

REVIEWS

MacGillivray on Insurance Law. Fourth edition. By E. J. MACGILLIVRAY, B.A., LL.B., Q.C. and DENIS BROWNE, M.A.

[Pp. lxxix + sections 2283. London: Sweet and Maxwell, Ltd. £9 9s. od.]

THE publication in 1953 of the fourth edition of the well-known text-book by E. J. MacGillivray, Q.C., is an event of first importance to the world of insurance men, in which for 40 years and upwards the name MacGillivray has been a household word. Succeeding generations have turned to his text-book for help and guidance on any difficult or unusual question of insurance law.

In their Preface to the new edition the joint authors point out that, since the publication of the third edition in 1947, several new statutes have been passed affecting insurance companies, including, among others, the Companies Act, 1948, the Industrial Assurance and Friendly Societies Act, 1948, the Civil Aviation Act, 1949, the Arbitration Act, 1950, and the Intestates' Estates Act, 1952. The new edition covers the changes that have been made.

Actuaries and others engaged in life assurance will naturally find chief interest in that part of the work which treats of the Law of Life Assurance. Many of them, including the writer of this review, naturally hesitate before expressing any opinion in conflict with that of the learned authors. If, however, the writer of a review is expected to show some independence and to call attention to passages where, for some reason or another, his view differs from that expressed in the work reviewed, the authors themselves give him an opening by stating in the Preface that the decision of the House of Lords in *d'Avigdor-Goldsmid v. I.R.C.* [1953] A.C. 347 was reported while the new edition was in proof and that they would have been glad if circumstances had permitted more detailed treatment. Every reader will share the regret of the authors that such fuller treatment was not found to be possible. The difficulty which the authors encountered is, indeed, further illustrated in section 1245, where reference is made to the decision of the Court of Appeal in *In re Brassey's Deed Trusts* [1951] Ch. 979, which was, in fact, reversed in the House of Lords on the same day as the House reversed the decision of the Court of Appeal in *d'Avigdor-Goldsmid's* case.

The writer of this review is, nevertheless, sufficiently bold to mention the following points:

(a) In section 613 the authors state that in the case of companies formed under the Companies Acts, 1862 to 1948, the powers defined in the Memorandum of Association are unalterable except by leave of the Court. The authors do not there mention the new powers to make alterations by special resolution contained in the Companies' Act, 1948, section 5.

(b) In sections 1951, 1962 and 1973 the authors give the scales of conveyance stamp duty which were operative before the Finance Act, 1952, but they do not refer to the important changes made by section 73 of that statute.

It is, naturally, for the authors to determine what shall be the scope of their exposition of a subject which has no defined limits, but the reader may perhaps be disappointed to find:

(a) that they do not discuss the income-tax relief in respect of life-assurance premiums and the case law affecting it;

(b) that they do not mention or examine the proposition that, in certain circumstances, a policy effected under the Married Women's Property Act, 1882, and appropriately drafted is not aggregable to determine the rate of estate duty payable on the policy money at the death of the assured;

(c) that they do not treat of the Exchange Control Act, 1947, and its restrictions, or of the earlier confused position under various statutory rules and orders, as fully explained in *J.I.A.* 72, 119.

The authors cover, nevertheless, a wide field in great detail, and section 1046, dealing with payees mentioned in policies, provides a good example of the thorough treatment of various aspects of the law. The authors there write:

Where the policy money is made payable to a person other than the assured, his personal representatives, or assigns, the person named as payee may be—(1) a beneficiary under an express or implied declaration of trust contained in the policy, or (2) a donee of the policy money under a gift from the assured, or (3) a nominee to receive the money on behalf and to the use of the assured.

(1) A beneficiary under a trust created by the terms of the policy has no title to sue the insurers at law, but in equity he may enforce his beneficial interest as against the assured or his representative as trustee, if he has received the money, or by an action against the insurers, to which action the assured or his representative is made a party either as plaintiff or defendant. (2) A donee, being neither a party to the contract nor a beneficiary under a trust, has no legal claim either at law or in equity to the policy money, but if he receives it he is entitled to retain it for his own use and is not accountable for it to the assured or his representative. It may be an essential term, express or implied, of the contract as between insurer and assured that the insurer will pay the policy money to the payee and no other. If that be so, the assured cannot intercept or countermand the destination of the money, and the insurer cannot get a discharge otherwise than by payment to the payee. But inasmuch as the payee has no contractual right to receive the money the insurer and assured may by agreement *inter se* cancel or vary the contract of insurance and so defeat the expectation of the payee. (3) A payee who is neither a beneficiary nor a donee has no right either to claim the money or, having received it, to retain it. He must account for it to the assured or his personal representative.

