, a planning exercise being carried out every three months, covering the coming five quarter period. The work is done on a large Ferranti "Mark I*" computer operated by the Group's research laboratory in Amsterdam.

There are plans for a wide extension of this work, using the much larger and faster new Ferranti "Mercury" computer which the Group is installing in London, and planning several years ahead.

Computers and Automation's

COMPUTER MARKET SURVEY 1959

"Between 5 Billion and 9 Billion Dollars Over The Next Five Years"

Edmund C. Berkeley

Editor

Computers and Automation

Two years ago, in the May 1957 issue of **Computers and Automation,** we published a computer market survey. This reported in detail 201 responses from our subscribers in United States and Canada. This showed that according to the estimates that they reported, their companies alone would be spending "between $400,000,000 and $750,000,000" for computer products and services over the next five years. We (perhaps rashly) estimated that a picture of the whole computer market in the United States and Canada could be obtained by multiplying those figures by 10, obtaining a 1957 estimate of "between 4 billion to 7.5 billion dollars over the next five years."

During the last few months we repeated this survey. This time we have 290 responses from our subscribers. This survey shows that according to their estimates, their companies alone would be spending "between $500,000,000 and $900,000,000" over the next five years. If we again multiply the sampling figures by 10, we obtain "between 5 billion and 9 billion dollars" as an estimate of what will be spent for computer products and services over the next five years.

Because of the value of the individual reports, we present them in a table. The organization's name of course cannot be given.

THE SURVEY FORM

Following is a condensed copy of the survey form used by **Computers and Automation** for this survey:

Questions:

What kinds of computer products and services does your organization buy or rent (or is considering buying or renting)?

Computers

— automatic digital computers?
— automatic analog computers?
— simulators?
— other data processing machines?

Components

— delay lines?
— magnetic tape devices?
— transistors?
— other components?

Services

— computing services?
— consulting services?
— other services?

Can you estimate (roughly and approximately) about how much your organization is likely to spend on products and services in the computer field

— in the next twelve months?
Between $——— and $———
— in the next five years?
Between $——— and $———

And for statistical purposes: Your department? / Your chief job responsibilities? / Do your recommendations affect purchases? / Your organization's main products? / No. of employees?

Filled in by: Name / Title / Date / Organization / Address

Approximately 3000 of these survey forms were mailed out; 290 had been returned up to August 5.

We think each return is important, because it represents a report by a subscriber of **Computers and Automation** who kindly took the trouble to send us his estimate for the advantage of others. We express our gratitude to these subscribers for sending us this information.

WHAT THE TABULATION CONTAINS

An explanation of the information in some of the columns in the table follows:

(1) **Code.** The code identifies the return, not the organization, in case looking back at the return is desirable.

(3) **Size.** Size is reported in number of employees. S stands for small size, 1 to 50 employees; M, medium size, 51 to 500 employees; L, large size, 501 to 5,000 employees; vL, very large size, over 5,000 employees.

(4) **Recom., Title.** Here is the answer to the question "Do your recommendations affect purchases?", and the title of the person filling in the questionnaire. The purpose of this column is to give some indication of the probable authority of the estimate here reported.

(5) **Products and Services.** This column reports on the question "What kinds of computer products and services does your organization buy or rent (or is considering buying or renting)?"

Column (a) reports on "automatic digital computers."

Column (b) reports on "automatic analog computers."

Column (c) reports on "other computers"; the codes are as follows:

S — simulators

v — other data processing machines

Column (d) reports on "components"; the codes are as follows:

D — Delay lines

M — Magnetic tape devices

T — Transistors

O — Other components

Column (e) reports on "services"; the codes are as follows:

P — comPuting services

S — conSulting services

O — Other services

(6) **Likely Spending Next Five Years.** This column reports on the question:

"Can you estimate roughly and approximately about how much your organization is likely to spend on products and services in the computer field in the next five years?

Between ———— and ————."

If a lower figure was given but no upper figure, we have inserted for the upper figure an amount equal to twice the lower figure. If this question was not answered, but the "likely spending" in the next twelve months was estimated, we have taken the one year figures and multiplied by five.

A ROUGH AND APPROXIMATE ESTIMATE OF THE MARKET FOR COMPUTER PRODUCTS AND SERVICES

The total of the figures in Column (6) of the tabulation "Likely Spending Next Five Years," for the 290 cases in the sample, is approximately "between $480,000,000 and $885,000,000," or rounding off "between $500 million and $900 million." In this sample, there are 67 reports not giving any figures; they have been added as zero; but let us ignore that in order to be conservative.

It is possible to take this total and multiply it by a factor F, and arrive at a rough and approximate estimate of the market for computer products and services. Everything however depends on the size of the factor F.

A reasonable choice for F is 10, the ratio of 3000 to 290.

Of course, it is not necessarily true that the sample here is a representative sample; it is far more likely to be non-representative.

Also, there may be bias associated with returning the survey form. A number of subscribers to **Computers and Automation** could have said to themselves "Well, my recommendations would not affect purchases — this kind of questionnaire is not for me to fill out and return."

But the factor F is almost certainly not less than 2. For it would be very hard to believe that a 10 percent sample has reported 50 percent of the market. Also it would be hard to believe that the factor F is much greater than 30; for it would be hard to believe that a 10 percent sample has reported only 3 percent of the market.

Suppose then that we apply a factor of 10. Then we reach a rough and approximate estimate of the computer market in the United States and Canada over the next five years: "between five billions and nine billions."

Tabulation

ESTIMATE OF COMPUTER MARKET, 1959 -- SUMMARY OF REPLIES

(1)	(2)	(3)	(4)	(5)					(6)	
				Products and Services					Likely Spending Next Five Years	
				(a)	(b)	(c)	(d)	(e)		
Code	Type of Organization	Size	Recom., Title	Dig.	Anal.	Other	Comp.	Serv.	Between	And
B1	electronic eqpmt	M	yes, lab mgr	-	-	-	MT	-	$200,000	$1,000,000
B2	consulting service	S	-, pres	v	-	-	Tv	S	-	-
B3	small reactors	M	yes, head of comp dept	v	-	-	-	-	100,000	175,000
B4	digital computers	M	yes, senior scientist, comp div	v	v	v	MTO	S	-	-
B5	insurance	vL	yes, VP & asst compt	v	-	-	-	P	5,000,000	10,000,000
B6	heat exchangers	L	yes, -	v	-	-	-	-	100,000	200,000
B7	locomotives	-	no, prgmr	v	-	-	O	-	90,000	180,000
B8	specialty steels	vL	yes, supv, EDP	v	-	-	-	-	1,000,000	1,500,000
B9	steel castings incl mining & construc products	M	sometimes, treas	-	-	v	-	-	200,000	240,000
B10	insurance	M	yes, supt, data proc dept	v	-	v	-	P	625,000	750,000
B11	air transportation	vL	yes, dir, advanced process research	v	-	v	MT	PS	10,000,000	15,000,000
B12	fire & cas insurance	vL	yes, sys anal & chief prgmr	v	-	-	-	P	720,000	1,440,000
B13	misc machinery	vL	yes, mgr, sys & procedures	v	v	v	-	PS	750,000	2,000,000
B14	military res & dev	M	yes, mgr, sys analysis dept	-	-	v	T	P	200,000	1,000,000
B15	banking	M	yes, cashier	-	-	-	-	-	-	-
B16	banking	L	yes, asst cashier	v	-	v	-	-	1,000,000	3,000,000
B17	synthetic fibers & films	-	-, head, data proc, research	v	v	-	MO	-	225,000	250,000
B18	tubes & semiconductors	M	no, head, tech publns	-	-	v	-	-	40,000	80,000
B19	atomic res & dev	L	yes, exec asst	v	v	-	DMTO	-	4,000,000	7,000,000
B20	maps and map data	L	yes, chief, math comp div	v	-	-	-	O	1,000,000	3,500,000
B21	petroleum	vL	yes, compr analyst	v	-	v	-	P	2,820,000	3,420,000
B22	oil production	L	yes, senior reservoir engr	v	-	v	-	-	1,500,000	3,000,000

