REVIEWS

Statistics: An Intermediate Text-Book. By N. L. JOHNSON, M.Sc., Ph.D., A.I.A.,
and H. TETLEY, M.A., F.I.A.

[Vol. I, pp. xii+294. Cambridge: Published for the Institute of Actuaries and the
Faculty of Actuaries at the University Press, 1949. 20s.]

SIR GEORGE MADDEX said recently that actuaries might safely be described as
scientific financiers, and that there was a certain dualism in the outlook of the
Institute, which had to maintain a balance between science and business, mathe-
matics and statistics, and investment and administration. The occasion of the
revision of the Institute's examination system has been taken to provide a new
text-book on Statistics, at the intermediate level, thereby going much further
than has been customary in dealing with probability as part of the necessary
mathematics for actuaries. The text-book has been planned in two volumes,
designed to read continuously, but only the first has so far appeared. It may be
said at once that a long-felt need has been satisfied. There is probably no one
existing text-book on statistics that would have satisfied the Institute's require-
ment by itself, and this addition to the series of Institute text-books is to be
warmly welcomed. Others, too, besides actuaries, will be interested in the
presentation of the subject-matter, since there is much demand at the present
time for the essentials of statistical methods to be available to a wide class of
student.

Text-books on statistics are usually of two kinds: (*a*) descriptive of statistical
methods, together with the formulae of the various tests and with worked-out
examples, but leaving out the mathematics, and (*b*) treatises on mathematical
statistics where the emphasis is on the somewhat formidable mathematical proofs
required for the elaboration of the required tests. Actuaries are reputed as
a class to be fond of mathematics, and to be unwilling to accept results without
proofs. A book of class (*a*) would not, therefore, be satisfactory. The difficulty
about one in class (*b*) is that it would scarcely qualify for the description 'inter-
mediate' if it proceeded to the full mathematical level which would be necessary.
With the work under review the difficulty has at least been postponed by con-
fining attention in Vol. I, broadly, to descriptive statistics and some fundamental
probability together with simple statistical tests, these latter being of the sort
usually described as large-sample tests based upon an assumed Gaussian dis-
tribution of the estimated quantities, such as mean and standard deviation. We
are promised a 'more exact', or small-sample, theory in Vol. II. There are,
however, two points. It has been decided to introduce fundamental ideas,
involving statistical hypotheses, at the Vol. I stage. This makes the ideas more
difficult to grasp by the student who is beginning the study, but it is at least a
refreshing variation on the usual 'spoon-feeding', and a method well worth
trying. The other point is perhaps a little more debatable. In view of this
method of approach, the large-sample tests seem to be just as difficult, com-
putationally, as the small-sample tests will prove subsequently to be, even
although only the Gaussian law, and a single probability-integral table, is used;
the main change later will be to substitute a different table for the more exact
test. Since a small-sample test is valid in the limit for large samples, while the

converse is not true, the authors are perhaps asking the student to adopt in all a rather formidable array of tests, when, in the long run, about half this number only will be needed. The division into two volumes, together with the postponement of the more advanced mathematics, has, however, made this inevitable.

There are chapters on the essential features of statistical data and on descriptive statistics, carrying the student up to correlation and linear regression. A chapter on the problem of statistical inference leads up to three on probability, in which the concept of the random variable is introduced and some important distributions are derived. Then comes the chapter on statistical hypotheses, followed by a classified series of the simple practical tests, for example, for means and standard deviations, and for the differences of these quantities when two samples are compared. Similar tests for correlation and linear regression are evidently postponed to the later volume. Appendices deal with grouping corrections, with Stirling's approximation to the factorial function, with the normal curve as an approximation to the binomial probabilities, and finally a table is given of the ordinate and area of the normal curve. There are exercises at the end of each chapter, the answers, together with notes on the solutions, being given at the end.

It is not possible to give a final judgment on the book as a whole until the second volume has appeared. But what we have before us is a sound production, attractively arranged, and printed in the excellent standard that we have come to expect from the Cambridge University Press. At first sight it seems surprising that the χ^2 distribution is not mentioned, in view of its many elementary uses, but evidently the mathematics involved is considered appropriate to Vol. II rather than Vol. I. A book for actuaries could appropriately have introduced factorial moments in the study of the simple discontinuous distributions, even if it were thought that cumulants were out of place. There are a number of slips which should be easily detected by the reader, but no errors of substance have been noticed.