There are, moreover, certain passages from which a reader of advanced or more modern outlook may derive some reassurance or encouragement when he wishes to depart from the 'ultra conservatism, ignorance and habit' mentioned by Lord Asquith of Bishopstone in his letter to *The Times* of 14 October 1953, and in particular the following.

(a) Section 1050 dealing with deferred assurances for children where the authors write 'It would be a simple matter now to draft a policy which, although not constituting the assured a trustee for the child, would be an effective gift to the child revocable only by the mutual consent of the assurance company and the assured. If the sum assured were expressed to be payable to "AB (the child) only for his sole use and benefit" that... would make a provision for the child which could only be diverted from him or her if the office in all circumstances of the case thought it right in the interests of the child to accede to the assured's request for a loan or surrender before maturity.'

(b) Section 1053 where the authors write 'A party to a contract of insurance may constitute himself a trustee for a third party of his rights under the contract, and thus confer on the third party a right to the insurance money enforceable in equity... Although the general rule is clear, it may often be difficult to determine whether a party effecting an insurance has constituted himself a trustee for the party whom he intended ultimately to benefit by it.'

In *Three Men in a Boat* Jerome K. Jerome tells the story of how, suffering from some slight ailment—hay fever he thought it was—he went to the British

Museum to read up the treatment for it, and while there, idly turning the leaves of the book, he began indolently to study diseases generally, with the result that he came away with the conviction that he was suffering from all known diseases other than housemaid's knee. He later visited his medical man who gave him the following prescription:

'1 lb. beefsteak with 1 pt. bitter beer every 6 hours.
1 ten-mile walk every morning.
1 bed at 11 sharp every night.
And don't stuff up your head with things you don't understand.'

MacGillivray on Insurance Law is not to be used to stuff up the heads of those who do not understand. It is not to be read idly or to be studied with indolence. It is not a book for the practical insurance man to read as if it were a bedside novel. He will then be spared anxious hours considering whether or not the authors are right when they say

(a) in section 1947 that certain policies effected under the Married Women's Property Act, 1882, attract a stamp duty in addition to the normal policy stamp duty and that the point may be affected by a restraint on anticipation which was in fact abolished in 1949,

(b) in section 1960 that a Life Office should obtain a special letter or letters from the Authorities at Somerset House before relying on the well-known practice under which it may regard itself as unconcerned with the stamps on documents forming a closed link in the title to a life policy,

(c) in section 1979 that an appointment of a new trustee, which operates by implied vesting declaration to vest trust property in the new trustees, strictly attracts a stamp of £1, although in practice it is stamped with ten shillings:

and so on.

The fourth edition is well bound and attractively printed and produced, the division of the text into numbered and headed sections being a feature which assists ready reference. It has a good index. The reviewer noticed only one printer's error, which he found in the footnote to section 1247, where the mention of Potter C.B. is intended to refer to Chief Baron Palles, one of whose judgments delivered 50 years ago has for so long seemed to so many (including the reviewer) to be so perfectly absurd but was, nevertheless, the basis of the official view on the taxation of life policies to estate duty under the Finance Act, 1894, s. 2(1)(d), until found incomprehensible and discarded by the House of Lords in the d'Avigdor-Goldsmid case.

MacGillivray on Insurance Law stands where it has stood for 40 years and upwards, in its proud and unassailable position as the outstanding authority on Insurance Law. It remains the one book to which all will turn for help and guidance in time of trouble.

D. H.

Torchbearer of Freedom: The Influence of Richard Price on Eighteenth-century Thought. By CARL B. CONE.

[Pp. 209. Lexington: University of Kentucky Press, 1952. \$3.75]

Thomas Young, Natural Philosopher, 1773-1829. By the late ALEXANDER WOOD, M.A., D.Sc. (Completed by Frank Oldham, M.A., B.Sc., F.Inst.P.)

[Pp. xx + 355. Cambridge University Press, 1954. 30s.]

THE actuary does not seem to make a good subject for a biography. Is it because the work for which he will be remembered is impersonal, so that his story is a history of thought, of somewhat abstract ideas, rather than of human

interest? If it is indeed so, it would explain the virtual absence of biographies of actuaries. But it is fortunate that some of the pioneers were men of astonishing versatility and claim biographical attention for their many activities, amongst which actuarial science was a comparatively small part. The subjects of the books under review are both such men, and it is interesting to contrast their personalities and the methods adopted by their biographers.

In a plaque on the Bridgend public library, Richard Price is described as 'Philosopher, Preacher, Actuary' and (in Welsh) 'Friend of Humanity'. Though his preaching continued to the end of his life, his advice was often sought and freely given as a consultant on actuarial problems and on national finance, and his advocacy of civil and religious liberty led to his international reputation as a pre-eminent leader of reform. His influence upon actuarial science was as profound as in other spheres.