(1) Code	(2) Type of Organization	(3) Size	(4) Recom., Title	(5) Products and Services (a) Dig.	(b) Anal.	(c) Other	(d) Comp.	(e) Serv.	(6) Likely Spending Next Five Years Between	And
B23	design	M	yes, head, compr svcs	v	v	S	–	PS	$200,000	$250,000
B24	telephone service	M	yes, stock transfer mgr	v	–	v	–	–	3,500,000	5,000,000
B25	integrated processes and consulting	S	yes, pres	–	–	–	–	PS	5,000	100,000
B26	insurance	L	yes, mgr, electronics dept	v	–	v	MTO	–	1,000,000	1,500,000
B27	computing services	S	yes, head, prgmg group	v	v	v	MO	S	4,000,000	10,000,000
C1	banking	L	yes, asst compt	v	–	v	MO	–	500,000	1,000,000
C2	research	vL	yes, consltnt	v	v	v	M	PSO	1,000,000	2,000,000
C3	research	L	no, librn, elec eng div	v	v	–	MT	PS	–	–
C4	helicopters	L	yes, engrg comp supv	v	v	S	O	PS	600,000	1,000,000
C5	telephones	vL	yes, res mathn	v	v	–	–	P	5,000,000	10,000,000
C6	manufacturing	vL	yes, mgr EDP	v	–	–	MO	–	1,500,000	2,000,000
C7	computers	M	somewhat, engr	–	–	v	MTO	–	–	–
C8	radar, communications, data procg	L	yes, asst proj engr	v	–	Sv	DMT	S	7,000,000	9,000,000
C9	mil weapon systems	M	yes, head, data procg dept	v	v	S	MTO	P	2,500,000	5,000,000
C10	finance	–	yes, res anal	v	–	–	M	–	500,000	1,000,000
C11	electronic counters analog computers	M	yes, purch mgr	–	–	–	DMT	–	–	–
C12	ground support eqpmt	M	yes, buyer	v	–	v	–	–	50,000	100,000
C13	reports, tables, indexes, forecasts	S	yes, chief res scientist	v	–	O	–	PSO	100,000	300,000
C14	airplanes; missiles	vL	yes, staff engr	v	v	Sv	MTO	PS	–	–
C15	aircraft	vL	yes, chief, digital comp	v	–	–	MO	PS	3,600,000	4,000,000
C16	dairy products (milk and ice cream)	vL	no, data proc committee	v	–	v	–	S	250,000	500,000
C17	proprietary research	M	yes, scientist	v	v	–	MT	P	500,000	1,000,000
C18	consulting engrs	S	yes, prgmr	v	–	–	–	–	50,000	100,000
C19	consulting services	S	yes, –	–	–	–	–	–	–	–
C20	recording & controlling instruments	L	no, mgr mkt res	–	–	–	–	–	–	–
C21	instruments & automation controls	L	yes, sr res engr	–	v	–	T	S	–	–
C22	research on contract	M	yes, editor	–	–	–	–	–	–	–
C23	research	S	yes, physicist	v	–	v	–	–	20,000	50,000
C24	financial	L	yes, mgr, data procg	v	–	v	M	S	2,000,000	3,000,000
C25	consulting service	M	seldom, civil engr	v	–	Sv	M	PS	0	90,000
C26	power plant design	L	yes, lead engr	v	–	–	–	PS	50,000	75,000
C27	newspapers and magazine clippings	M	– , –	–	–	–	–	–	–	–

(1) Code	(2) Type of Organization	(3) Size	(4) Recom., Title	(5) Products and Services (a) Dig.	(b) Anal.	(c) Other	(d) Comp.	(e) Serv.	(6) Likely Spending Next Five Years Between	And
C28	insurance	L	yes, VP	v	–	–	–	–	300,000	400,000
D1	water project devt	L	yes, supv hydro engr	v	–	v	–	O	800,000	1,000,000
D2	highways	–	yes, hwy econ	v	–	–	–	–	750,000	1,000,000
D3	advertising	L	yes, director	v	–	–	M	P	150,000	300,000
D4	earthmoving mach	vL	yes, supv engr	v	v	v	DMTO	PSO	500,000	750,000
D5	comp services	M	yes, admn officer	v	–	–	M	PS	1,200,000	4,000,000
D6	research	M	yes, tech libr	v	v	v	DMTO	PSO	–	–
D7	production problems	S	yes, supv	–	–	v	MO	–	948,000	1,500,000
D8	A-D, D-A converters	M	yes, supv	–	–	–	DMT	–	1,000,000	1,500,000
D9	service	vL	yes, elcnc res officer	v	–	–	–	S	–	–
D10	machinery	L	yes, assoc dir	v	v	v	DMTO	PS	10,000	20,000
D11	elec utility	L	yes, gen supv	v	–	–	–	P	1,300,000	1,500,000
D12	analyzer lab	S	yes, dir	–	–	–	–	–	–	–
D13	agricultural mgmt	L	yes, analyst	v	v	v	DMTO	PSO	500,000	750,000
D14	banking	L	yes, VP	v	–	–	M	–	1,200,000	1,500,000
D15	–	–	probably, asst tech grp engr	v	v	–	DMT	–	–	–
D16	mags & advtg	L	yes, mgr engrg	v	–	–	T	PSO	500,000	600,000
D17	elecnc motor control	vL	yes, mgr, data procg	v	v	Sv	DMTO	PSO	700,000	960,000
D18	elecnc trainers	vL	yes, chf, elecncs	v	v	Sv	DMT	PS	–	–
D19	simulators	–	yes, asst controller	v	v	Sv	DMTO	PSO	100,000	200,000
E1	accounting	–	–, CPA	–	–	–	–	PS	–	–
E2	electricity	vL	to some extent, comp apln engr	v	–	v	M	–	3,500,000	4,500,000
E3	forest products	vL	yes, mgr data procg	v	–	–	–	PS	225,000	285,000
E4	mgmt consulting	–	–, pres	–	–	–	–	–	–	–
E5	digital systems	M	yes, VP	–	–	–	MTO	–	500,000	1,500,000
E6	aircraft & missiles	vL	yes, compr coordinator	v	v	Sv	DMTO	PSO	25,000,000	50,000,000
F1	air transportation	vL	yes, supt comm & data procg	v	–	v	–	–	3,000,000	5,000,000
F2	business forecasts	S	–, consultant	–	–	–	–	P	2,500	5,000
F3	elecnc data procg sys	L	somewhat, sr elec engr	–	–	v	DMTO	S	–	–
F4	consl svc & data procg	S	yes, owner	v	v	Sv	DMTO	PSO	15,000	40,000
F5	res & devt of comprs	M	no, librarian	v	v	–	DMT	–	–	–
F6	life insurance	L	yes, assoc actuary	v	v	Sv	DMTO	PSO	230,000	750,000
F7	research	L	yes, chem engr	v	v	–	M	P	10,000,000	20,000,000

(1) Code	(2) Type of Organization	(3) Size	(4) Recom., Title	(5) Products and Services (a) Dig.	(b) Anal.	(c) Other	(d) Comp.	(e) Serv.	(6) Likely Spending Next Five Years Between	And
F8	flight propulsion	vL	yes, mgr	v	-	-	-	-	$5,000,000	$7,500,000
F9	mach tools, dairy equip & aircraft parts	vL	yes, dir, meth procedures	v	v	Sv	DMTO	PSO	-	-
F10	manufacturer	S	yes, sales mgr	-	-	-	-	-	-	-
G1	aviation supervision	M	yes, chief, spec facility	v	-	v	-	-	1,250,000	2,500,000
G2	machine tools	L	yes, engr	v	-	-	O	-	40,000	60,000
G3	banking services	L	yes, VP	v	-	v	M	-	2,500,000	3,000,000
G4	process control instrumentation	L	yes, administrator	-	-	v	MTO	-	-	-
G5	aircraft engines	L	yes, head, comp lab	v	-	v	MTO	-	10,000,000	15,000,000
G6	construction & maint. of highways	vL	yes, auditor	v	-	v	-	-	700,000	800,000
G7	army ordnance missile range	vL	no, analyst	v	-	-	M	-	-	-
G8	consulting services	S	yes, VP	-	-	-	TO	-	250,000	1,000,000
G9	coffee	M	yes, mgr, data procg	v	-	-	-	-	420,000	500,000
G10	steel	L	yes, supv, sys & proc	v	-	-	-	P	375,000	500,000
G11	computing services	S	yes, sr methods analyst	v	-	-	-	-	250,000	350,000
G12	life insurance	L	yes, VP & compt	v	-	-	DM	P	1,000,000	2,000,000
H1	tires, hoses, molded rubber goods	vL	yes, supv of data procg grp	v	-	v	-	-	700,000	1,000,000
H2	systems management & engineering	L	yes, mgr, data procg	v	v	-	-	-	5,000,000	10,000,000
H3	comprs & compr svcs	-	yes, mgr, compr center	v	-	-	-	-	2,000,000	2,500,000
H4	compr systems	vL	yes, regional sales mgr	-	-	-	-	-	-	-
H5	control systems	S	yes, mgr, engr lab	-	v	S	-	-	100,000	1,000,000
H6	compr services & test eqpmt	S	yes, VP	-	-	-	M	P	-	-
H7	navigatnl sys, electronic eqpmt, data handling & display	L	yes, assoc head	-	-	v	MTO	PS	5,000,000	10,000,000
H8	banking	L	no, asst VP	v	-	-	MTO	P	1,000,000	2,500,000
H9	analyses & compns	S	yes, grp ldr	v	-	v	MO	-	1,500,000	2,000,000
H10	petroleum	vL	yes, electronics coordin	v	v	Sv	M	-	10,000,000	20,000,000
I1	ladies ready-to-wear, retail	-	yes, dept mgr, sys & proc	v	-	v	-	S	250,000	275,000
I2	consultation	-	yes, principal	-	-	-	-	-	-	-
I3	certified public accountants	-	yes, principal	-	-	-	-	-	-	-
I4	ultrasonic transducers	M	yes, dir of res	-	-	-	-	P	15,000	20,000
I5	test eqpmt	L	yes, proj engr	v	-	-	DTO	-	400,000	1,500,000
I6	civil eng	M	yes, chief of comp	-	-	v	-	P	5,000	10,000
I7	life & grp ins	L	no, methods asst	v	-	-	-	P	250,000	1,000,000