J. WISHART

Numerical Calculus. By W. E. MILNE.

[Pp. x + 393. Princeton University Press, Princeton, New Jersey, 1949. £1. 12s.]

THE development of electronic and mechanical methods of computing which has taken place in recent years has tended to divert attention from the ever-growing requirements for small-scale computation. However, the high-speed machines can do no more than they are instructed, and the field of numerical analysis must still be explored by individual labours, and the publication of a new book on computing methods is thus of special interest.

Prof. Milne has produced a refreshing approach to a subject long studied by actuaries, and the book can be recommended to those whose interests lie in this field. It does not pretend to be a self-contained treatise on all aspects of computing, and the author, who is Professor of Mathematics at Oregon State College, indicates in the preface that in the selection of topics personal interest rather than objective logic has probably influenced the choice. Nevertheless, from the point of view of the student who is learning to interpret analysis in numerical terms, or the scientist who has to handle numerical data, the book is

valuable throughout and imposes a minimum of demand on mathematical equipment.

The book is mainly written for the computer with a machine, and care has been taken with the worked examples to emphasize practical points so that the maximum benefit may be obtained from the methods available. We thus find that Lagrange's method of interpolation, which has risen in popularity in recent years, particularly in the United States, receives prominent attention. With the recent publication of extensive tables of Lagrange coefficients this formula has become of considerable practical convenience for interpolation in tables for which no differences are available, particularly when an automatic calculating machine is available.

The first chapter deals with the solution of simultaneous linear equations by determinants and by elimination. For reasons well known the method of elimination is normally the practical method, and a very tidy solution is developed involving a minimum of recorded figures. This latter point is important because the time taken to record figures in a badly planned computation may easily represent a large proportion of the total time taken for a practical problem. The chapter concludes with a valuable section on errors arising from the nature of the data, called 'inherent errors'.

Since only a small proportion of equations arising from practical problems permit of analytical solutions, resort must be had in practice to iterative or · successive approximation methods. These are dealt with in Chapter 2, and the illustrative examples well set out the various practical difficulties likely to be met. The chapter includes sections on the evaluation of complex roots of algebraic equations and on the calculation of latent roots of determinantal equations.

Polynomial interpolation is developed in Chapter 3 after an introduction by way of interpolating functions. Aitken's and Neville's methods and Lagrange's formula are developed, and there is a useful section on the error term.

From the interpolating polynomial defined in Chapter 3, and in particular from Lagrange's formula, a considerable number of formulae for numerical differentiation, including the error terms, are developed in Chapter 4. Approximate integration formulae are introduced by integrating the Lagrange formula and then developed by the method of undetermined coefficients. This leads naturally to the trapezoidal rule, Simpson's rule and the Newton-Cotes closed and open formulae. A considerable number of formulae are given both in the text and as examples, practically all of which are given in W. G. Bickley's two papers in the *Mathematical Gazette*, Vol. XXIII, 1939, pp. 352–9 and Vol. XXV, 1941, pp. 19–27, to which no reference is made in this book. It is interesting to notice that the Euler-Maclaurin formula is not given, although Gregory's modification is.

Chapter 5 is a short one of fourteen pages on the numerical solution of differential equations and provides a very condensed treatment of the basic problems involved. Success in practice in this field depends to a large extent on the nature of the equation being solved, and emphasis is properly given in the short space allowed to the type of difficulty likely to be met rather than to the development of the various special techniques available.

Finite difference formulae are developed in Chapter 6 which deals with factorial polynomials, Newton, Gauss, Everett and Bessel formulae, subtabulation and related topics. A short table of Stirling's numbers of the first

kind is given on p. 146, in which the final entry has one too many noughts. Chapters 7 and 8 deal with divided and reciprocal differences respectively. The latter technique is used when the approximating function is a rational fraction and is thus of considerable practical value for interpolation near points where the function becomes infinite. More emphasis on the practical aspects of divided and reciprocal difference formulae would have been useful, as the illustrative examples do not bring out the need for retaining adequate significant figures in calculation.