By way of contrast Thomas Young was a brilliant scientist, a medical man who yet found time to master many different scientific subjects. His inscription in Westminster Abbey describes him as 'eminent in almost every department of human learning'. He first established the undulatory theory of light; he first showed how to tackle the deciphering of the hieroglyphics of the Rosetta Stone; and he had a (literally) encyclopaedic knowledge of the scientific literature of many subjects. He held an appointment to a life office as Inspector of Calculations and Physician, but this was presumably as a consultant, not a whole-time appointment, since at the same time he continued his work as Superintendent of the *Nautical Almanac* and Secretary of the Board of Longitude. He made a number of contributions to actuarial science, but his actuarial work seems to have suffered an undeserved neglect and his influence on actuarial science has been small.

Richard Price has had two previous biographers. His nephew, William Morgan, in 1815, published a sketch of his uncle which remained for a long time the only substantial account of him; and in 1924 a full and accurate biography was published by Roland Thomas, M.A. (reviewed in *J.I.A.* 56, 109). Thomas hoped that his book would prepare the way for a far more exhaustive work, but though Prof. Cone has had access to a wider range of sources his book does not pretend to exhaustiveness. It has other merits which commend the work to us. Prof. Cone has produced a description of Price and his work which is readable throughout, except perhaps for the chapter on philosophy, and which succeeds in relating Price's development at each stage to the human personality that was found so lovable by his contemporaries.

Richard Price is often misunderstood. In the opinion of the reviewer it is because his ideas are usually considered apart from his very human personality. One of his main characteristics was a passion for reform, which was an integral part of his religious vocation and was no doubt coloured by the circumstances of his early life. It was a time when the drift from country to town was proceeding at a rapid pace, when the healthiness of the countryside contrasted with the luxury and debauchery, the close air and unhealthiness of the towns. Price's zeal for reform was not confined to his sermons. It expressed itself in his interest with problems of population and of national finance, in his concern for political liberty and the promotion of thrift through many kinds of social organization. Population statistics were unreliable and difficult to obtain; Price collected what he could and stubbornly maintained that they showed that the population of England was declining. In this he was wrong—but his aim was to enforce his protest against conditions of life in the towns, especially in

London, and shall we blame the reformer if the changes he helped to bring about vitiate his arguments? Price viewed with dismay the rapidly rising public debt; his advocacy of the sinking fund was an expression of his desire for a general reform of public finance so that the profligacy of governments should be curbed and sufficient taxes raised for the nation to pay its way. Price was persuaded that misgovernment was at the root of the nation's troubles; his concern for political liberty was based on the belief that political freedom would enable virtuous men to exercise a purifying influence on public life. Price was disturbed to see so many annuity and other societies started upon an insecure foundation; he laboured to make actuarial principles more widely known so that habits of thrift would be promoted and his influence led, indirectly, to the Act of 1793 for the encouragement of friendly societies.

To the actuary the chapter on 'Mathematics and life insurance' is not wholly satisfactory. For example, the British Government commenced the sale of annuities in 1808 (not 1789 as stated on p. 43); it is unfair to criticize Price for the use of one of his tables in unsuitable circumstances many years after his death. The Carlisle table was constructed by Milne from the statistics collected by John Heysham, M.D. (not the Bishop of Carlisle as stated on p. 44), and it was not used by Finlaison for government annuities—he constructed tables from the actual experience. Price's advocacy of the sinking fund (criticized on p. 140) stemmed from his desire that more of the current costs of government should be borne by his own generation, and less left to future generations. Though the annual service of a 4 % loan is higher than a 3 % loan, the raising of the additional taxes for the 4 % loan would, Price argued, be desirable because the sinking fund would operate to redeem the debt in a shorter period.

Thomas Young also has had two previous biographers. A short memoir by Hudson Gurney was published in 1831, two years after Young's death, and his scientific papers were edited by George Peacock, who produced an account of Young's life and works in 1855. The present biography is based on the papers of Dr Alexander Wood, who had been accumulating new matter about Young for some 40 years and had written two-thirds of the book at the time of his death. The biography was completed by Frank Oldham. It includes a memoir of Alexander Wood.

The manner of treatment of the biography is more scholastic than Prof. Cone's work. Perhaps the material was not available which would bring Thomas Young to life as a man. The book under review is a careful and systematic treatment of Young's ideas and the controversies in which he became involved. Members of the Institute who are interested in science will be enthralled by the descriptions of Young's scientific work. His reluctance to add his name to his scientific publications (p. 304) would surely be due to professional etiquette, as a medical man.

In one of his early medical books Young listed the important works, pamphlets and papers under the various diseases on the basis of a new nosology, or systematic classification of diseases. It would be of interest to know whether this new nosology of his had any bearing on the system used by William Morgan in his statistics of deaths analysed by causes, published eight years later.