(1) Code	(2) Type of Organization	(3) Size	(4) Recom., Title	(5) Products and Services (a) Dig.	(b) Anal.	(c) Other	(d) Comp.	(e) Serv.	(6) Likely Spending Next Five Years Between	And
I8	banking	M	yes, asst VP	v	-	-	MT	-	$1,000,000	$1,250,000
I9	eng data procg support	S	yes, -	v	-	v	M	-	420,000	500,000
J1	data procg eqpmt	S	yes, off mgr	v	-	v	O	PSO	5,000,000	9,000,000
J2	data procg eqpmt	vL	yes, data procg sales rep	v	-	Sv	MT	-	2.5 billion	5 billion*
				*(omitted from total because of duplication)						
J3	bus machines & comprs	-	- , applied science rep	-	-	-	-	-	-	-
J4	data procg eqpm	vL	yes, staff engr	-	-	-	DTO	-	-	-
J5	data procg machines	vL	yes, mgr, commercial systems	v	-	v	MTO	-	-	-
J6	cooling systems	L	yes, mgr admin	v	-	v	-	-	200,000	250,000
J7	farm eqpmt & mtr trks	vL	yes, res engr	v	-	-	-	-	10,000,000	20,000,000
J8	instruction	M	yes, head statl dept	v	-	-	-	S	25,000	50,000
J9	-	-	no, supv, info section	v	v	v	O	-	-	-
K1	missile res & dev	L	yes, section chief	v	v	v	MT	-	2,500,000	5,000,000
K2	ordnance res & dev	L	yes, supv, data procg	v	v	v	-	-	4,500,000	9,000,000
K3	surgical dressings	L	yes, supv elec data procg	v	-	v	-	S	350,000	1,250,000
K4	steel	M	yes, res engr	v	v	-	DTO	P	50,000	100,000
L1	invention, design, consltg service on mgt & mfg problems	S	yes, consult	-	-	-	-	-	-	-
L2	education & res	-	yes, asst prof of psych	v	-	-	-	PS	10,000	50,000
L3	instruments & syst	L	yes, proj engr	v	v	Sv	T	PS	50,000	500,000
M1	welfare, fund-raising agency	M	yes, dir, res	-	-	v	-	P	75,000	100,000
M2	automatic typecasting eqpmt; adding mach & photo mech eqpmt	M	yes, chf engr	-	-	v	MTO	-	1,000,000	1,500,000
M3	aircraft radio communication & navigation eqpmt	-	yes, div gen mgr	-	-	-	T	-	-	-
M4	electrical control instruments	L	no, chief, industr eng	v	v	S	MT	-	150,000	200,000
M5	process instruments	L	yes, res engr	-	v	S	DMT	-	-	-
M6	solenoids, selectors	M	yes, chf engr	v	v	-	T	P	150,000	300,000
M7	detergent, toilet & edible products	vL	yes, syst analyst	v	-	v	-	S	950,000	1,200,000
M8	military elecnc eqpmt	L	yes, dir, res & eng	-	-	-	DMTO	PS	-	-
M9	electronic eqpmt	M	yes, chf engr	-	-	-	DMTO	-	-	-
M10	fire & casualty ins	vL	yes, engr, elecncs chf	v	-	v	-	-	750,000	1,000,000
M11	life ins	L	yes, VP	v	-	-	-	-	150,000	200,000
M12	welding eqpmt	L	yes, engr	-	-	-	-	-	25,000	100,000
M13	telephone services	L	yes, controller	v	-	v	-	-	750,000	1,500,000

(1) Code	(2) Type of Organization	(3) Size	(4) Recom., Title	(5) Products and Services (a) Dig.	(b) Anal.	(c) Other	(d) Comp.	(e) Serv.	(6) Likely Spending Next Five Years Between	And
M14	special purpose digital computers for aviation, etc.	M	yes, gen engr	–	–	–	DMTO	P	$2,000,000	$5,000,000
M15	mil data processors	M	yes, res sci & hd sys logic	v	–	S	–	P	–	–
M16	elecnc products	vL	yes, hd prgmg & sim grp	v	v	S	MT	S	–	–
M17	airframes & missiles	vL	yes, corp dir of sys plan	v	v	S	M	–	35,000,000	40,000,000
M18	life ins	M	yes, asst VP	v	–	v	M	P	1,000,000	1,250,000
N1	aircraft	vL	yes, asst mgr, tabg & DP	v	–	v	–	–	5,000,000	6,000,000
N2	aircraft mfg	vL	yes, prgmr	v	–	–	M	–	500,000	750,000
N3	tv, hi-fi, radar, data procg eqpmt	vL	yes, comp prgmr	v	v	Sv	DMT	–	500,000	600,000
N4	life ins	L	yes, asst secy	v	–	–	MT	–	2,000,000	3,000,000
N5	missiles	vL	yes, proj ldr, data systems	v	v	S	MT	–	15,000,000	100,000,000
N6	pulp, paper, board	vL	no, corp librn	v	–	v	–	–	–	–
N7	banking svcs	L	yes, asst cashier	v	–	–	–	–	500,000	750,000
N8	research	M	yes, supv, anal & comp ctr	v	v	–	–	P	500,000	1,500,000
N9	life ins	vL	yes, res assoc	v	–	v	–	–	10,000,000	15,000,000
N10	credit info	M	yes, partner	v	–	v	–	–	50,000	250,000
N11	engrs & technicians	M	yes, prof of elec eng	v	v	Sv	MTO	–	–	–
N12	automatic guidance & environment control for air & space vehicles	L	yes, sr res engr	v	v	Sv	DMTO	PSO	2,000,000	4,000,000
N13	education & res	vL	yes, dir, opns	v	–	–	DMT	–	500,000	1,000,000
N14	res	S	– , prgmg supv	v	–	v	T	P	50,000	150,000
N15	industrial chemicals	vL	yes, eng supv	v	v	–	–	–	2,000,000	3,000,000
O1	govt res orgn, aeron & space	–	yes, aero res engr	v	v	Sv	MT	–	500,000	1,750,000
O2	research, govtl	L	yes, asst chf, comp lab	v	–	–	–	–	1,500,000	2,000,000
O3	res & eng	S	yes, tab proj planner	v	v	Sv	–	PSO	500,000	2,500,000
O4	ins business	M	yes, mgr EDP	v	–	v	MO	O	1,500,000	2,500,000
O5	aircraft & missiles	vL	yes, chf comp & data ctr	v	v	v	–	–	5,000,000	7,000,000
O6	fire, auto, cas ins	L	yes, elecns res	v	–	–	–	–	600,000	800,000
P1	education & res	L	yes, hd EE dept	v	v	–	MTO	–	20,000	100,000
P2	petroleum	M	yes, sr res mathn	v	v	S	TO	O	5,000	50,000
P3	comp service	S	yes, head DPD	v	–	v	–	–	300,000	360,000
P4	education	M	yes, dir, bus data procg	v	–	v	–	–	35,000	40,000
Q1	consumer finance cas ins	L	yes, supv, comp systems	v	–	v	M	–	2,000,000	2,500,000
Q2	fire & cas ins	L	yes, mgr, DP	v	–	v	–	S	500,000	1,000,000

(1)	(2)	(3)	(4)	(5)					(6)	
				Products and Services					Likely Spending Next Five Years	
				(a)	(b)	(c)	(d)	(e)		
Code	Type of Organization	Size	Recom., Title	Dig.	Anal.	Other	Comp.	Serv.	Between	And
Q3	semiconductor devices	L	yes, mgr EDP	v	–	v	–	P	$400,000	$700,000
Q4	consulting service	S	yes, comp aplns engr	v	–	–	–	P	25,000	60,000
Q5	design & construc, process industries architect & engrg	L	yes, staff engr	v	–	–	–	–	125,000	500,000
Q6	education	L	yes, assoc prof	v	v	S	DMT	–	–	–
Q7	textiles	vL	no, supv, sys & purch	v	–	–	M	S	650,000	750,000
Q8	corn	M	–, dept hd	–	–	–	0	–	150,000	200,000
Q9	banking	L	yes, asst VP	v	–	v	M	S	1,500,000	3,000,000
Q10	comprs	–	– , reg sales mgr	–	–	–	–	–	–	–
Q11	res & devt	L	yes, section chief	v	v	Sv	DMTO	P	3,000,000	5,000,000
Q12	banking	S	yes, asst treas	–	–	v	–	0	–	–
Q13	service	L	yes, asst mgr, elecns div	v	–	–	–	–	250,000	300,000
Q14	wood & metal cutting saws	L	yes, mgr DPD	v	–	v	–	P	50,000	100,000
Q15	mass flow instruments	M	yes, res dir	–	–	–	–	–	–	–
Q16	tape transports, digital high-speed printers	M	yes, chf engr	–	–	–	TO	P	250,000	1,000,000
R1	women's sportswear	L	yes, compr dept mgr	v	–	–	MO	–	120,000	150,000
S1	elecns; instrumentation; data handling systems	L	yes, sr dev phys	v	–	–	DMTO	PSO	–	–
S2	electronics	L	yes, librn	–	–	–	–	–	–	–
S3	appliances	vL	yes, mgr, advanced prgmg	v	v	Sv	DMTO	PSO	20,000,000	40,000,000
S4	res & devt	M	yes, mgr	v	–	–	0	P	125,000	250,000
S5	systems res	M	yes, systems analyst	v	–	–	–	P	–	–
S6	digital comps	L	no, engr, writer	–	–	–	DMTO	–	–	–
S7	comps & allied eqpmt	L	yes, supv of pubn	–	–	–	–	–	–	–
S8	comprs	L	yes, sec supv	–	–	–	DMTO	–	50,000,000	100,000,000
S9	lg scale elecn comps	L	– , dir, purch div	–	–	–	–	–	–	–
S10	aircraft	vL	yes, supv, dig compg	v	v	–	MTO	PS	5,000,000	6,000,000
S11	comprs	–	yes, assoc prof	v	–	–	DMTO	–	150,000	300,000
S12	education & res	S	yes, head	v	–	–	MTO	–	625,000	900,000
S13	engrs & scientists	S	yes, librn	–	–	–	–	–	–	–
S14	data procg eqpmt	M	– , apln anal	–	–	–	–	–	–	–
S15	comps, data procg eqpmt	vL	yes, prod prgm coordinator	–	–	–	TO	S	1,500,000	2,500,000
T1	programs	L	yes, model mgr	v	–	v	M	PSO	–	–