Least squares methods have long been used when dealing with functions subject to experimental errors, and Chapters 9 and 10 deal with various aspects of these methods of approximation. Chapter 9 deals with polynomial approximation and thus contains a development of Legendre orthogonal polynomials, the use of which materially shortens the computation. This chapter also includes a short section on graduation, various smoothing formulae being developed by assuming that successive groups of terms may be represented by a polynomial of a certain degree. The resulting formulae are in the form of expanded summation graduation formulae, and no reference is made to the formulae of the Spencer type developed by actuaries. In the space allotted the treatment of graduation is, of course, superficial. Chapter 9 concludes with a short section on the Gauss method of approximate integration, deferred to follow the development of the orthogonal polynomials. No reference is made to other formulae of this group such as Tchebycheff's.

Chapter 10 deals with a number of problems, of which trigonometrical approximation, harmonic analysis and the Gram-Charlier approximation may be mentioned. The latter involves the use of the Hermite polynomials which are suitably developed, although it may be noted that many authors prefer to introduce the factor $(-)^n$ in the definition of $H_n(x)$. There is a misprint in the table on p. 316 where, for $\phi_0(3\cdot24)$, $\cdot0210$ should read $\cdot0021$.

The final chapter provides a useful introduction to the numerical solution of difference equations.

The topics covered by the book are thus seen to be a fair sample of the problems likely to arise in practice. As a text-book it suffers from an almost complete absence in the text of references to sources or more detailed development, although a bibliography is given in an appendix which includes most of the standard works.

As the author remarks in the preface 'mathematical elegance and rigor have frequently been sacrificed in favour of a purely naive treatment', and thus the purist will remain unsatisfied, but from the point of view of practical computing the book serves a valuable purpose. There is, however, one rather loose statement on p. 96 which is disconcerting in a book on computation. In discussing the error involved in a calculation of $\frac{d}{dx}\sin x$ the author remarks 'the error of our result above is actually greater than this, due probably to neglect of digits beyond the sixth in the value of y'. The anomalous result should have justified a further calculation, and had this been done it would have been found that the calculated error term was actually one-tenth of that shown, that there was a misprint in the calculation, and that the result was shown to more significant figures than was justified by the data. Furthermore, the calculation to additional decimal places would have shown that the actual error was definitely due to the limited number of significant figures and the rather untidy statement would have been avoided.

The book concludes with a number of tables as follows:

Table I. Binomial coefficients

$$\binom{n}{k} \qquad\qquad n = \text{1 (1) 20}, \quad k = \text{0 (1)} \, n.$$

Table II. Interpolation coefficients for Newton's binomial interpolation formula

$$\binom{s}{2}, \binom{s}{3}, \binom{s}{4} \quad \text{and} \quad \binom{s}{5} \qquad\qquad s = \cdot00 \, (\cdot01) \, 1\cdot00, \, \text{5 dec.}$$

Table III. Everett's interpolation coefficients

$$\binom{s+1}{3} \quad \text{and} \quad \binom{s+2}{5} \qquad\qquad s = \cdot00 \, (\cdot01) \, 1\cdot00, \, \text{5 dec.}$$

Table IV. Lagrange's coefficients for five equally spaced points

$$\cdot00 \, (\cdot01) \, \cdot50, \, \text{6 dec.}$$

Table V. Legendre's polynomials (interval $0 \leqslant x \leqslant 1$)

$$P_1(x), \, P_2(x), \, P_3(x), \, P_4(x) \text{ and } P_5(x) \qquad x = \cdot00 \, (\cdot01) \, 1\cdot00, \, \text{5 dec.}$$

Table VI. Orthogonal polynomials for $n+1$ points

$$n = \text{5 (1) 20.}$$

Table VII. Integral of binomial coefficients

$$\int_0^s \binom{t}{k} \, dt \qquad\qquad k = \text{0 (1) 9}, \quad s = -\text{1 (1) 8.}$$

Table VIII. Gamma and digamma functions

$$x! \text{ and } \psi(x) \qquad\qquad x = \cdot00 \, (\cdot02) \, 1\cdot00, \, \text{5 dec.}$$

Unfortunately, these tables contain a number of errors some of which are typographical, but others have clearly arisen from careless transcription from tables to a larger number of significant figures. The following list has been compiled:

ERRORS

Table IV

s	Term	For	Read
$\cdot08$	$L_2(s)$	$\cdot006888$	$\cdot006889$
$\cdot09$	$L_1(s)$	$\cdot065267$	$\cdot065268$
$\cdot14$	$L_2(s)$	$\cdot012238$	$\cdot012239$
$\cdot25$	$L_{-2}(s)$	$\cdot017091$	$\cdot017090$
$\cdot25$	$L_0(s)$	$\cdot922952$	$\cdot922852$
$\cdot28$	$L_1(s)$	$\cdot234225$	$\cdot234250$
$\cdot32$	$L_2(s)$	$\cdot927766$	$\cdot027766$
$\cdot36$	$L_1(s)$	$\cdot315824$	$\cdot315825$
$\cdot39$	$L_{-2}(s)$	$\cdot022180$	$\cdot022183$
$\cdot39$	$L_0(s)$	$\cdot815686$	$\cdot815659$

Table V

x	Term	For	Read
·34	$P_5(x)$	·33970	·33970 −
·35	$P_3(x)$	− ·39250	− ·38250
·42	$P_5(x)$	·26498 −	·26499 −

Table VI

	Term	For	Read
$n = 9, s = 4$	$P_5(s)$	−6	+6
$n = 20, s = 1$	$P_2(s)$	135	133

Table VII

	For	Read
$k = 9, s = 3$	25/3548	25/3584
$k = 8, s = 8$	3953/14175	3956/14175

Table VIII

	Term	For	Read
$x = ·02$	$\psi(x)$	− ·54480	− ·54479

As regards Table IV the tabulated values have not been 'forced' to secure
that $\Sigma\, L_r\,(s) = 1$. The above corrections do not allow for forcing for consistency
with the remainder of the table, being taken to the nearest sixth decimal place.

The book appears to have been produced by a photographic process from
typewritten sheets, a process which is rapid but which suffers in comparison
with text set up in print. It is well stocked with examples, the value of which
would be materially enhanced were solutions to be given.

R. E. B.

A Demographic Survey of the British Colonial Empire. By Dr R. R. KUCZYNSKI.
   Issued under the auspices of the Royal Institute for International Affairs.
   Oxford University Press.

Vol. I. West Africa. [Pp. vii + 821. 1948. 75*s*.]
Vol. II. South Africa High Commission Territories, East Africa, Mauritius, Seychelles.
   [Pp. x + 983. 1949. 75*s*.]
[To be completed in four volumes.]

THE efficient collection of population statistics requires the services of ex-
perienced administrators, the guidance of demographers and the co-operation
of a people of a certain minimum standard of education. In his book *Colonial
Population* published in 1937 Kuczynski showed briefly, and the present book
demonstrates more fully, that these requirements are not wholly satisfied in the
Dependencies. Bearing in mind that it is only a hundred and fifty years since
the first census was held in this country and the imperfections of the early
enumerations, it is not surprising that colonial population records are somewhat
unsatisfactory and untrustworthy. Censuses have often been conducted by
persons without experience in this field, and the inadequacy of the data is
frequently concealed under a mass of estimates or guesses presented as facts.

By careful research it is possible to distinguish, somewhat imperfectly, the
small quantity of truth from the large volume of speculation. It is remarkable
that this labour should have awaited and attracted the attention of a foreign-born

demographer who can hardly have visited more than a few of the Dependencies or have had close contacts with their administrators, for it was only after nearly all the Survey had been completed that the author was appointed Demographic Adviser to the Colonial Office. If there was a chink of light amid all the obscurity, however, he was one of the persons best qualified to see it, by reason of his thorough researches and his skill in perceiving the weaknesses in published reports and figures.

The fact that the material has been set out fully accounts for the great length of the volumes; indeed, two more are to follow, dealing with Dependencies in America and Asia respectively. Historically, and as a reference book for those needing to use the published data, these pages are valuable, and they should also be important for the education of those who will be concerned with censuses and registrations in the Colonies in future. There are annotations to every page, and a full index and bibliography. Each volume consists of the particulars for several Dependencies set out on a consistent plan, dealing successively with census taking, total population, composition of native and non-native populations, birth and death registration, native fertility, mortality and population growth and non-native mortality. It is hardly a work for the ordinary reader, for it is unenlivened by any diagrams or summaries which would assist him to grasp the general situation. Even the tables of figures are relatively infrequent because they have had to be qualified at length by pages of comment. The omission of maps seems a pity from the point of view of any type of reader.