Sixty-one of the articles of the *Encyclopaedia Britannica* (1817–25) were written by Thomas Young, including one on annuities. He devised a mathematical formula to represent d_x throughout life; he applied the doctrine of chances to the theory of risk; and he suggested various approximations to compare the effects of different mortality tables. This work was scattered

through various journals in the years 1826-28, and seems to deserve more attention from actuaries than it has received.

The reading of both books has given the reviewer much pleasure. May their publication encourage the study of the history of actuarial science!

M. E. O.

Statistical Method in Biological Assay. By D. J. FINNEY, M.A., Sc.D.

[Pp. xix + 661. London: Charles Griffin and Co. Ltd., 1952. 68s.]

It would be pointless to review this book, in this *Journal*, on the basis of its potential value to biologists or to professional statisticians working on biological problems. Rather should it be welcomed as an excellent example of the best features of modern British statistical thought—a complete acceptance of all that mathematical theory can offer combined with a clear understanding of the final purposes of the analyses described. We may cite, in particular, sections on ‘fundamental’ and ‘statistical’ validity, on ‘the objectivity of statistical analysis’, and a number of other sections concerned with the economics of various forms of analytical refinement. In places the discussion may seem tedious and trite, and occasionally ill-informed (as, for example, in the footnote on p. 396 which appears to ignore much recent work on the effects of non-normality on the *t*-distribution); but the general impression is of careful and thorough consideration of the issues involved.

This book can be read with profit by anyone with a solid grounding in elementary statistics, provided he realizes that it is a reference work of techniques applicable in a certain restricted sphere, rather than a general text-book. There are also certain initial difficulties, arising from a dismissal of the difference between confidence intervals and fiducial intervals as ‘important to the theorist’ without defining either, and the uncritical introduction of the Behrens-Fisher distribution. These circumstances being allowed for, the first three-quarters of the book provide an exposition of unrivalled thoroughness of methods of analysis for problems involving comparisons of regressions. The amount of detail may appear excessive unless it is remembered that for reference purposes an extensive array of ready-made formulae is invaluable.

Dr Finney has already, in his *Probit Analysis*, dealt with assays based on quantal (‘all-or-none’) reaction in some detail. Typical of this type of reaction is the ‘dosage-mortality’ situation wherein the reaction measured is death (1) or survival (0) of the experimental animal. The last quarter of the present book contains practically all the matter in the earlier *Probit Analysis*, revised in the light of later developments. The study of quantitative responses leads to the regression analysis to which we have already referred.

The author gives four ‘schemes of study’ suited to various classes of readers. Of these schemes (C) appears most suitable for the majority of persons likely to read this review, though the reviewer hopes they would appreciate the rather more thorough treatment of the logic of the methods, which can be found elsewhere in the book. Provided they do not expect to learn too much, despite the prolonged text to be studied, such readers will find much valuable information on the technique and mental outlook of present-day statistics.

N. L. J.

Investment of Life Insurance Funds. Edited by DAVID McCAHAN.

[Pp. xvii + 302. Philadelphia: University of Pennsylvania Press, 1953. \$3.75]

THIS book contains a series of lectures given under the auspices of the Huebner Foundation for Insurance Education at the University of Pennsylvania. The fourteen lectures were delivered by members of the staff of the Wharton School of Finance and Commerce at the University, and by executives of a number of American life offices. They are addressed primarily to college and university teachers in the social sciences who include life assurance in their courses of study.

The contributors cover various aspects of the investment of life funds in a condensed but not a superficial manner. Most of the subjects are made more interesting by historical treatment, and the book contains useful data and sources of reference. Two chapters deal with the demand for capital and the supply of saving; the next with the management of the investment portfolio; six chapters are devoted to different types of security; one to the valuation of assets; there is a chapter on the influence of government; and the last two chapters summarize the conditions in which life assurance has grown, and the changes in the investment portfolios, over the past hundred years.

It is estimated by one of the contributors that the ratio of total saving, including consumers' durable goods, to national income has remained fairly stable at around 15 % during the past 50 years, although if saving through consumers' durable goods is eliminated there is a slightly declining trend. It is also estimated that the proportion of total saving derived through life assurance has risen from 7 % before the first world war to 17 % after the second world war, although in recent years life assurance has declined relatively to some other forms of saving and, in particular, the amount saved annually through government and self-administered pension schemes now exceeds that saved through life offices.