(1) Code	(2) Type of Organization	(3) Size	(4) Recom., Title	(5) Products and Services (a) Dig.	(b) Anal.	(c) Other	(d) Comp.	(e) Serv.	(6) Likely Spending Next Five Years Between	And
T2	banking svcs	L	yes, asst treas	v	-	v	-	S	$1,000,000	$2,000,000
T3	res	L	yes, tech librn	v	-	-	M	-	40,000	50,000
T4	petroleum	M	yes, grp ldr	v	-	-	-	-	-	-
T5	oil	L	yes, head DPD	v	-	v	M	PS	2,000,000	3,000,000
T6	oil	vL	yes, sr prgmr	v	-	-	MO	P	1,000,000	1,250,000
T7	commun & data hdlg eqpmt	M	yes, sr engr	-	-	-	T	-	25,000	50,000
T8	soc sec prgm	vL	yes, mgt anal	v	-	v	-	-	15,000,000	25,000,000
T9	res	M	yes, sr mathn	v	v	-	-	PS	150,000	250,000
T10	petroleum	L	yes, sr specialist, comps	v	-	v	-	-	200,000	300,000
T11	education & res	-	yes, prof of transp & mgt	v	v	-	MT	PS	900,000	1,000,000
T12	solid state devices	-	yes, consltnt	v	-	v	DMTO	-	50,000	100,000
T13	woolen & worsted fabrics	-	yes, dir of DP	v	-	-	MTO	S	1,375,000	2,000,000
T14	compr readout devices	M	yes, asst mgr	-	-	-	DMTO	P	3,000,000	6,000,000
T15	digital, communications & sound sys	vL	yes, EE	v	-	-	DMTO	-	5,000,000	10,000,000
T16	savings	M	yes, auditor	v	-	-	MTO	-	1,000,000	1,250,000
T17	telephone	-	yes, engr	v	-	v	-	-	-	-
T18	military elecns	vL	yes, engr dept head	v	v	-	DMTO	P	-	-
T19	compr displays & printers	L	yes, sec hd	-	-	-	MTO	S	1,000,000	2,000,000
T20	digital comps & data converters	L	yes, prgmr, opr	v	-	-	DMTO	PS	-	-
T21	compr prgms	L	no, sr prgmr	v	-	-	M	-	-	-
T22	petroleum	S	yes, tech asst to mgr	v	-	-	MO	PS	3,000,000	4,500,000
U1	thrift & home ownership	M	yes, TAB mgr	v	-	-	-	-	250,000	500,000
U2	service; res	M	yes, mathn	v	-	-	-	-	20,000	40,000
U3	automation	-	yes, VP	-	-	-	DMTO	S	1,000,000	2,200,000
U4	mech & elecnc components	L	no, DP mgr	v	-	v	MO	-	1,400,000	1,500,000
U5	elecnc data procg	L	yes, proj engr	v	-	-	MT	-	-	-
U6	comp svcs	S	yes, supv	v	-	v	M	-	1,500,000	1,600,000
U7	data procg svcs	S	yes, data anal mgr	v	v	S	DM	S	850,000	1,500,000
U8	airframe, missile, elecnc components	vL	yes, chief of comp	v	v	S	MT	P	2,500,000	3,750,000
U9	integrated oil & gas activities	L	yes, actg supv meth & sys	v	-	-	MO	-	2,000,000	3,000,000
U10	literature res	S	yes, librn	-	-	-	-	-	-	-
U11	rocket engines	L	yes, sr engr	v	v	S	MT	PS	500,000	1,000,000
V1	education	S	yes, asst dir	v	-	-	-	-	65,000	100,000

(1)	(2)	(3)	(4)	(5)					(6)	
				Products and Services					Likely Spending Next Five Years	
				(a)	(b)	(c)	(d)	(e)		
Code	Type of Organization	Size	Recom., Title	Dig.	Anal.	Other	Comp.	Serv.	Between	And
V2	plastics; raw mat	vL	yes, mgr, stat dept	v	–	v	–	–	$1,200,000	$1,500,000
V3	air transp	vL	yes, sys engr	v	–	–	M	S	–	–
V4	personnel res	M	yes, chief of comp anal sec	v	–	–	–	–	1,000,000	1,250,000
V5	statl reports	M	yes, chf EDP	v	–	v	MO	P	750,000	1,250,000
V6	data procg, air base	M	yes, mgr DPD	v	–	–	M	–	13,000,000	15,000,000
V7	eng & construction	L	yes, hd engr	v	–	v	–	–	100,000	300,000
V8	data anal & consltg services	S	yes, chf statl res & anal grp	v	–	v	M	–	100,000	300,000
V9	comp sys for a field army	M	yes, asst chf, fld test	v	v	v	M	PSO	10,000,000	15,000,000
V10	res & devt	L	no, mathn	v	v	Sv	DMTO	SO	–	–
V11	scoring of test instruments (army)	S	yes, capt, USA	v	–	v	–	O	200,000	250,000
V12	mil inventory control	–	yes, chf DPD	v	–	–	M	PO	3,000,000	3,125,000
V13	army ordnance	–	yes, chf DPD	v	–	–	–	–	6,000,000	8,000,000
V14	planning services, naval air sta	S	no, mgt anal	v	–	v	–	–	1,250,000	1,750,000
V15	officer education	M	yes, prof	v	v	v	DMT	–	–	–
V16	navy retail mdsg	vL	yes, LCDR, USN	v	–	–	MO	PO	750,000	1,000,000
V17	res & devt	M	yes, –	v	–	–	DMTO	P	50,000	100,000
V18	mechanical searching	L	yes, dir, res & devt	v	–	–	–	–	–	–
V19	retirement & unemployment ins	L	yes, mgt anal officer, dig comp sys	v	–	–	M	–	–	–
V20	res & devt	M	yes, grp ldr	v	v	Sv	MTO	P	150,000	300,000
V21	eng service	L	yes, asst to pres	v	–	–	–	–	500,000	750,000
V22	res	L	yes, physicist	v	–	v	MT	–	500,000	750,000
V23	education	–	–, consltg engr	–	–	–	–	S	–	–
V24	service	M	yes, supv	v	v	v	M	PS	1,000,000	2,000,000
V25	res & devt	S	yes, sec hd	v	–	–	DMTO	–	50,000	500,000
V26	res	L	–, res phys	v	v	Sv	DMTO	PS	500,000	2,000,000
V27	res	S	yes, –	–	–	–	–	P	10,000	30,000
W1	banking	L	yes, asst compt	–	–	–	–	–	1,500,000	2,000,000
W2	electronic eqpmt	M	no, adm asst	–	–	–	DT	S	300,000	750,000
W3	voltage measuring eqpmt	S	yes, opr mgr	–	–	–	TO	–	–	–
W4	helicopters	L	no, sr prgmr	v	v	v	–	P	360,000	500,000
W5	missile eng sys	–	yes, dept hd	v	–	–	T	PS	175,000	187,500
X1	welfare, state provided	L	yes, supv, mach oper	v	–	–	MT	–	1,000,000	1,500,000

(1) Code	(2) Type of Organization	(3) Size	(4) Recom., Title	(5) Products and Services (a) Dig.	(b) Anal.	(c) Other	(d) Comp.	(e) Serv.	(6) Likely Spending Next Five Years Between	And
X2	civil eng res & devt	L	yes, chief, comp ctr	v	-	v	-	-	$750,000	$1,000,000
X3	consltg & comp svc	M	yes, supv engr	v	v	v	TO	-	2,500,000	4,000,000
X4	devt	M	yes, sec mgr	v	v	Sv	MTO	PS	500,000	1,000,000
X5	mil electronics	L	yes, reliability coord	v	v	Sv	DMTO	P	1,000,000	2,000,000
X6	steam turbines	vL	yes, supv	v	-	-	MT	-	3,000,000	3,500,000
X7	education	M	yes, prof of math	v	v	-	-	-	25,000	100,000
Z1	drugs	vL	yes, -	v	-	-	MT	-	300,000	500,000
Z2	industrial products & farm mach	vL	yes, -	v	v	-	M	PS	6,000,000	10,000,000
Z3	medical care	S	no, asst to area med adm	-	-	-	-	P	-	-
Z4	res	S	yes, -	v	-	v	-	PS	700,000	1,250,000
Z5	-	-	yes, -	v	v	Sv	M	P	200,000	1,000,000
Z6	missiles	vL	yes, asst hd comp lab	v	v	Sv	M	P	10,000,000	15,000,000

KEY TO SOME ABBREVIATIONS

(Most abbreviations can be guessed, like those in a telephone book)

admn	adminstration	hdlg	handling
anal	analyst	info	information
apln	application	mags	magazines
compn	computation	mat	material
compr	computer	mathn	mathematician
compt	comptroller	mfg	manufacturing
consl	consulting	mgmt	management
consltnt	consultant	mgr	manager
dev	development	mil	military
dig	digital	orgn	organization
elecnc, elecn	electronic	prgmr	programmer
eng, engrg	engineering	procg, proc	processing
engr	engineer	res	research
engrs	engineers	statl	statistical

BUFFERIN' IS ASPIRIN FOR EDP HEADACHES

Ernest Jacobi
Litton Industries
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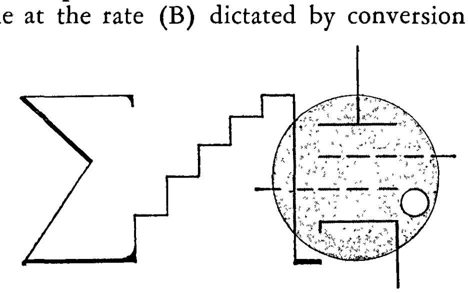
ELECTRONIC data processing systems are getting increasingly larger and more complex, but the trend in the associated field of buffering equipment is in the opposite direction, toward greater simplicity and hence lower cost. This is due partly to improved design techniques; but for the most part it is the result of the recognition of the need for buffering leading to the development of specialized types of equipment. As a rule, these are more functional and, therefore, more economical than general purpose buffers suitable for diverse applications.

