Part I. However, the subject-matter is less elementary and although Part II is suitable for postgraduate study it cannot be recommended for less sophisticated students. This is not meant to imply that others will get nothing out of Part II: there is a background of historical and other details for the reader to enjoy. (The author's comments on the foundations of geometry are especially interesting.) Part III is not mathematical, but mathematicians with an interest in philosophy will certainly find it stimulating. The Appendix and Bibliography are useful sources of information and references.

R. M. DICKER

MACON, NATHANIEL, *Numerical Analysis* (Wiley, New York and London, 1963), xiv+161 pp., £2.

This book opens with the definition: " Numerical analysis, by general definition, is the branch of mathematics concerned with developing and evaluating techniques of employing computers to solve problems." One cannot accept this definition without reservation. Many problems on computers do not involve numerical analysis, while sound numerical analysis brings many others within convenient range of desk calculation. Accordingly, though much must be left out of " a textbook for a one-semester first course in numerical analysis ", this reviewer cannot accept that an account which nowhere uses or refers to finite difference methods is a suitable introduction to the subject.

Within the terms of reference of the opening definition the coverage of the subject is reasonable for a first course, though very heavily coloured by this avoidance of finite difference methods. For example, quadrature methods are confined to trapezium and Simpson rules and Gaussian methods. The latter, though excellent for automatic computation, are hopelessly impracticable for hand work on those occasions when the former rules gives insufficient precision without an absurdly large number of ordinates. Similar remarks could be made in many other places. Curiously, the opposite failing is present in the chapter on characteristic values and vectors of a matrix, where the only method discussed, iteration by repeated multiplication of an arbitrary vector by the given matrix, is one which is satisfactory on matrices within range of desk calculation, but only when used with a degree of intelligence difficult to simulate on a machine.

In short, the author's attempt to pave a royal road to high-speed automatic computation is unsuccessful, leaving a large gap between what can be done by the untrained arithmetician and what should be done on an automatic computer, and this is inevitable for there is no such road.

JOHN LEECH

COCHRAN, W. G., *Sampling Techniques* (John Wiley & Sons, 2nd edition, 1963), ix+413 pp., 72s.

The second edition of this excellent book shows a number of changes from the first edition. A glance at the table of contents shows that not only has the book been brought up to date, but many sections have been added or rewritten. In the earlier chapters one notes the introduction of estimates and comparisons between means and proportions for sub-populations or domains of study. The chapter dealing with stratified sampling has been sub-divided. The first part consists of standard theory and the second part contains not only the more specialised sections of the first edition but also new major topics such as the construction and choice of the number of strata, optimum sample sizes in strata under given precision conditions and two-way stratification for small samples. In Chapter 10, which is concerned with two stage sampling, Professor Cochran has omitted the elementary theory based on an infinite population of units each of which contains an infinite number of elements and by the use of two general results by Durbin has presented the general theory in a very clear and concise manner. Chapter 11 has been considerably strengthened by a more detailed discussion of the mean square error when there is more than one strata. Finally one must note the new sections of Chapter 13 with particular reference to the effectiveness of call-backs when dealing with non-response. The number of exercises, with answers, has been greatly increased and there is a full list of references covering 148 authors as against 85 in the first edition.

This book is invaluable to all statisticians and to all those interested in sample surveys.

R. A. ROBB

GOODSTEIN, R. L., *Boolean Algebra* (The Commonwealth and International Library of Science, Technology, Engineering and Liberal Studies, Vol. 6, Pergamon Press, Oxford, 1963), 140 pp., 12s. 6d.

The book begins with an excellent elementary and informal introduction to the algebra of sets. The word " class " is used rather than " set ", and the notation employed, e.g. 1 and 0 for universal set and empty set, is geared towards the later work on Boolean algebra. The proofs of properties of the operations $-$, $+$ and $\times$ provide good illustrations of the use of the basic properties of union, intersection and complementation of sets.

In Chapter II, Boolean algebra is defined after careful motivation. Four suitable properties (2·01-2·04) of union, intersection and complementation together with axioms covering equality are extracted from the many properties in Chapter I and it is shown that 2·01-2·04 and their consequences are complete with respect to their interpretation as an algebra of classes. The four axioms 2·01-2·04 are shown, by the use of suitable examples, to be independent of one another. Homomorphism and isomorphism of Boolean algebras is introduced by a consideration of the cartesian product of a Boolean algebra with itself. This may be difficult for a reader who has not already met these ideas.

A different set of axioms for Boolean algebra, based only on intersection and complementation, is given at the beginning of Chapter III and a detailed proof is given that this set is equivalent to that of Chapter II. The chapter contains also the derivation of the general solutions of several Boolean equations.

In Chapter IV a model for Boolean algebra in terms of sentence logic is given, and it is proved in detail that the axioms used (together with the rules of inference) are complete with respect to the truth tables. The independence of the axioms and the Deduction theorem for sentence logic are established.

In the final chapter lattices are introduced and it is shown that a complemented distributive lattice is a Boolean algebra, and conversely. The important representation theorem for a finite Boolean algebra in terms of the atoms of the algebra and Stone's theorem on infinite Boolean algebras are proved.

Each chapter contains a carefully selected group of examples and there are fifteen pages of solutions to these at the end of the book.

The printing and layout are excellent and only a few printer's errors were noticed, the most serious of these being in axiom 4·24 on page 78 (where $r \rightarrow q$ appears in place of $r \vee q$) and in the important statement on page 89 (probable for provable).

The only other minor criticism that might be made is in the use of reference numbers; it would probably have been better not to have dropped the chapter number in many of the back references.

J. HUNTER