It may be useful to recapitulate the extent to which life office investments in the United States are subject to state supervision. Insurance companies are governed by the laws of their state of domicile, but in addition several states require all companies transacting business within their borders to comply substantially with their statutes. Most states follow closely the detailed regulations prescribed by New York State. They permit investment only in certain specified fields and limit the extent to which investments may be made within these fields; for example, foreign bonds other than Canadian bonds are excluded altogether and common stocks are limited to 3 % of the total assets or one-third of the surplus. The accumulation of surplus is restricted to 10 % of reserves and other policy liabilities, and the valuation of assets is closely regulated. The rules for valuing assets have been evolved over the years by the National Association of Insurance Commissioners, and they receive some criticism in this book. At present mortgages and real property may be valued at discretion, bonds reaching certain standards set each year by the Commissioners may be carried at amortized values, other bonds must be valued at prices laid down by the Commissioners (market values where the securities are quoted), and preferred and common stocks must be carried at the market values prevailing at the end of the year. A Committee on Valuation set up by the life offices has suggested that investment risks are comparable to mortality risks and that the real protection for both sides of the business lies in spreading

the risks and holding adequate contingency reserves. The Committee has proposed valuing all bonds at amortized values and setting aside funds each year to a reserve for investment losses. Since 1951 the Commissioners, without extending the scope for amortized values, have required annual contributions to compulsory valuation reserves, but these reserves are designed primarily to absorb fluctuations in market values and only one-half of realized losses are permitted to be charged to the reserves.

From various figures mentioned in the book it has been deduced that at the end of 1951 the distribution of securities of American life offices was approximately as follows:

Mortgages	30 %
Property	3 %
U.S. Government securities	17 %
Bonds	46 %
Preferred stocks	3 %
Common stocks	1 %

It is interesting to note that, although the amount invested in equities has quadrupled in the last eight years, partly as a result of a revision of the New York State law in 1951, the proportion is no greater than 1 % of the assets.

The book enables us to glance at the conditions under which our big American brothers operate and to study some of their investment problems and the way in which they deal with them. It is noteworthy that they are sensitive about government interference and anxious lest, because of their importance in the capital market, the Federal Government may seek to regulate the direction of their investments and in particular prescribe a minimum proportion to be held in government securities.

C. J. B.

Automatic Digital Calculators. By A. D. BOOTH and K. H. V. BOOTH.

[Pp. vii + 231. London: Butterworth. 32s.]

MANY actuaries must by now be aware that modern automatic computers are very powerful tools and will want to know more about them. The subjects on which information is wanted can be briefly summarized as capability, cost and reliability. This book sets out to answer the first of these questions, and, in view of the extensive developments in recent years, it will fill a very real need.

After an introduction dealing with the history of these machines, and giving brief particulars of existing machines, the book falls naturally into two sections. In the first the problems of the design of the machine are dealt with; both the logical and the engineering aspects are considered. This part is hard going for the layman, but is not to be neglected on that score, as design problems bulk large in the economics of the subject.

This is not the place to attempt to assess this part of the book in detail, but it is important to bear in mind that the design of the machine and its capacity for the performance of work are both dependent on the electronic engineering facilities available. This part of the book forms an essential part of the whole; its usefulness could however be considerably increased by a discussion of the reliability of the various devices described.

The remainder of the book is concerned with coding and programming, with numerous examples of varying degrees of complexity. Anyone who has been able to follow Mr Michaelson's exposition in his recent paper (*J.I.A.* 79, 274)

should be able to understand these examples. It is a matter for regret, however, that they all consist of calculations of some considerable complexity performed on a limited quantity of data; an example of a simpler calculation to be performed a vast number of times on simple data would have been welcome, together with some ideas as to the modifications in the design of the machine which would be necessary.

The remarkable potentialities of these machines would perhaps have been brought out better if the types of problem chosen for illustration had been more varied. Actuaries have, however, a very good description of a method of dealing with a problem involving the handling of a mass of data in the report made in 1951 to the Society of Actuaries on New Recording Means and Computing Devices.

The authors go on to describe certain computer applications—not all numerical. These have been well chosen to illustrate the astonishing capacity of these machines and are of great interest, although here again an example from the commercial field would have been of service.

In conclusion, the authors consider the question: 'Can an automatic digital calculator be considered intelligent?' The answer to this depends of course on the meaning given to 'intelligent', and that chosen by the authors is by no means the only possible one. As the authors state, the question is essentially one for each person to answer for himself; this reviewer's opinion is that in their present or any foreseeable future form, these machines are not intelligent in any real meaning of the word—a view apparently contrary to that of the authors though it is not explicitly stated.

A number of misprints have been detected, and in the diagram on page 91 R_1 and R_2 have been interchanged, which might confuse readers.

Although, as has been stated, the book is not easy reading, actuaries interested in this subject will find it of use and interest, both as a text-book and as a work of reference.

E. J. W. D.

Practical Compound Interest. By EDWIN F. W. SUMMER, F.I.A., A.S.A.

[Pp. 176. Wellington, N.Z.: Financial Publications Ltd., 1953.]

THE author defines the scope of this book as a handbook prepared for the use of banks, local bodies, lending institutions, building societies, assurance companies, accountants, solicitors, sharebrokers and other professional men. It is specifically not a treatise and cannot be judged by the standards one would use for a text-book on the subject.

