SHARE Information Available to Nonmembers

Dear Editor:

Not long ago several leading members of the ACM stated quite positively to me that programs, decks, listings, etc. which are distributed by the SHARE Distribution Agency to members of SHARE are not available to nonmembers. In the interests of better communication between organizations and people, I wish to bring to the attention of all interested parties the following section from the SHARE Reference Manual (p. 2.01–19, dated 6/6/62: Article X-B SHARE Policy Concerning Distribution to Non-Members:

> SHARE wishes the information contributed by its members for distribution through the SHARE Distribution Agency to be made as accessible as is practicable to any one in the computing field who has a legitimate interest in the information. To this effect, the membership confers on the SHARE Distribution Agency the right to distribute to non-members any of the material that the members contribute for formal SHARE distribution.

I hope this will clear the air somewhat and help make more available some of the excellent algorithms available through SHARE. The address of the SHARE Distribution Agency is: Mr. Donald C. Cashman, DP Program Information Department, I.B.M. Corporation, 112 East Post Road, White Plains, N.Y.

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Printer Plotting Not New

Dear Editor:

This letter refers to the article "Programmed Methods for Printer Graphical Output" by David Garfinkel in the September issue of the *Communications*. Although the notion of printer plotting has received little publicity, it is by no means new. In November of 1955, Mr. Robert J. Hunn and I, then with DuPont, described a UNIVAC I program for preparing contour diagrams with the high speed printer, plotting values computed from second degree polynomials in four variables. We designed this program specifically for certain statistical application, and subsequent to its completion it saw considerable use. The presentation was made at the UNIVAC Systems Programmers' Conference held in New York and was reported in the June, 1957 issue of *The Programmer*, a publication unhappily now defunct.

At the same time we were bold enough to extend the concept to a broader class of plotting applications and included a set of subroutines in the GP Compiler library for UNIVAC I. These routines regarded the printer as a strip-chart recorder, admitted a variety of choices of superimposed grids and scale factors, and could be used either to plot already tabulated data or to plot values as they were computed. Mr. Leslie Shaw, then with Remington Rand, prepared these programs.

More recently Mr. Michael Lesk and I have exploited these programs with the object of a graphical presentation of certain statistics on the occurrence of nouns in text, for purposes of the automatic identification of document content. We did this latter work at Harvard under Air Force contract AF19(604)-8509, Project No. 5632; it is described in a forthcoming report on a series of information retrieval studies.

EDWARD F. STORM
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Page Turning in Multiprogrammed Computers

Dear Editor:

The article "A Heuristic for Page Turning in a Multiple Programmed Computer" by John W. Weil, which appeared in the September issue of the *Communications* described a digital algorithm to be used in determining "when a new page must be brought into a full main store, which page, currently in main store, must be displaced in order to make room for a new arrival." Although the proposed method has several novel and worthwhile ideas, it still requires the use of a master program to update the figures of merit and the times. Further, it requires that all pages in the primary store (in the case of ATLAS this is 32) be accessed when a page is to be returned to secondary store so that the page which has the lowest figure of merit can be determined.

At an AIEE Workshop[1] during the summer of 1961 and again at the AIEE Winter General Meeting in January 1962, we presented a paper[2] which made reference to an analog system which could be used to solve this problem. The context in which the analog devices were used did not coincide exactly with the page turning problem (the differences are indicated in the paper) but the inference appeared quite clear, that the system was applicable to the solution of this problem.

As mentioned in the paper, condensers, one associated with each page, could easily be charged each time a word in a page in main store was accessed (or each time a page was turned) and then be allowed to decay between accesses (or turnings). An automatic method of detection would then be used to determine, *without any master control program whatever*, which page should be returned to memory. Using several condensers per page with different criteria for charging and decaying, schemes could be devised which would choose the page to be returned, in a quite sophisticated way.

Such a system might use one condenser which was associated with word access activity and a second associated with page turning activity. The former might decay with time, the latter might be caused to discharge a percentage of its potential each time a page was displaced. Determination of which page should be displaced could then be accomplished by some combination of the values of the two condensers. Consideration of page turning activity as well as word access activity appears superior to considering either alone. The problem of a new program entering use for the first time being turned in and out several times unnecessarily should thereby be eliminated. Such a scheme is practical here because no program time is consumed in activating or testing the condensers.

