Preface

The Algorithms department of *Communications of the ACM* (CACM) was established in February 1960, with J. H. Wegstein as editor, for the purpose of publishing algorithms, consisting of procedures and programs, in the ALGOL language. In 1975 the publication of ACM algorithms material was transferred to *ACM Transactions on Mathematical Software* (TOMS). A wide variety of algorithms has been published and many of them have been used heavily—either in original form or as translated into other languages. Recognizing the general acceptance of the algorithm material published in CACM and TOMS, the Association for Computing Machinery (ACM) has collected and reprinted the algorithms to make them more readily accessible and more serviceable to a larger group of users.

The collection contains all algorithms published in the Algorithms department of CACM and in TOMS. Covering a great variety of subjects, these algorithms include many for standard computational tasks, such as evaluation of special functions, solution of systems of linear equations, estimation of definite integrals, and sorting of data. Most of them are written in Algol or ANSI Fortran.

For convenient reference, the "Revised Report on the Algorithmic Language Algol 60" is reprinted here from the January 1963 issue of CACM. In addition, a more informal description of Algol by B. Higman is reprinted from the April 1963 issue of *The Computer Journal*. The Association for Computing Machinery expresses its gratitude to the British Computer Society and to Mr. Higman for permission to reprint this copyrighted material. Alternative expositions of Algol have been given by Schwarz [6], Bottenbruch [3], McCracken [5], and Baumann, Feliciano, Bauer and Samelson [2].

Also, "History and Summary of Fortran Standardization Development for the ASA" by W. P. Heising, and "Fortran vs. Basic Fortran," "Clarification of Fortran Standards—Initial Progress," and "Clarification of Fortran Standards—Second Report," all printed in CACM are reprinted here.

A cumulative index to algorithms published since 1960 is provided. In addition to algorithms published in CACM and TOMS, the index lists many which appeared elsewhere. The classification scheme is a modified form of the SHARE classification. The early indexes were prepared by G. E. Forsythe (Algorithms department editor in 1964) and J. M. Varah, and succeeding editors have annually issued updated versions.

Algorithms 1–220 were originally published as received—without any refereeing whatever. Many of these have since been certified and/or corrected by their authors or by other contributors. Beginning with Algorithm 221, in March 1964, all algorithms have been refereed independently. For many, Certifications have appeared, and modifications to some have been proposed in Remarks. In this volume, Certifications and Remarks for a given algorithm are collected with the algorithm.

Since 1964 an effort has been made to choose for publication those of the refereed algorithms that are interesting and of good quality and, at the same time, likely to be useful to others. Probably few of these algorithms would satisfy all the criteria for excellence proposed by G. E. Forsythe [4]. However, it is hoped that many will be useful and will help to disseminate good methods of solution for many problems. Some of the earlier algorithms which were not refereed are very good too, but those having Certifications and/or corrections (included in Remarks) are more likely to be valuable. It is hoped that users of those without Certifications or Remarks will contribute their experiences to TOMS so that all may benefit from them. Algorithms 1–50 have been reprinted with revisions and corrections by Ageev, Alik and Galis in Russia [1].

For general information, the present Algorithms Policy Statement of TOMS is provided. The final paragraph is of particular importance: "Submittal of an algorithm for consideration for publication in TOMS implies that unrestricted use of the algorithm within a computer is permissible. General permission to republish, but not for profit, the algorithm is granted provided that ACM's copyright notice is given and reference is made to this publication, its date of issue,

and to the fact that reprinting privileges were granted by permission of the Association for Computing Machinery."

As new Algorithms, Certifications, Remarks, and Surveys appear in TOMS, they are reissued quarterly to Collected Algorithms subscribers, in loose-leaf form, so that their collections may be kept up to date.

Beginning with Algorithm 493, algorithms are available in machine readable form—tapes or cards—from ACM Algorithms Distribution Service, c/o IMSL, Sixth Floor, GNB Building, 7500 Bellaire Boulevard, Houston, TX 77063.

To facilitate the updating and to make this volume convenient to use, an understanding of the page numbering scheme for the algorithms is helpful. The page designation is in a three-part format: the left part is the algorithm number; the middle part is the page number within the algorithm (the first page of each algorithm is P1); and the right part is the number of the revision of that page. All sheets in the original, or first, insertion of an algorithm have "0" for the right part. The first revision of a page will have a page number having the left and middle parts identical with those on the page to be replaced, but the right part will be "R1" instead of "0." The second revision of the same page would read R2, and so on. For example, 123-P2-R1 would mean the first revision of page 2 of Algorithm 123. Revised pages for an algorithm, or additional pages if required, are provided when Certifications or Remarks are added.

The Introduction that appeared in Collected Algorithms at its inception was written by John G. Herriot, department editor at that time. As present Algorithms Editor of TOMS, I have prepared this revision to include current information.

Lloyd D. Fosdick
Algorithms Editor
ACM Transactions on Mathematical Software
Department of Computer Science
University of Colorado
Boulder, Colorado 80302

December 1975

REFERENCES

1. Ageev, M. A., Alik, V. P., Galis, R. M. Algoritmy 1–50. Akad. Nauk SSSR, Vychislitelnyi Centr, Obschie voprosy programmirovaniya, vypusk 2.
2. Baumann, R., Feliciano, M., Bauer, F. L., and Samelson, K. *Introduction to ALGOL.* Prentice-Hall, Engelwood Cliffs, N.J., 1964.
3. Bottenbruch, H. Structure and use of ALGOL 60. *J. ACM 9* (Apr. 1962), 161–221.
4. Forsythe, G. E. Algorithms for scientific computation. *Comm. ACM 9* (Apr. 1966), 255–256.
5. McCracken, D. D. *A Guide to ALGOL Programming.* Wiley, New York, 1962.
6. Schwarz, H. R. An Introduction to ALGOL. *Comm. ACM 5* (Feb. 1962), 82–95.