When, however, the scope of a book is limited to an elementary treatment, one inevitably finds differences of opinion as to what constitutes elementary matter and what is advanced. Thus the reviewer is of the opinion that few, if any, of those relying solely on this level of compound interest will ever find themselves constructing tables without supervision, yet many will find themselves allowing for income tax in calculating yields on redeemable stocks (in this country at least). Certainly many will find themselves using bond tables, which are not mentioned, and treating the broken period by a method which is theoretically sound yet completely at variance with the author's method.

Again, one feels that most, if not all, of the businesses mentioned would include a reasonable set of interest tables in the equipment provided for their computers and one can feel doubts as to the wisdom of devoting nearly one-

half of an elementary manual to interest tables at 43 different rates, ranging from 1 to 10 %, not to mention such tables as one of pence expressed as decimals of a pound.

The third main point of comment lies in the printing, which strikes one as unfamiliar. This is due entirely to the fact that the actuarial notation has clearly been produced, to the best of their ability, by people having considerably less experience of it than have the Institute's regular printers. No confusion can arise; but actuaries in this country will undoubtedly prefer the more familiar.

Despite these criticisms the book is, as one would expect, unexceptionable on the matters it does treat, and it is quite certain that many of those for whom it is intended have much to learn from it. As for members of this Institute, one can only suggest that some students might find it helpful to fill in the long summer evenings between passing the Preliminary Examination and starting serious work for Part 1. Not all would benefit; but for some the result might be a reduction of that early—and sometimes long—period when the problems appear insoluble, the tutors oracular and the examiners satanic. H. C. C.

Design and Analysis of Industrial Experiments. Edited by OWEN L. DAVIES, M.Sc., Ph.D.

[Pp. xiii + 636. London and Edinburgh: Oliver and Boyd (for Imperial Chemical Industries Ltd.), 1954. 63s.]

IN recent years we have witnessed the proliferation of books of what may be termed the 'Statistics for...' class. The blank may be filled in with any one of a wide range of professions, but many of these works have much, in fact too much, in common. They are, indeed, little more than thinly disguised, more or less elementary, statistical text-books, with a leavening of professional jargon and examples. The latter may help the reader to feel that he is mastering the subject, but often the treatment of statistical theory and principles is inadequate for further independent work. It is only too likely that books of this type have been responsible for a large amount of misdirected effort, entailing waste of time and money, and ultimately, perhaps, a return to the time-honoured attitude of prudent distrust of all things statistical.

The publication, in 1947, of *Statistical Methods in Research and Production* (reviewed in *J.I.A.* 74, 163) produced an outstanding exception in this class of book. Here the basic ideas of statistical theory are adequately explained, and their application to a wide variety of technical problems clearly discussed. The success which this book so well deserved has encouraged Imperial Chemical Industries to sponsor the publication of a sequel, the work now under review. This is a really ambitious project and, it would appear, is intended to constitute a standard source of reference for industrial statisticians, as well as a 'text-book' for chemists and others desirous of increasing their knowledge of the applications of statistical methods to their particular problems.

It must be emphasized that this is not a book for the beginner in statistics. Chapter 2 contains a summary of the more common basic statistical ideas and techniques, but reference is freely made to the earlier book described in the preceding paragraph. The assumption of reasonable statistical competence in the reader enables the authors to concentrate on the important task of explaining the reasons underlying the development and application of appropriate techniques to deal with various types of problems arising in industrial research.

Theoretical development is strictly related to practical requirements, and fully illustrated by application to data which, in nearly every instance, consist of observations made in the course of actual investigations.

The subject matter of the book is naturally determined by the types of problem most frequently encountered in industrial work. A large part (about one-half) of the book is concerned with standard 'design of experiments' and associated analysis of variance, from randomized blocks and Latin squares, through incomplete blocks to factorial experiments, confounding and fractional replication. The importance of the last of these forms of experimental design in industrial research is well described. A fractional replicate is a portion (usually $1/2^n$ part) of a complete factorial design, so chosen that in the resulting analysis of variance important effects (e.g. main effects and first order interactions) are represented by functions which also represent effects assumed to be negligible (usually high order interactions). Provided such assumptions are justified useful information on the effects of most interest is obtained from the expenditure of but a fraction of the effort required for the complete factorial experiment. The results of such a fractional replicate may lead to a decision to undertake a further experiment, consisting of another portion of the complete factorial design. In turn the results of this experiment may lead to the execution of further experiments, and it is possible that in time the complete design may be used. This procedure, an example of the 'sequential approach', has the advantage that wasteful expenditure can be avoided by stopping at a suitable stage.