This trend is reflected in the line of products developed by Telemeter Magnetics, Inc., of Los Angeles, California. The firm was the first to design an all-transistorized buffer using ferro-magnetic memory cores. As of today, approximately three years later, it can still claim to have manufactured nearly every core buffer installed and in use anywhere in the world.

What is a Buffer?

In general terms, a buffer is a memory that is used for temporary storage of digital data to smooth out the kinks in the flow of data due to differences in speed of two or more associated types of data handling equipment. Typical examples are: (1) data translators which reshuffle and adapt mutually incompatible data formats; (2) output buffer systems for transcribing by mechanical means electronically produced data; and (3) input buffers which rearrange continuous data, for instance from a missile in flight, into a format suitable for a given computer.

A concrete example for the first group is a Data Converter which was recently delivered to the Data Reduction Center of Patrick Air Force Base at Cape Canaveral, Fla. The system uses two buffers, one for input and the other for output, to achieve compatibility between five different tapes and formats (besides performing a number of complex editing functions). During a conversion, for instance from IBM 704 to FLAC paper tape, the input buffer is loaded at the rate (A) of the IBM Magnetic Tape handler; and unloaded into an interbuffer zone at the rate (B) dictated by conversion and/or editing requirements. The output buffer is then loaded at a rate (C) which must be different from (B) since during the conversion new characters had to be added, and unloaded at the rate (D) of the relatively slow paper tape punch.



Asynchronous Flow of Data

This example demonstrates the need for buffering whenever the flow of data through a system is asynchronous. It also makes a good case for the desirability of status signals (FULL and EMPTY) from the buffer in such special applications. For although load and unload operations are interlaced, it is obvious that when there exists such a vast difference of speed as between the IBM Magnetic Tape handler and a paper punch, one or the other of the two buffers will inevitably become filled or emptied and that at this point loading or unloading must be stopped.

The buffers used in this system employ magnetic storage cores. They are fully transistorized, have capacities of 1092 seven-bit characters, and operate at frequencies up to 100 KC (10 microseconds per character). They store characters sequentially and make them available in the same order as they were received; loading and unloading are completely independent of each other so that either mode may be interrupted, switched over, and later resumed at the same address. Also, the units generate FULL and EMPTY pulses regardless of the address at which either state may occur.

Because of its high degree of flexibility, this type of buffer is very useful for a wide range of special applications. Aside from the Patrick Data Converter, it forms the heart of the National Security Administration's SWALLOW Data Translator, of the FLAC High Speed Output Buffer system, of the many data translator systems developed by Electronic Engineering Co. of California; and of many laboratory variations especially designed for their own use by research groups at Lincoln Laboratories, Bell Telephone Laboratories, San Diego Naval Research Center, etc.

New Models

Since there continues to be a market for this highly versatile, general-purpose buffer, the manufacturer has recently introduced two new models of the same general type. Characteristically, though, the new models feature design simplifications that are equivalent to a reduction of approximately 20 percent in total circuitry. In addition, one of the new models provides double the previous storage capacity, and in both character length has been increased from seven bits to eight.

While the two new models are still general purpose buffers with separate drivers for loading and unloading, the introduction of a type of buffer called "BA" represents a radical departure from this concept. In this type, storage cores are initially cleared to the ONE state. During loading, the cores that are to store ZEROs are reset while the cores that are to store ONEs are not. (Their resetting is prevented by means of inhibit currents). During the subsequent unload cycle, no inhibit currents are generated and all cores still in the ONE state are reset. This resetting produces output pulses that are read as ONEs, while the cores that were reset to ZERO during the load cycle cannot now produce such pulses so that the absence of the pulses is read as ZERO. Thus both loading and unloading is performed with the same set of drivers.

This technique was developed for a buffer that required a 120-way reversible magnetic current steering switch where the elimination of one of these units created very essential savings. It has since been applied to other special buffers all of which have in common the characteristic that they do not require a high degree of mutual independence between loading and unloading operations.

The particular buffer for which this technique was developed is the model 120-BA-36 which forms part of the UNIVAC 1105 system where it serves as a data link between the central computer and a tape control unit. The buffer has a capacity of 120 thirty-six bit words and an operating speed of 16 microseconds per word. The words are loaded and unloaded in parallel by means of a common 36-stage input/output register that serves the double purpose of aligning skewed information and converting pulses into DC levels. The unit has a control matrix that generates Blockette (20 words) markers and Block (120 words) markers. Words are loaded and unloaded sequentially, but a special feature of the buffer permits unloading of information in reverse order (last in, first out). This feature is the reason for the reversability of the magnetic switch.

Flexible Link

By serving as a flexible link between the computer and the tape, this buffer has greatly increased the efficiency and speed of the computer. The computer unloads a block of words at high speed and then continues with its arithmetic operations instead of having to wait for the tape to catch up. A similar bottleneck exists again in the transfer of data from the tape to a high speed printer. In this case, another type of "BA" buffer with a different configuration serves as a second flexible data link.

This core buffer memory is the model 720-BA-7M which accepts data in the form of seven-bit characters from the magnetic tape and makes them available to the gas memory of a UNIVAC high speed printer in the form of blockettes (120 characters). The unit is so completely integrated with the system that it is entirely under external control and has no operating controls of its own except a margin switch for its power supply. Its capacity is exactly one UNIVAC block of 720 seven-bit characters, and its relatively slow operating speed of 40 KC per character is likewise geared to the system requirements. Besides transmitting data in suitable form, this unit also checks input information for parity errors and "all-ones" errors.

"Corner-Turner" Buffers

A different approach to the problem of buffering the flow of data to a high speed line printer is represented by the series of so-called "corner-turner" buffers which have been developed for use in conjunction with the Anelex, Shepard, and National Cash Register type high speed line printers.

Corner-Turner buffers are series-to-parallel storage units which serve the printer as an assembly stage for the up to 120 characters of a line it prints in one revolution of its print drum. The name is derived from the corner-turning effect of loading data serially and unloading it in parallel. The memory of such a buffer is the wheel image representation of the print drum: each storage cell corresponds to one specific type face. Thus this type of buffer stores markers rather than binary characters; this produces considerable savings in components and circuitry, especially since most of the required decoding is being performed externally.

Since this buffer requires random addressability, an "end-fire" method for energizing the matrix lines is used instead of magnetic switches. Here, too, refined design techniques made it possible to perform both loading and unloading with just one set of drivers. This is done in this case by threading each core with two Y-lines instead of one. Each is looped so that it will pass load current through one row of cores and unload current through the other. Selection of one or the other of the two rows is made by means of an array of AND gates.

A final type of buffer worth mentioning is the 144 BQ series. Its storage capacity of 144 four-(or eight-) bit characters is roughly equivalent to the total information contained on one (or two) IBM punched cards. Despite this limited capacity, however, the buffer offers a very high degree of flexibility since it has the same feature of mutually independent load and unload drive as the larger, general purpose buffers and is thus capable of interlacing load and unload operations. The unit is compact, relatively inexpensive, has its own power supply, and appears ideally suited for a large number of what might be called EDP "branch" operations.

An example of this is the Kinecard Converter system manufactured for the U.S. Air Force and commercial users by Collins Radio Corporation of Cedar Rapids, Iowa, and Burbank, California. The Kinecard Converter is used in conjunction with the IBM 523 card reader/punch in EDP applications involving inventory control and others. It transmits or reproduces IBM punched cards at the rate of 100 cards per minute. The buffer is used in the receiving section of the system. It stores data received over telephone lines and makes it available to the card punch at its own rate of speed.

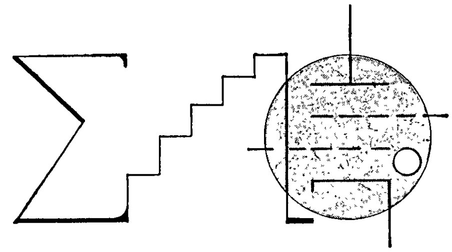
The applications described are just a few where buffering improves the efficiency of electronic data processing equipment. In addition, other types of buffers for different applications have already been designed and will be on the market soon. Still others will surely be developed before long. Telemeter Magnetics, Inc., meanwhile are understandably happy about this mushrooming of demand for a product for which a market seemed uncertain as little as two years ago.

Readers' and Editor's Forum

[Continued from page 6]

horts say: "Many scientists the world over do have very special knowledge, hence a quite special responsibility to inform people (including backward power-wielders) all over the world." Essentially, you are calling for increased competition for annihilation, while they want more co-operation for survival.

For various reasons — including protection of generations of the unborn — I agree uncompromisingly with the second viewpoint, and entirely disagree with ". . . we cannot appeal to all scientists in the world . ." We most certainly can; we do. I for one certainly do hope and believe that the eventual result will be that many more scientists all over the world will refuse to work on projects that threaten the very existence of our earth as we know it. If this is not patriotism, what is?



It can be proved that depressions and present-day wars, besides being unnecessary, are preventable (and by far better means than the disease of "cold war"), and are almost unimaginably more disastrous to the very groups who encourage them than would be the conditions brought about by peaceful changes. Barring significant rise in the level of world rationality, all the exquisite, swarming devices of extermination, the elaborate hypocracies and the theories of power politics and bluff will not save humanity.

I am sorry to say that, in my opinion, it is your eyes that need to be opened, not Macdonald's and his cohorts'; I also do not believe that he is ignorantly or knowingly trying to mislead his readers. There really is a genuine difference of opinion; if only you would move forward a little, this difference could be largely resolved.

