continuity; following that compactness and product spaces are discussed. There is then a chapter on Metric Spaces, which were first introduced earlier in the book. Function spaces, nets and convergence and continuous curves are also treated; the last sections lead up to a proof of the Hahn-Mazurkiewicz Theorem. Thus the book covers some worth-while topics, without doing too much. I would recommend it enthusiastically to any beginner.

E. M. PATTERSON

MILNOR, J., *Lectures on the h-Cobordism Theorem*, Notes by L. Siebenmann and J. Sondow (Princeton Mathematical Notes, Oxford University Press), 18s.

In 1962 Stephen Smale (On the structure of manifolds, *Amer. J. Math.* **84**, 387-389) proved that if $W$ is a compact smooth manifold with two simply connected boundary components $V$ and $V'$ of dimensions greater than 4, both of which are deformation retracts of $W$, then $W$ is diffeomorphic to $V \times [0, 1]$ and $V$ is diffeomorphic to $V'$. In these preliminary informal notes of a Princeton seminar on differential topology, a proof of this theorem is presented. The original methods of Smale are circumvented and an argument is given which is inspired by recent ideas of Marston Morse. Thus the use of handlebodies in the manner of Smale is avoided completely and the proof proceeds by constructing a Morse function for $W$ which is successively simplified by alteration and elimination of its critical points until no such points are left, and $W$ is in consequence seen to be a product cobordism between $V$ and $V'$, as required.

W. H. COCKCROFT

MUMFORD, D., *Geometric Invariant Theory* (Ergebnisse der Mathematik und ihrer Grenzgebiete. Band 34. Springer-Verlag, Berlin).

The main purpose of this book is to investigate two invariant-theoretic problems in algebraic geometry. In classical terminology (which the author nowhere uses) the first is: if an algebraic variety $V$ is acted on by an algebraic group $G$, when does a decomposition variety $V/G$ exist? The second investigates what the author calls moduli; classically, the Riemann surfaces with a given genus are specified, conformally, by a number of parameters (moduli) and the ultimate generalisation (suitably interpreted!) appears as: when can a set of algebraic varieties be turned " naturally " into an algebraic variety? This is soon restricted to specific cases and related to the first problem, i.e. the desired variety becomes a decomposition space.

The book is written throughout in the language of schemes and, owing to the generality and relative inaccessibility of the background material, the book is made to serve as " an exposition of a whole topic ". A number of years has now passed since Grothendieck first began to develop his theory of pre-schemes. The full—and only—version of this work has never been completed, although several volumes have appeared and the author here succeeds in giving a readable and condensed account of much of Grothendieck's work. Nevertheless, the readership of the book will necessarily be small owing to the peculiarities of the expository section itself (that this is probably intentional appears from the specialised bibliography): from the onset the reader is assumed to be familiar with pre-schemes (surely, a small additional chapter could have dealt with this) and there is much reference to unpublished material.

However, the book is well written, and the fast flow of concepts should convince any die-hard geometer of the value of schemes.

P. H. H. FANTHAM

MATES, B., *Elementary Logic* (Oxford University Press), 42s.

This book sets out to cover the basic notions of logic in a way which is both rigorous and comprehensible to the beginner. After a couple of introductory chapters dealing with the fundamental ideas the author sets up a formalised predicate calculus and goes on to deal with the problem of translating ordinary sentences into a formal logical language. The difficulties inherent in this process are not minimised and the author makes clear some of the pitfalls involved. A natural deduction system for the predicate calculus is then set up followed by a section dealing with a number of metatheorems. An axiomatic treatment of logic is also given followed by a number of examples of formal theories. A final chapter is included on the history of logic.

The section on sets would have benefited from the inclusion of a brief description of Venn diagrams and how they can be used to illustrate the properties of sets. Another point where greater clarity could have been achieved is in the section on truth tables. Examples of truth tables are given for fairly complex sentences, but the truth tables for the basic sentential connectives are not explicitly given. One place where the author takes up a contentious position is in describing criticisms of the " tertium-non-datur " as foolish.

However, the overall impression the book makes is favourable. It is well supplied with illustrative examples and should make a useful introduction for newcomers to the subject. M. PARTIS

SHCHIGOLEV, B. M., *Mathematical Analysis of Observations* (Iliffe, London, 1965), xvi+350 pp., 63s.

In many branches of science it is becoming necessary to find mathematical laws which govern physical phenomena. These laws may be suggested by direct experimental measurements or may be based on theoretical considerations and later tested experimentally. It is therefore essential that scientists should have a clear understanding of all aspects of correct evaluation of experimental data. This book, written by a leading Russian mathematician and physicist and well translated, usefully collects together several relevant topics in numerical analysis and statistics which are often found scattered in different books.

The first part deals with errors due to limited sensitivity of measuring instruments and rounding-off. The ideas of exact error, limiting absolute error, limiting relative error and the estimation of error are developed. The compounding of errors in the fundamental arithmetic operations of addition, subtraction, multiplication and division of components subject to independent errors is examined. This section is completed by a discussion of the errors in functions of one or more variables subject to error; illustrative examples of the simpler elementary functions of one variable are included.

There follows a comprehensive treatment of interpolation which covers the general ideas of polynomial interpolation with reference to tables with constant and with varying intervals. Most of the standard formulae are developed and their accuracy and relative merits are examined.

The interpretation of most experimental results depends on mathematical statistics. The third section of the book discusses probability and its axioms and the properties of discrete and continuous random variables. Properties and applications of the binomial, the Poisson and the normal distributions are described. Various limit theorems and inequalities, which among other things emphasise the extent of agreement between theoretical probability and relative frequency in repeated trials and the fundamental role of the normal distribution are introduced. A final chapter is devoted to theoretical joint distributions of two random variables including the concepts of correlation and regression, and the general ideas are illustrated by detailed treatment of the bivariate normal distribution.

The fourth part of the book deals with the best estimation of an unknown parameter or parameters from observational data subject to experimental error by the method of least squares. Both the single parameter problem and the problem of simultaneous estimation of several parameters are discussed for equally weighted and unequally