In so far as a book of this nature can be said to have a central theme it is that the 'sequential approach' is of fundamental importance in industrial problems. It is now becoming generally realized that statistical theory will correspond more closely to the normal way in which humanity acquires knowledge if it goes beyond the treatment of fixed sets of data, more or less on their own merits, and deals with the construction of further enquiries on the basis of existing results. This constitutes the sequential approach, which includes the rapidly growing subject of sequential tests, but is of much wider scope and is likely to be a fruitful field of statistical research in the immediate future. Sequential tests are described adequately in Chapter 3, though by no means exhaustively, probably because of the rapid growth to which reference has been made. The final Chapter 11 (The Determination of Optimum Conditions) is concerned with a less rigorously restricted example of the sequential approach. The methods described have been developed largely on the initiative of one of the authors, and this is their first appearance in a book. When a paper presenting these methods was read at the Royal Statistical Society, the present reviewer found difficulty in the fact that the 'method of steepest ascent', to be used in the initial stages, leads to changes in the variables which depend on the units in which they are measured. (This can be seen clearly in Table 11.22 of the book.) It was then explained that the chemist's knowledge of the conditions of the reaction should enable him to select appropriate units. This is briefly referred to in § 11.31, but still not sufficiently emphasized.

The aim and general plan of this book are so admirable, and its usefulness so evident, that criticism is difficult. The difficulty is increased by the fact that the methods of presentation of the more well-established techniques are similar to those used by the reviewer in lectures, so that they are obviously the best, in his opinion. There are, however, a number of slips in points of detail which it may be well to indicate. A footnote on p. 60 ascribes the approximate-

ness of sequential theory to the unnecessary concept of an imaginary line crossing an acceptance boundary between integer sample sizes, whereas the inequality between the value of test criterion and acceptance value is more apt and just as simple to understand. On p. 114 it is stated that rejecting negative values given by a confidence interval for the ratio of two variance components reduces the confidence coefficient. This is incorrect, as is obvious from an elementary knowledge of the theory of confidence intervals. Incidentally confidence limits are introduced (p. 21) as equivalent to fiducial limits, which latter term is then discarded. On p. 255 the lack of interaction between two factors is said to imply that they operate *independently*, where *additively* would be a more appropriate word.

It will by now be apparent that this is not a book which should be on every actuarial bookshelf. It is, however, a book which many actuaries may find interesting, particularly in the sections describing the reasons why particular statistical techniques are developed. Intending candidates for Part IV C (3) of the Institute's examinations will find in Chapters 5-9 a valuable treatment of those parts of experimental design with which they should be familiar. Split-plot designs are absent, presumably not being of importance in industrial work. For the statistical specialist the book is practically a necessity, and it should become more valuable as the years pass if the authors persevere in their intention to keep it up to date.

N. L. J.

Population Statistics and Their Compilation. By H. H. WOLFENDEN (with an appendix by W. E. DEMING).

[Pp. xxiii + 258. Chicago: Published for the Society of Actuaries at the University of Chicago Press, 1954. \$7.50.]

THIS text-book by an actuary of international repute first appeared in 1925. The long interval of time which has elapsed and changes in the content of the book justify more than a brief notice of the new edition.

This is not an orthodox treatment of demography as the term is currently understood, and though a first reading gives rise to criticism of scant attention paid to some aspects of population statistics of importance to social administration (e.g. practical methods of population projection, the inherent difficulties of mortality analysis by cause, sickness registration or family composition) such criticism is disarmed by the concluding statement of the author that the study is concerned primarily with the methods of compiling the various types of population statistics which are of value to the actuary. The emphasis is markedly actuarial and the student is given a wide range of references to which to turn for more general discussion of analysis and interpretation of population statistics. By comparison with this text-book, however, the shorter volume *Demography* prepared by P. R. Cox for the Institute of Actuaries and the Faculty of Actuaries embraces a wider field and suggests a difference in the teaching of population statistics encouraged by the profession on the two sides of the Atlantic. Mr Wolfenden's decision to refer students elsewhere for more general reading is matched by a very copious account of such sources of information, but it does appear that on occasion the ultimate effect is the sacrifice to an account of other people's work of space which might be well used in explanation of method or in elementary treatment of fundamental concepts.

The book gives a good historical account of the development both of

registration procedures and of census enumeration. The fundamental requirements for registration are methodically treated. This aspect is indeed of vital importance since upon the satisfaction of these requirements depends the accuracy of demographic data. Errors in census statistics are exhaustively treated, and much up-to-date information is given of studies associated with recent census operations. An important facet of this problem is the skill required in the design of the census schedule and in the drafting of the questions to be answered. Associated with this is the need to carry out pilot investigations to indicate whether the questions are understood and in what manner they are interpreted by the public. More adequate treatment of this aspect could have been given in the book with advantage. The more mature student will be stimulated by the detailed discussion of errors of age in census statistics and methods for adjustment, including the problem of grouping before graduation. The discussion of population estimates follows an attractive order of development, but is rather too formal in character and tends to understate the difficulty of making intercensal population estimates in the conditions encountered in normal practice with, for example, inadequate statistics of migration.