IV. From: Neil Macdonald
To: The Editor

I am glad to have an opportunity to comment on this argument. I know it is the policy of Computers and Automation to grant Mr. Johnson (and any others who wish it) an opportunity to comment, and not to suppress their views.

Mr. Johnson's position was once stated by Admiral Perry of the United States Navy at the Battle of Lake Erie, if I remember correctly my United States history, as this: "My country right or wrong — may she be always right — but my country right or wrong."

This position is no longer morally right; in fact it is morally irresponsible and wrong. It was established as wrong in 1945-46 at the trials of the major German World War II leaders before the International Tribunal at Nuremberg, Germany. There the government of the United States, associated with the governments of Great Britain, France, and the Soviet Union in the International Tribunal, wrote a new chapter of international law. This

[Please turn to page 36]

Readers' and Editor's Forum

[Continued from page 34]

tribunal recognized the crime of plotting aggressive war and crimes against humanity such as the extermination of millions of people in concentration camps. It found all of the defendants, except two, to be guilty, and sentenced them to death for their crimes.

So it is no longer true that any person in any country is relieved of his duties to the human race by saying "My country" (which usually means the men who happen to be at the time in control of the government of the country) "ordered me," or "persuaded me," or "induced me."

More and more scientists all over the world are seeing this. The old-fashioned irrational patriotism of Admiral Perry is as out of date as the bow and arrow. We need a new kind of rational, moral, patriotism as up to date as useful power from a nuclear reactor.

Whoever again participates in a crucial way in the aggressive use of weapons that exterminate millions of human beings (and "preventive war" is as fine a phrase for "aggressive war" as Hitler could have coined) will certainly be condemned as criminal by the peoples of the world. And if nuclear extermination happens on a large scale henceforth, the human species will go the way of other extinct species of life, for Nature has no use for inability to adapt to new conditions.

Computer scientists like atomic scientists and rocket power scientists are charged with a special social responsibility because they have special knowledge, special capacities, and a special relation to modern weapons of mass destruction.

CALENDAR OF COMING EVENTS

Sept. 6-12, 1959: Machine Searching and Translation Conference, Tudor Arms Hotel, Cleveland, Ohio.

Sept. 7-10, 1959: 6th Annual International Meeting, Institute of Management Sciences, Paris, France.

Sept. 9-13, 1959: International Symposium on Geodetic Computations, Polish Academy of Sciences, Krakow, Poland.

Sept. 21-25, 1959: Instrument Society of America, Annual Conference, Chicago, Ill.

Sept. 28-30, 1959: National Symposium on Telemetering, Civic Auditorium and Whitcomb Hotel, San Francisco, Calif.

Oct. 5-7, 1959: 5th National Communications Symposium, Hotel Utica, N.Y.

Oct. 12-14, 1959: International Systems Meeting, Royal York Hotel, Toronto.

Oct. 12-14, 1959: 15th National Electronics Conference, Hotel Sherman, Chicago, Ill.

Oct. 28-29, 1959: 6th Annual Computer Applications Symposium, Armour Research Foundation, Chicago, Ill..

Oct. 28-30, 1959: 2nd Annual Equipment Systems Conference and Exhibit, Conference Building, San Diego, Calif.

Nov. 4-6, 1959: National Automatic Control Conference, Sheraton Hotel, Dallas, Texas.

Nov. 11-13, 1959: 16th National Meeting, Operations Research Society of America, Huntington Sheraton Hotel, Pasadena, Calif.

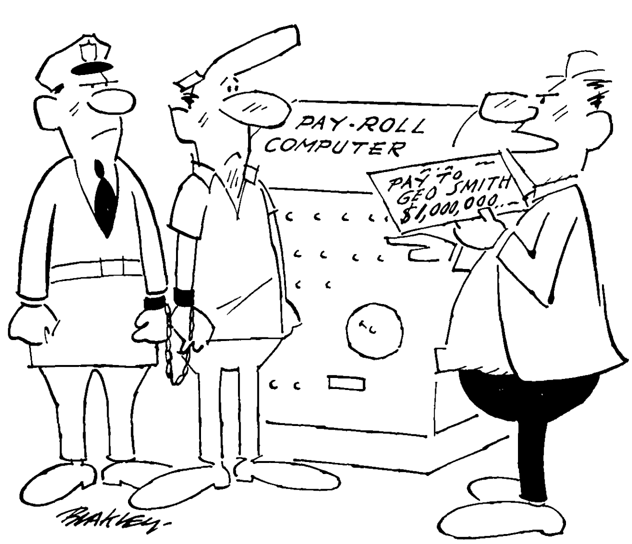
Dec. 1-2, 1959: 4th Midwest Symposium on Circuit Theory, Marquette Univ., Milwaukee, Wisc.

Dec. 1-3, 1959: Eastern Joint Computer Conference, Statler Hotel, Boston, Mass.

March 21-24, 1960: IRE National Convention, Coliseum and Waldorf Astoria Hotel, New York, N.Y.

May 2-6, 1960: Western Joint Computer Conference, San Francisco, Calif.

AUTOMATIC PAYROLL COMPUTER



Aren't you the George Smith that used to gimmick the soft drink machine?

SURVEY OF RECENT ARTICLES

Moses M. Berlin

Cambridge, Mass.

We publish here a survey of articles related to computers and data processors, and their applications and implications, occurring in certain magazines. We seek to cover at least the following magazines:

Automatic Control
Automation
Automation and Automatic Equipment News (British)
Business Week
Control Engineering
Datamation
Electronic Design
Electronics
Harvard Business Review
Industrial Research
Instruments and Control Systems
ISA Journal
Proceedings of the IRE
Management Science
The Office
Scientific American

The purpose of this type of reference information is to help anybody interested in computers find articles of particular relation to this field in these magazines.

For each article, we shall publish: the title of the article / the name of the author(s) / the magazine and issue where it appears / the publisher's name and address / two or three sentences telling what the article is about.

When Not to Use a Large Computer / Dr. E. E. Blanche, Chief Research Scientist, E. E. Blanche & Associates, Inc. / Journal of Machine Accounting, vol. 10, no. 5, May, 1959, p 15 / National Machine Accountants Assn., 208 S. Main St., Paris, Ill.

After some experience with large computers, a number of firms realize that they save neither time nor money by using them. The author first discusses major items to consider before using the computer. The article then includes a group of typical problems which were processable on smaller computers.

Crystal Balls or Magnetic Cores — The Application of Computers to Canadian Business Forecasting / W. A. Beckett, Asst. Prof. of Economics and Statistics, U. of Toronto, Toronto, Canada / Journal of Machine Accounting, vol. 10, no. 2, May, 1959, p 28 / National Machine Accountants Assn., 208 S. Main St., Paris, Ill.

The author believes computers mean more efficient and sophisticated predictions. The article describes a number of improvements in statistical theory, resulting in better computer programs for business.

Towards Electronic Banking / D. Whipp, Automation & Automatic Equipment News, vol. 4, no. 9, May, 1959, p 1144 / A. & A. E. N., 9 Gough Square, Fleet St., London, E. C. 4

It becomes increasingly apparent that British banking will become directly linked with electronic data processing. A group of five lectures point out the problems to be solved if a bank is to use a computer; many advantages are anticipated from automated banking.

Survey of Digital Computer and Calculator Users and Orders (5) / D. G. Pedder and R. Pedder / Automation and Automatic Equipment News, vol. 4, no. 9, May, 1959, p 1150 / A. & A. E. N., 9 Gough Sq., Fleet St., London, E. C. 4

A list of computers delivered or on order, showing a reduction in both departments.

Fractional Design on Medium Size Electronic Computers / R. L. McIntire, The Datics Corp., Fort Worth, Texas / Automatic Control, vol. 10, no. 5, May, 1959, p 56 / Reinhold Pub. Corp. 430 Park Ave., New York 22, N.Y.

A number of principles are stated which should compose the "perfect" design solution for petroleum fractionalization. The article includes a detailed block program of a step-by-step solution, which illustrates an application of computers to petrochemical industry problems.

Picking the Computer's Boss—A Decision of Import / D. R. Daniel, McKinsey & Co., N.Y. / Management and Business Automation, March, 1959, p 21

Contains a number of suggestions for the structure of the computer department of an organization, to ensure maximum efficiency in a firm's data processing. The author urges that the boss of the computer be a highly-placed person, to provide company-wide supervision and coordination of all work connected with the computer.

What Do Computers Think About? . . . . / E. Heine, Associate Editor, Du Pont Magazine / Journal of Machine Accounting, vol. 10, no. 4, April, 1959, p 10 / National Machine Accountants Assn., Chicago, Ill.

A description of the computer program at Du Pont, and the people who work in it.

Electronic Mortgage Accounting / R. T. Wiseman, Planning Officer, Sun Life Assurance Co., Montreal, Canada / Systems, vol. 23, no. 3, May-June, 1959, p 9 / Systems Magazine, Sperry Rand Corp., 315 Fourth Ave., New York 10, N.Y.

A single magnetic tape file replaces five separate master files; a single monthly processing cycle replaces fourteen separate machine operations a month, plus five additional operations each quarter. Thus actuarial and accounting functions are modernized with the use of a computer, and still it has not yet been fully exploited.

The Computer in Canadian Railroading: C.P.R. System-Wide Data Processing / H. C. Reid, Asst. V. P., Canadian Pacific Railway / Journal of Machine Accounting, vol. 10, no. 6, June, 1959, p 41 / Journal of Machine Accounting, 720 Kensington Rd., Arlington Heights, Ill.

The use of electronic data processing by a Canadian railway is described in this article. The system is designed as follows: the recording of initial data in mechanized form; transmission of data by wire, or otherwise, to a central processing location; using a high-speed computer to produce reports for all levels of management.