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[1] AIEE Workshop on Kilomegacycle Computers, Carmel, Calif.

[2] "Considerations in the design of a computer with high logic-to-memory speed ratio," Proc. Sessions on Gigacycle Computing Systems, S-136 AIEE.

Measurement accuracies on analog devices are, of course, not quite what they would be if digital algorithms were used. It has been our contention that the inaccuracies which might result from the use of the analog devices, viz., that the page least likely to be required would be replaced, would have little effect on the total running time of the programs. We presume that the editors agree with this contention when they say in the footnote on page 481, "Exponentials would hardly need to be evaluated with great accuracy for this purpose."

In summary then, it appears that a low-cost, simple method for solving the page turning problem is available. What needs to be done is to find the correct analog algorithm which will *best* solve the problem.

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A Missing Factor in Medical Case History?

Dear Editor:

In the article on the coding of medical case history for computer analysis [*Comm. ACM 15*, October 1962], there is no apparent provision for the encoding of the sex of the patient.

Are we to assume from this that with the advent of computers into medical science the ultimate has been reached, and that sex has been abolished. Such a move would have serious repercussions on the field of computing. No longer could we speak of machines as being big (or little) brothers of one another; rather we would have to call them siblings, and worse yet a machine that behaved in an erratic or unexpected way could no longer be compared to a woman. *Sic transit gloria.*

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Accuracy and Precision With a Character-Addressable Machine

Dear Editor:

Recently you published a letter from Fred Gruenberger [*Comm. ACM 5*, 4 (Apr. 1962), 221] on the subject of computations with high precision on a character-addressable machine (IBM 1620).

There is still another, and I think more important, possibility in computations with this kind of machine, namely, the determination of the reliability of results and the realization of a given precision by estimating rounding-errors. In digital computing on a large scale, and especially in technical calculations, roundoff of the intermediate results is almost always necessary. The effect of rounding-errors on the ultimate results has been studied for many years. (See for example: (1) Henrici, P., "Theoretical and Experimental Studies on the Accumulation of Errors in the Numerical Solution of Initial Value Problems for Systems of Ordinary Differential Equations"; (2) Wilkinson, J. H., "Rounding-errors in Algebraic Processes"; (3) Blanc, Ch., "Sur l'Estimation des Erreurs d'Arrondi"; all in *Information Processing UNESCO*, Paris, 1959.)

With the introduction of electronic computers, the importance of these investigations is greater than ever. In the theoretical approach to the determination of these errors one usually starts by assuming them to be always equal to their largest possible value. But a probabilistic approach is preferable since this yields results of greater applicability. This probabilistic approach contains a number of initial assumptions whose validity can be proved only by experience. Once this validity has been established, the result of the investigation concerning rounding-errors can be applied to allow an evaluation of the digital methods themselves.

Despite the difficulties in the theoretical approach, there is a very simple method of determining the accuracy of results and of achieving a required precision with a character-addressable machine. For example, on the IBM 1620 (the basic model with no built-in floating point) we compute first with a floating-point subroutine set with rounding, and a second time with a floating-point subroutine set without rounding. By comparison we can easily decide on the reliability and accuracy of the results, since the last identical digit is correct with a 90% probability. If this precision is not sufficient, we reassemble the program with a greater length of the mantissa and repeat the calculation until we get the required precision.

This method is not only very fast but also simple and reliable, and therefore very useful for practical computations.

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Thank You

To the ACM Membership:

In reply to those who have written regarding the duplication of content in two recent articles in the ACM publications, the Editors wish to express appreciation for the interest and concern shown and to say that steps are being taken to coordinate the contents of the *Journal* and the *Communications*.

C. C. GOTLIEB
For the Editors

Machine Graphing

Dear Editor:

In an article entitled "Programmed Methods for Printer Graphical Output" in the September, 1962 (Volume 5, Number 9) issue of the *Communications of the ACM*, David Garfinkel makes the observation that "Virtually nothing on this subject has been published. . . ."

In self defense, I would like to call Mr. Garfinkel's attention, and that of any others who may be interested, to an article of mine in the August, 1960 (Volume 72, Number 3) issue of the *Journal of the American Society of Naval Engineers*. The article, entitled "A Technique for Digital to Graphic Analog Data Transformation", gives a fairly thorough presentation of a generalized technique for machine graphing and illustrates the approach with an application believed to be somewhat novel in the field.

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