12 [9].—HORST G. ZIMMER, *Computational Problems, Methods, and Results in Algebraic Number Theory*, Lecture Notes in Math., No. 262, Springer-Verlag, Berlin, Heidelberg, New York, 1972, 103 pp., 25 cm. Price D.M. 16,—.

This is an excellent survey of problems, methods of computation, and tabular matter in the general area of algebraic number theory. There are 12 chapters, headed: Finite Fields, Factorization of Polynomials, Galois Groups, Continued Fractions, Field Extensions, Modules and Orders, Products of Linear Forms, Units in Algebraic Number Fields, Class Numbers of Algebraic Number Fields, Class Groups and Class Fields of Algebraic Number Fields, Diophantine Equations, and the Hasse Principle for Cubic Surfaces. Each chapter contains a concise theoretical discussion of the relevant subject matter, a description of the main computational algorithms required, a statement of the significant problems in the area, and a wealth of information on tabular material and results obtained by computation. There is an extensive bibliography containing 408 items, some of which are manuscripts yet unpublished. Although no claim to completeness is made by the author (indeed, the subject matter grows too fast to allow any such claim) the material presented is comprehensive, important, and arranged in an attractive and easily assimilated manner. The author has performed a valuable service to the mathematical community in producing this compilation, and it should retain its interest for a long time to come.

MORRIS NEWMAN

National Bureau of Standards
Washington, D. C. 20234

13 [12].—JONATHAN L. GROSS & WALTER S. BRAINERD, *Fundamental Programming Concepts*, Harper & Row, Publishers, New York, 1972, x + 304 pp., 24 cm. Price $8.95.

This book is intended for use as a text in an introductory computer programming course, probably for those outside the field of computer science. It uses the BASIC programming language. About the first fifth of the book is concerned with teaching BASIC itself, and the remainder is concerned with various applications.

The most appealing aspect of this text is the wide range of interesting examples that the authors have chosen. There are chapters devoted to information processing, character manipulation, simple numerical methods, simulation using Monte Carlo methods, solution of puzzles, and artificial intelligence. Each of these chapters contains sample programs for several different problems, as well as a good collection of exercises. The variety and imaginativeness of these problems is illustrated by the chapter on simulation, which contains the following programs: simulation of pollution level in a lake; results of two different betting policies at roulette; waiting times for tellers at a bank; political polling; and a search problem in archaeology. Typical programs for these problems consist of about 25 BASIC statements, which should indicate how difficult these problems are.

The book is rather fast-paced, and I suspect that the typical student in a

programming course for non-majors would find it difficult. The explanation of BASIC, in particular, has very little redundancy in it, and would not be suitable for self-study. At the same time, the range of topics covered, the lack of depth of the programming section, and the choice of BASIC as a language would make this book unsuitable for computer science majors.

I noticed that one of the sample programs includes the use of a computed GO TO statement, though this statement is never described in the book. This creates the suspicion that there are other such difficulties. There is a chapter at the end on machine language, compilers, and similar topics. This chapter seems rather badly written and hard to follow; the explanation of compilers and operating systems is so abbreviated as to be virtually worthless.

This book would be appropriate for a class of interested students and an instructor inclined to provide a great deal of extra explanation. For a less interested class (for instance, a required course) or for an instructor who wanted to use a text more intensively, I would not recommend the book.

PAUL ABRAHAMS

Courant Institute of Mathematics Sciences
New York University
251 Mercer Street
New York, New York 10012

14 [12].—RALPH E. GRISWOLD, *The Macro Implementation of SNOBOL4*, W. H. Freeman and Co., San Francisco, Calif., 1972, xii + 310 pp., 26 cm. Price $14.95.

A case study of machine-independent software development.

SNOBOL is a computer programming language designed for the manipulation of symbolic, as contrasted to numeric, data, and character strings in particular. It is by far the best and most popular language of its type, and has been implemented on many different machines. SNOBOL originated in 1963, and SNOBOL4 is the present version of it. For a long time there has been interest in the approach used in implementing SNOBOL4, and this book explicates that approach.

As the author points out, there is a scarcity of books describing implementations of programming languages in depth. This book is a fine example of how such a description ought to be written down. It is a hazardous subject, for a writer can easily be bogged down in the details without elucidating the larger themes; or, conversely, a writer may avoid the details only to have the reader forever asking, "How did he *really* do it?" Implementations have a way of becoming less and less coherent as they become encrusted with extensions, and as the implementors seek to compensate for early faults of judgment. Thus the object being described is far more complex and less rational than one would like it to be.

This book is both clear and well-organized, and contains a variety of material. The coherence of the presentation is remarkable; the logical development of concepts and techniques is worthy of a mathematics text. The book is divided into four parts: the SNOBOL4 language, the organization of the system, the language in which the implementation was done, and an overview of the results. The most interesting and challenging section is the one on the system organization; the section on the implemen-