To those who seek to study demography on a world-wide basis the book may seem disappointing because so much of it is negative in character; but it furnishes a valuable warning against reading into the figures more than is strictly justifiable.

P. R. C.

Les Causes de Décès en Suisse étudiées à la lumière de la Démographie Actuelle et de la Démographie Potentielle. By GERALD MENTHA.

[Pp. 240. Georg et Cie S.A., Geneva, 1948. No price.]

IT has been suggested by Prof. L. Hersch that years of future lifetime should be used as a unit of demographic measurement instead of human beings. Under such a system a person would be reckoned as having a value of the expectation of life according to his age. Death-rates at separate ages would remain the same as on the present system whereby an individual is counted as one whether he is an infant or a centenarian, but when age groups are used happenings at the younger ages would be given more prominence than those at the older ages. Thus measles would appear of greater, and heart disease of less, importance as a cause of death than by the normal standards because the former brings about a larger loss of 'potential lifetime'. The aim of Mentha's book is to use Hersch's methods as well as the more customary approaches to analyse the mortality rates of Switzerland during the last thirty years.

In so far as the Swiss experience is summarized, some material is provided which should be of much interest to those concerned with the course of the death-rates in that country. Any general interest which the book may possess, however, depends on the value of the methods of presentation of mortality

statistics which are used. The author is in favour of Hersch's suggestion but he does not wholly succeed in carrying his conviction to the reader. The expectation of life is not a very satisfactory unit of measure because it relates to a life table based on current mortality rates and can be said to illustrate the potential future lifetime of a person only in an approximate manner. In comparing two communities by means of the group death-rates of each assessed in relation to its own life table the weighting systems are different, with possibly misleading results.

In giving a greater value to young lives than to old it is implied that the younger the age at which death occurs the more serious the loss. This is true from the point of view of individuals, who lose the opportunity for personal experience and enjoyment. From the national point of view the position is different. In states where child mortality is high the elimination of deaths at the young ages is liable to lead to great population pressure and thus to changes in experience in the future which may falsify the system of values represented by present expectations of life.

P. R. C.

Miscellaneous Accident Insurance. By J. B. WELSON, LL.M., F.C.I.I., Barrister-at-Law.

[Pp. xii + 227. London: Sir Isaac Pitman and Sons, Ltd., 1949. 15s.]

THIS, the fourth of the text-books issued by the Chartered Insurance Institute primarily for the guidance of its students, deals with the numerous forms of general insurance which do not fall into the main categories of fire, marine and personal accident but which are usually transacted by the accident departments of the large composite offices. They include comprehensive insurance of private dwellings, plate glass, live stock, hailstorm, contingency insurance of various kinds, and others too numerous to mention.

This varied material is comprehensively dealt with, technical terms being carefully defined, and specimen proposal and policy forms are set out. The book cannot fail to be of great value to students, and it may be commended also to those who require insurance against various business risks.

The book touches life assurance at a number of points, mostly in connexion with matters such as loss of premium on redeemable securities, missing documents, etc. There is a section on marriage and issue risks containing some statements with which an actuary may disagree. On p. 117, referring to the risk of future marriage of a person who has a living spouse, where survivorship, divorce and remarriage are involved, the author says: 'While the first risk can be actually calculated, the two latter are beyond the assessment even of an actuary.' Remarriage rates are of course well known to actuaries concerned with pension funds and social insurance. As to the chances of divorce, although no rates exist so far as is known, here is clearly a challenge to those actuaries specially interested in demography!

On the same page it is stated that the risk of future issue to a male is usually uninsurable; but it is believed that offices which specialize in reversionary transactions quite commonly quote for this risk and have standard scales of rates for ordinary cases.

E. C. E.

The Conduct of Life Assurance Examinations. By E. M. BROCKBANK.

[Pp. 171. Revised ed. H. K. Lewis, 1949. 12s. 6d.]