Some Studies in Machine Learning Using the Game of Checkers / A. L. Samuel / IBM Journal of Research and Development, vol. 3, no. 3, July, 1959, pp 211-229 / IBM Corp., 590 Madison Ave., New York 22, N.Y. /

Machine learning procedures are investigated, using the game of checkers. To date, from two such procedures it has been found that a computer can learn to play a better game than the programmer who "taught" the machine to play. Moreover, the principles of learning verified by the experiments are applicable to many other situations. Three appendices to the article include programming details, and sample games.

Analog-Digital Converters / Electromechanical Design, vol. 3, no. 6, June, 1959, p 65 / Electromechanical Design, 1357 Washington St., West Newton 65, Mass.

Analog-to-digital conversion devices are classified, described, and discussed, in this Components Digest No. 7. The first of two parts, the digest covers shaft-angle encoders of the brush type that generate digital output as a function of shaft position.

The Solid-State Era / A. C. Hancock / Systems, vol. 23, no. 3, May-June, 1959, p 3 / Systems Magazine, Sperry Rand Corp., 315 Fourth Ave., New York 10, N.Y.

Based on solid-state design, a number of new features in data processing systems effect economy in initial cost, maintenance, floor space, power requirements, and facilitate speed of operation. As an example, the author describes the elimination of manual and peripheral machine operations, allowing for direct feeding of tapes into a Document Printer. The design of this system is based on solid-state applications.

Census Girds for Action / M. H. Hansen, Asst. Director, Statistical Standards, Bureau of Census, Washington, D.C. / Systems, vol. 23, no. 3, May-June, 1959 p 11 / Systems Magazine, Sperry Rand Corp., 315 Fourth Ave., New York 10, N.Y.

With a number of important census activities scheduled in the next few years, including a major population census in 1960 the Bureau of the Census is preparing for the task by acquiring and working with various computers and data processing components.

Steps in Achieving Control of Material on an Electronic Computer / H. Warren White, Manager, Data Processing Planning Dept., Lockheed Aircraft Corp., Calif. / N. A. A. Bulletin, vol. 40, no. 10, June, 1959, p 51 / Nat'l. Assn. of Accountants, 505 Park Ave., New York 22, N.Y. /

What is — and what is not — practically possible in inventory control by computer. The author, writing from experience, discusses a number of basic principles involved in data processing of manufacturing data, lists some areas where money can be saved. Tables of figures and material control ledgers accompany the article, and a progress report is given at the conclusion.

Management's Right-Hand Robots / R. J. Fitzpatrick, Chairman, Accounting Dept., Bellarmine College, Louisville, Ky. / N. A. A. Bulletin, vol. 40, no. 10, June, 1959, p 25 / National Assn. of Accountants, 505 Park Ave., New York 22, N.Y. /

With philosophical overtones, the author marvels at the accomplishments of the computer, predicts greater applications in the future. The article asserts that placing the computer in its proper perspective is an initial requirement for achieving success with it. A number of current applications are discussed, also, the uses of both digital and analog computers.

Your Data Processing Organization 15 Years From Now / C. I. Keelan, Office Methods Specialist, Johns-Manville Corp., New York / The Office, vol. 49, no. 6, June, 1959, p 135 / Office Publications Inc., 232 Madison Ave., New York 16, N.Y.

The "demand" for work by electronic data processing systems will force a change in the organizational structure of companies employing computers. The author questions the desirability of such changes to suit the needs of computers which originally were designed to suit the needs of the company.

A High-Speed Analog to Digital Converter / S. D. Savitt, Res. Lab. Div., Bendix Aviation Corp., Detroit, Mich. /

IRE Transactions on Electronic Computers, vol. EC-8, no. 1, March, 1959, p 31 / IRE, Inc., 1 East 79 St., New York 21, N.Y. /

This article describes an electronic voltage encoder which converts analog voltages to corresponding parallel seven binary-digit representations. The encoder has been designed for use with a combined analog-digital computer, in real-time simulation of complex nonlinear systems. The encoders can, alternatively, provide more precise conversions or higher encoding rates.

A Non-Real-Time Simulation of SAGE Tracking and BOMARC Guidance / D. W. Ladd and E. W. Wolf, MITRE Corp., Lexington, Mass. / IRE Transactions on Electronic Computers, vol. EC-8, no. 1, March, 1959, p 31 / IRE, Inc., 1 East 79 St., New York 21, N.Y. /

Extensive modifications of the SAGE computer program are necessary, to enable computers to control a defensive weapon, such as the BOMARC missile. A program has been written for the IBM 704 to simulate the proposed employment of BOMARC in the SAGE system. This article discusses, too, a program which presents the desired output data in the form of frequency distributions, and offers detailed results pertaining to selected target or missile tracks.

Binary Multiplication in Digital Computers / A. Green, Taller and Cooper, Div. of American Electronics, Inc., Brooklyn, N.Y. / Proc. of the IRE, vol. 47, no. 6, June, 1959, p 1159 / IRE, Inc., 1 East 79 St., New York 21, N.Y.

A brief discussion of the basic arithmetical operation multiplication, as performed in binary form by the computer. Multiplying with just ones and zeroes, the machine performs the operation in the manner of an addition manner but using electronic ingenuity to multiply even more intelligently than a human being does.

Computer Control of Distillation Reflux / D. E. Lupfer and D. E. Berger, Process Dev. Div., Phillips Petroleum Co., Bartlesville, Oklahoma / ISA Journal, vol. 6, no. 6, June, 1959, p 34 / Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa.

This article discusses the use of a simple pneumatic analog computer to measure internal reflux flow and adjust external reflux flow, which are necessary in controlling temperatures. The automatic control is achieved by the computer, which also performs necessary relevant calculations.

Experiments on the Relation of the Operator to the Control Loop of an Airborne Digital Computer / C. A. Bennett / IBM Journal of Research and Development, vol. 3, no. 3, July, 1959, p 275 / IBM Corp., 590 Madison Ave., New York 22, N.Y.

In contemporary bombing and air navigational systems, tracking of missiles and other aircraft is an essential task, performed by human beings and computers. A number of experiments were performed to provide information on improving the design of digital systems, offering better checks of error in tracking. Observations were made on a simulated digital control loop. This article reports results of the studies conducted, covering relationships between recovery time and solution rate, transmission delays, hand-control sensitivity, sampling rate, and scanning rate.

A Computer Primer / F. J. Rex, Jr. / Punched Card Data Processing, vol. 1, no. 4, May-June, 1959, p 32 / Gille Associates, Inc., 956 Maccabees Bldg., Detroit 2, Mich.

This article includes a brief history of their development, with definitions and a discussion of programs, the various computer-components, the types of computers, and applicability to diverse problems. Easy to read, the article is aimed at laymen who find their business activities linked to the computer.

Automation: Challenge, Not Threat, to Office Workers / C. S. Willis / Punched Card Data Processing, vol. 1, no. 4, May-June, 1959, p 6 / Gille Associates, Inc., 956 Maccabees Bldg., Detroit 2, Mich.

The advent of the automation age, as seen by this "outsider," offers a challenge to the office worker which can bring him a brighter, more secure future. It is the individual's responsibility to explore the new horizons of automation, learning to work with the computer not against it. The article suggests a number of ways to learn about data processing.

The Anti-Social Responsibilities of Computer People / Computing News, vol. 7, no. 14, July 15, 1959, p 153-13 / C. N., 12805 64 Ave. South, Seattle 88, Wash. /

With tongues half-way in cheek, a group of frightened computer people urge that computers be kept confusing, "... mysterious. Otherwise, anybody will understand what we're doing, salaries will come down, and the public will start to muscle in on our business."

Paris in the Spring / W. F. Bauer / Computing News, Vol. 7, no. 14, July 15, 1959, p 153-3 / Computing News, 12805 64th Ave. South, Seattle 88, Wash.

This brief report on the First International Conference on Information Processing, covers the "color" of the Conference. Mentioned too are some of the notables that were present, the plans for the University of Illinois computer, and plans — tentative — for another international meeting in 1963.

Error Analysis in Floating Point Arithmetic / John W. Carr III, Univ. of North Carolina, Chapel Hill, N.C. / Commun. of the Assoc. for Computing Machinery, vol. 2, no. 5, May, 1959, p 10 / Assoc. for Computing Machinery, 2 East 63 St., New York 21, N.Y.

A great amount of programming for large and small computers makes use of floating point arithmetic. This article discusses two general systems, "normalized" and "significant," and describes error analysis methods based on procedures formerly employed in fixed-point systems.

High-Speed Readout for Data Processing / R. E. West, Res. Center, Burroughs Corp., Paoli, Pa. / Electronics, vol. 32, no. 22, May 29, 1959, p 83 / McGraw-

Hill, 330 West 42 St., New York 36, N.Y.

A high-speed teletypewriter prints: more than 3,000 words per minute, when driven by a parallel input; and 750 words per minute when receiving a Baudot teletype code. The printer is described, with a number of diagrams to illustrate encoder operations, print-head selector functions, and code transmission.

The Type 59 SATT Computer / M. H. Esperseth, Project Engineer, General Telephone Labs., Inc. / Gen. Tel. Technical Journal, vol. 6, no. 4, April, 1959, p 129 / Gen. Tel. Labs., Inc., Northlake, Ill.

The Strowger Automatic Toll Ticketing system computes charges on telephone calls, by considering three basic factors: distance between calls; length of conversation in minutes; and specific day and time of day of the call. The SATT produces a punched tape which can be used in one of a number of ways, including automatically converting the tape into printed tickets. The article is accompanied by a schematic diagram, which helps to explain how the system works.

Machines Can Automatically Type Most Data on Forms / I. Eisen, Systems Mgr., and P. Mastroni, Systems Analyst, Burndy Corp., Norwalk, Conn. / The Office, vol. 50, no. 1, July, 1959, p 98 / Office Publications, Inc., 232 Madison Ave., New York 16, N.Y.