THIS is the second edition of a book in which Dr Brockbank sets out for the benefit of less experienced practitioners the results of a wide experience of conducting medical examinations for a large number of offices. The book is in two sections. The first section deals with the actual conduct of a medical examination and contains introductory information regarding types of assurance and the evidence contained in proposal forms, friends' reports, and medical reports on the basis of which the proposal is considered. Dr Brockbank is careful to emphasize that the medical examiner acts solely for the insurance office; he comments on the consequences of this in certain difficult cases.

The second section of the book deals with impairments which are considered with reference to various statistics as well as to Dr Brockbank's own wide experience.

Considerable emphasis is given to blood pressure and the cardio-vascular system, and these chapters will attract much attention in view of the current interest in cardio-vascular disease and the ever-present problem of the proper underwriting of proposals where the blood pressure reported is abnormal. Dr Brockbank refers to the two points at which the diastolic pressure may be taken and, although he says that the difference between the two readings is generally small, it is a pity that when quoting American and Canadian statistics he does not mention that the figure taken in America is usually the lower, whereas that taken in this country is usually the higher. It is also a pity that the statistics have not been more carefully presented on this subject as well as on others, particularly where figures are quoted in running text and not in tables. The incorporation of figures into an ordinary sentence in the text has sometimes produced an ambiguous statement.

Apart from tables for heights and weights and the corresponding ratings suggested as additions to the age, there is little in the way of definite recommendation which would assist inexperienced examiners to classify proposers according to the various grades of risk in the manner usually required by a medical report—otherwise than the mention of more or less obvious circumstances in which a life is uninsurable. Admittedly medical reports are not standard in this respect, nor would it be desirable to attempt to be precise in a matter which must depend on the examiner's clinical judgment on the facts disclosed by the examination; but it might be expected that a book of this nature would give rather more help than it seems to do in this respect.

The treatment is surprisingly uneven. In some places the information is severely technical in a way that suggests a book written for other medical practitioners; in others it is extremely elementary. A medical man could hardly profit much from the information that baldness is not necessarily an indication of premature senility, or from the reminder that the saying 'A man is as old as his arteries' is a common one. Surely, too, a doctor does not really need a description of a normal chest, nor detailed instructions for the testing of urine for albumen or sugar including a dictionary definition of the word 'glycosuria'.

Ostensibly the various subjects dealt with are well classified by being divided into chapters with sections and subsections headed by different styles of type. The system has not, however, been applied very well. It is, for example, some-

what surprising in a chapter on the abdominal organs to find the gall bladder treated as a subsection of the section dealing with the stomach, even though there is some further information in the appropriate place. This, and many other disquieting imperfections, may be due to insufficient care in revising for the second edition. For example, on p. 128 the same paragraph is repeated with minor variations in the wording, and there are many instances of similar repetitions of shorter statements. The style is frequently obscure or ambiguous, as has already been mentioned with reference to statistics, and the reader is left with an impression of regret that so interesting and important a subject has not been dealt with more carefully.

R. G. B.

Archer's Loan Repayment and Compound Interest Tables. Compiled by J. A. ARCHER, F.I.A., 9th ed. by P. G. BROWN, M.A., F.I.A. F.S.S., and W. A. FORSTER, F.I.A.

[Pp. ix + 372. Shaw and Sons, Ltd., 1949. £3. 18s.]

AMONG the numerous books of Compound Interest tables, that associated with the late J. A. Archer holds an honoured place; it is probably one of the oldest of such works still in active use, for the first edition appeared in 1886. The nature of Archer's work with the Public Works Loan Office led him to concentrate in the first instance on Loan Repayment tables, but for many years the book has catered very fully for all who need Compound Interest tables in the widest sense in connexion with their work. Since 1886 fresh editions have appeared at intervals, and in 1907 the general tables, as distinct from the Loan Repayment tables, were bound up and issued as a separate and additional volume. This experiment was not, however, repeated.

With the passage of time the book has expanded considerably both in number of tables and in detail. In the third edition it is observed that results were given to 7 places of decimals, but the functions are now tabulated to 8, and in some cases 10, places of decimals. The stages by which the tables have grown can almost be detected by the different kinds of type employed. No doubt it would be impracticable, except at prohibitive cost, to bring all the tables into line in this respect. It is in no spirit of disparagement to the adequacy of the earlier type that one is inclined to draw attention to the superiority of the more modern type.