An automatic data-processing order-writing system enables a company which designs and manufactures electrical connectors, to deliver the same day or the next day. The automatic system, using pre-punched cards and punched tape, prepares shipping orders, provides for subsequent data processing of stock records, sales analysis, invoices, back-order control and accounts receivable. This article describes in detail the operation of the system.

"Speed" and the LGP-30 / Datamation, vol. 5, no. 3, May-June, 1959, p 38 / Datamation, 141 East 44 St., New York 17, N.Y.

An explanation, with two examples, of the "Speed" system used in programming for the smaller computer. Designed for personnel which may not be especially trained in computer techniques, the coding system employs the elementary rules of algebra, eliminating consideration of scaling techniques.

News of Communist Computer Technology / E. Guerin / Datamation, vol. 5, no. 3, May-June, 1959, p 37 / Datamation, 141 East 44 St., New York 17, N.Y.

A single page of descriptive information on a matrix-type electrointegrator — called an "Oil Pool Analyzer" — used to predict the future behaviour of oil fields. The underlying principle of the machine is that the mathematical expression of laws governing the movement of oil in subterranean deposits coincides with the mathematical expression of the laws governing the passage of electric current through conducting plates.

BOOKS and OTHER PUBLICATIONS

Moses M. Berlin
Cambridge, Mass.

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

McCormick, E. M. / Digital Computer Primer / McGraw Hill, 330 West 42 St., New York 36, N.Y. / 1959, printed, 214 pp $7.50 /

This book presents the fundamentals of modern digital computers and is an easy introduction to computing. With illustrations and a comprehensive general bibliography, the author, head of the Data Assessment Div., U. S. Naval Ordnance Lab., Corona, Calif., has combined a review of basic information with chapters on most phases of the computer — input-output, storage, elementary coding, etc. in an appendix. The author discusses representation of logical operations by means of Boolean algebra.

McCarthy, J. / Recursive Functions of Symbolic Expressions and their Computation by Machine — The LISP Programming System / reprint, Quarterly Progress Report No. 53, Research Laboratory of Electronics, M.I.T. / 1959, offset, 30 pp, cost ?

A report of work done with the List Processor (LISP) system, by members of the Artificial Intelligence Group, at the MIT Computation Center. Twenty useful subroutines have been programmed, translated into SAP, checked out on the IBM 704. Studies are being conducted on the use of LISP in engineering problems, but the system was used mainly in the study of recursive functions, and the description of this application constitutes the major part of the report. A number of operations are described, and the language of LISP is discussed.

George, F. H. / Automation, Cybernetics, and Society / Philosophical Library, Inc., 15 East 40 St., New York 16, N.Y. / 1959, printed, 283 pp, ?

In the present age, Dr. George feels that in one way or another the lives of all human beings are affected by automation. This book is an explanation for laymen as well as scientists of cybernetics, and its application as automation. He treats automation as part of the process of scientific evolution. In that sense, then, it isn't as new a system as it appears to be. Society, however, must decide which of the endless possibilities of automation it wishes to exploit. In the final chapter, the philosopher-author discusses the future with optimism — after warning that automation, used unwisely, can destroy this world.

Williams, Samuel B. / Digital Computing Systems / McGraw-Hill, 330 West 42 St., New York 36, N.Y. / 1959, printed, 231 pp, $7.75

This book is especially written for readers who are familiar with electrical circuits and apparatus, but who have little knowledge of mathematics or computers. It gives a broad, technical introduction to the design, construction, and operation of digital computing systems. The author reviews the elements contained in digital computers, and discusses and illustrates the principles of devices used. Each chapter has a brief summary of its major points and also usually an extensive bibliography. The final three chapters cover engineering design, programming, and applications. The author is one of the pioneers in the computing machinery field, and spent more than 40 years on the technical staff of Bell Telephone Laboratories.

Experiment with Automatically Legible Transfer Forms / Netherlands Postal and Telecommunications Services, publication no. 3, May, 1959 / Netherlands P. and T. Services, 12 Kortenaerkade, The Hague, Netherlands / printed, 1959, 42 pp, cost?

Contains a description of a new input technique in which the public enters on checks numbers once as figures and a second time in certain positions in a grid; this makes it possible to automatically read data produced by the public. The first experiment having been a success, a second and larger experiment is under way by the Netherlands Postal Cheque and Clearing Service. The purpose of this report is to inform computer people of the work being done, in the hope that international cooperation will lead to progress in this phase of computer input.

ADVERTISING INDEX

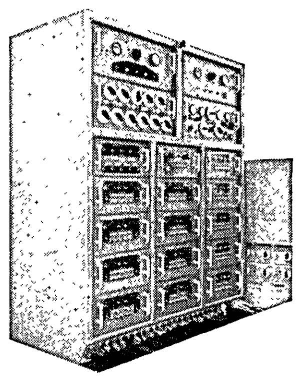
Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

Here's how General Electric solves typical DC power-supply problems

for computers and special applications

PROBLEM

"We need to devote our engineering time to designing our electronic circuitry . . . not the power components."



SOLUTION

This is a frequent problem facing computer manufacturers. General Electric's Rectifier Department has complete engineering and manufacturing capability not only to design and apply all types of power supplies, but also to incorporate power supplies into completely integrated systems.

These systems could include load distribution, supply sequencing, protection for power supply and load, and complete power distribution. Let General Electric tackle your DC power problems such as those associated with load IR drop, "cross talk," and other nuisance-type problems plaguing your engineers.

PROBLEM

"It's always a problem making sure transistorized equipment is safe from its power supply."

SOLUTION

To alleviate this problem, General Electric has developed several methods of making transistorized equipment safer in this respect. With G-E protective circuits, shorting a plus high-voltage bus to a plus or minus low-voltage bus would not cause the low-voltage bus to exceed a small percentage of nominal rated value.

General Electric power supplies protect completely transistorized pieces of equipment from large losses due to over-voltage failures.

PROBLEM

"My power supply requirements fluctuate so much . . . big jobs, little jobs, all in between."

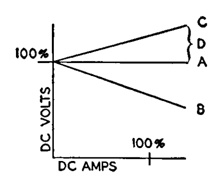
SOLUTION

G.E. has built individual power supplies and complete systems ranging from less than one watt up to 35,000 kilowatts. These power supplies span the complete range of DC power—regulated and unregulated—applying all types of components. G-E experience includes completely transistorized supplies, and supplies with the new controlled rectifier, magnetic amplifiers, voltage stabilizing transformers, and motor-alternator "brute force" systems.

PROBLEM

"We have a real low-voltage power distribution problem with our computer."

SOLUTION



Low-voltage distribution problems can be handled easily through load compensation. Curve "A" is net desired no-load to full-load regulation at load point. "B" is regulation at load without remote sensing or load compensation. "C" represents IR compensation in power supply itself. "D" is amount of IR or load compensation.

NO MATTER WHAT your computer and other special power-supply problems are, General Electric can help you economize—economize by helping you free your engineers of these problems. For more information on power-supply products and services, contact your nearest General Electric Apparatus Sales Office or write to Section F 535-2, General Electric Company, Schenectady, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

10 Mc "flip-flop" circuit utilizing either a pair of RCA-2N1300 or RCA-2N1301 Mesa Transistors.

RCA-2N1300 and 2N1301

LOW-COST MESA COMPUTER TRANSISTORS

Now in quantity production . . . and available!

RCA-2N1300 and 2N1301 Germanium P-N-P Mesa Transistors offer these 10 major benefits to designers of switching circuits. And they're ready for you now!

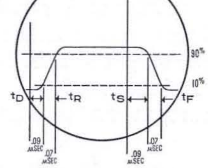
- rugged Mesa structure—permits extremely small base width to insure top performance at high frequencies
- fast switching times with low values of base input current—made possible by high frequency response and low total stored charge
- high current gain—permits high fan-out ratios (number of paralleled similar circuits per driver-stage output)
- high breakdown voltage and punch-through voltage ratings—the result of the diffusion process
- high power dissipation—150 milliwatts at 25°C—aids in the design of reliable circuits
- high current ratings—improve overall system speed
- rugged overall design—units have unusual capabilities to withstand severe drop tests and electrical overloads
- electrical uniformity—a result of the diffused-junction process used by RCA in the manufacture of Mesa Transistors
- especially well suited for use at pulse repetition rates up to 20 Mc
- exceptionally well suited to applications in saturation-type switching circuits

Information on RCA-2N1300 and 2N1301 Low-Cost Mesa Transistors is available from your RCA Field Representative. For technical data, write RCA Commercial Engineering, Section I-90-NN, Somerville, N.J.

RCA TYPE	Maximum Ratings▲ Absolute-Maximum Values						Characteristics: Common-Emitter Circuit, Base Input Ambient Temperature of 25° C		
	Collector-to-Base Volts	Emitter-to-Base Volts	Collector Milli-amperes	Transistor Dissipation—mw			Minimum DC Current Gain		Gain Bandwidth Product● Mc
				at 25°C	at 55°C	at 71°C	at collector ma= −10	at collector ma= −40	
2N1300	−13	−1	−100	150	75	35	30	—	40
2N1301	−13	−4	−100	150	75	35	30	40	60

▲Maximum collector-to-emitter voltage rating= −12 volts

● For collector ma= −10 and collector-to-emitter volts= −3.



Oscilloscope wave form shows typical delay, rise, storage, and fall times achieved with 10-ma inverter circuit utilizing the RCA-2N1301 MESA TRANSISTOR.

RCA Field Offices

EAST: 744 Broad St., Newark 2, N.J. HUmboldt 5-3900

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