The Editors of the present edition are P. G. Brown, M.A., F.I.A., F.S.S., and W. A. Forster, F.I.A. Both were associated with the eighth edition, the former as Joint Editor and the latter in connexion with the calculations. Forster has also taken an independent interest in the subject, and some useful tables of his were reprinted in *J.I.A.* Vol. LXV, pp. 365–401. With the element of continuity assured and the above Fellows of the Institute as Editors, actuaries are likely to feel that responsibility for the ninth edition rests in very safe hands.

Twenty to thirty pages of the present volume are devoted to reading matter and practical examples, but otherwise the space is entirely taken up by the various tables, which show only two alterations from those appearing in the eighth edition. That edition was reviewed in *J.I.A.* Vol. LXVII, pp. 94–7, where a useful synopsis of the tables was given. In referring to that synopsis it should be borne in mind that the present edition omits the House Purchase tables in so far as they relate to quarterly or monthly instalments *on account* of half-yearly payments by way of annuity. These values, it is explained, can readily

be obtained from other tables in the book. The second alteration consists in the addition of valuable tables of $i^{(m)}$ and $i/i^{(m)}$ to 10 and 8 places of decimals respectively and at rates of interest from $\frac{1}{2}$% to 8%, the intervals being the same as for the four main compound interest functions. On a point of detail, it is noted that nearly all the pages of tables have the useful feature of an example or examples by way of footnote, but this does not occur on pp. 144–50, which are all that remain of the former House Purchase tables. To that trifling extent there is a lack of consistency. In considering the wealth of detail presented by the tables as a whole it needs courage to ask for more, but there are some to whom a welcome feature would be the tabulation of the functions $(1+i)^n$, v^n, $a_{\overline{n}|}$ and $s_{\overline{n}|}$ at intervals of $\frac{1}{8}$% between 4% and 5% instead of the present $\frac{1}{4}$% interval.

Turning to the reading matter, the omissions in terms of pages are considerable and are mainly responsible for the present edition running to only 372 pages in comparison with the 480 pages of its predecessor. Two Appendices dealing with Trustee Investments and House Purchase Loans have been left out, but a more important casualty is the omission of five introductory chapters giving information for the guidance of Local Authorities and their advisers. These chapters brought together in a convenient form much material not otherwise so readily accessible, and the decision to omit them may have been a difficult one to make. But, as the Editors point out, material of this kind needs constant revision, and now that the book is of service to *all* concerned with compound interest calculations it has been thought better to leave out information having only a limited appeal.

So much for the omissions. On the other side of the account there is included for the first time a short 'Explanation of the Tables' consisting of 11 pages. After giving the actuarial symbols for the functions tabulated, this deals with the various methods of repaying a loan and explains how to value an annuity. The complications arising from frequency of payments, payments made at the beginning of a year, or after a fractional period, are also referred to and the difference between effective and nominal rates of interest is explained. This introductory feature is stated to be especially for the guidance of 'those who have had no technical training in the theory of compound interest'. The Editors have set themselves a difficult task in so short a space, and it may be doubted whether anything less than a miniature text-book would suffice to make the tables clear to many of those coming under the above definition. If, however, it be accepted that the majority likely to use the tables, other than those well versed in the subject, will have had some business training and be possessed of average intelligence, it would seem that the task for this limited (but probably adequate) objective has been well accomplished. An actuary is possibly not the best person to judge of this matter, but the view expressed has been confirmed in at least one non-actuarial quarter. This 'Explanation' may be said to give rules rather than formulae and actuarial symbols are avoided as far as possible. There are frequent examples in the course of the text, and the chapter is followed by thirty-one 'Practical Examples' reproducing many of those appearing in the eighth edition.

Two points of detail may perhaps be mentioned in regard to the 'Explanation'. First, it seems rather strange that, in giving the various actuarial symbols, the letters i, m, n and t are not defined at that stage. Secondly, the type throughout is almost uniform. Heavier type might have been useful at intervals to bring important points or rules to the special notice of readers.
A. W. E.