The chapter on the construction of mortality tables from population statistics is comprehensive and provides an exhaustive account of methods of interpolation and graduation, as well as of more fundamental problems such as the separation of infant deaths in relation to births. The discussion of abridged life tables is excellent both in content and in orderly development—it is very well written and easily assimilable. The section dealing with formulae for rates of mortality proves to be a rather frightening array of symbolic expressions some of which would be more profitably treated from the point of view of the student by verbal development from first principles.

The discussion of fertility is directed mainly to social insurance purposes. The author still speaks of rates of issue and has little to say about distributions of family size. There is a certain lack of proportion for, although Mr Wolfenden claims that 'a complete treatment of the character and technical utilization of the marriage statistics derivable from population data does not fall within the scope of this study', and although he spends some time in emphasizing the defects of reproduction rates as being of limited practical use, he nevertheless devotes a long mathematical section to dealing with the reconciliation of reproduction rates for males and for females. The concept of the gross reproduction rate is alleged to be unrealistic and meaningless by virtue of its assumption that mothers are not subject to mortality, but in the numerical example given based on statistics of 1944, the ratio of the net reproduction rate to the gross reproduction rate reaches .91. In 1944, therefore, the difference between the two rates was not so large as to make the gross reproduction rate an unrealistic index, and since 1944 mortality has declined still further. The author is correctly sceptical of the value of single figure indices of fertility. It seems likely that most profitable future development will lie in the direction of generation analysis such, for example, as appeared in the Registrar General's *Statistical Review*, 1946-50, *Text, Civil*, p. 84.

Dr Deming's appendix on sampling is a valuable addition to the book. The widening statistical needs of Government make it increasingly necessary on grounds of cost to resort to sampling procedures. It is, however, not only a matter of total cost. The development of sampling theory has been such that an acceptable level of precision can be reached without covering the entire population of statistical units. Quite apart from cost, therefore, this enables so

many more questions to be asked in a shorter period of time. Dr Deming's account is lucid, especially in its important statement of the aims of modern sample design and in the concise treatment of the associated probability theory.

This book will keep its place as a valuable work of reference in actuarial libraries. If in places it seems somewhat difficult for students, we must agree with the author when he says in his preface that

hard work and concentrated thinking—both of which take time and effort—will always be essential in the handling of technical procedures which naturally demand knowledge, judgment and experience in their practical applications.

The student who is prepared to make this effort will be amply rewarded, and the more mature reader will find the book a source of stimulation to fresh thinking.

B. B.

CORRESPONDENCE

(To the Editors of the Journal of the Institute of Actuaries)

DEAR SIRS,

Review of C. W. Jordan's *Life Contingencies*

I wonder if I may ask your kind indulgence to comment briefly on one portion of the highly stimulating review by P.F.H. of the book, *Life Contingencies*, by C. Wallace Jordan, which appeared in *J.I.A.* 79, 233. On page 235 the reviewer says:

On p. 29 he says that, in a select table with a 3-year select period, l_{25} represents the survivors of the $l_{[20]}$ lives insured at age 20 and of the $l_{[22]}$ lives insured at age 22; this was the misconception that lay at the root of Sprague's famous theory of damaged lives. There is a curious lapse on pp. 118 and 119 where the rather tricky problem of equality of policy values by two different tables is investigated. In his anxiety to avoid Sprague's error of first proving that a condition is necessary and then assuming that it is sufficient, the author blindly follows Mr Thomas N. E. Greville (*T.S.A.* 3, 533) in thinking that the most convenient way to complete the proof is by induction; he apparently fails to realize that when the problem is limited to a range of ages one has only to reverse the steps in the proof by which the necessary condition has been established in order to show that the condition is sufficient.

In the same paragraph on page 29, a few sentences before the statement cited by the reviewer, Jordan says:

The select symbol $[x]$ is not used in the l_{x+3} column, since the effects of selection do not carry over into the fourth year, and l_{x+3} is therefore equally representative of the number of survivors of the $l_{[x]}$ lives insured 3 years previously, the $l_{[x-1]}$ lives insured 4 years previously, and so on. (*Italics mine.*)

The actual sentence commented on by the reviewer reads:

Note that this same value for l_{25} also represents the survivors at age 25 of the $l_{[20]}$ lives insured at age 20 and of the $l_{[22]}$ lives insured at age 22. (*Italics mine.*)

The use of the words 'number' and 'value' seems to me to make it reasonably clear that it is not being suggested that the same lives appear as survivors in the two cases—which, I am informed, is the idea underlying the misconception attributed to Sprague.

The reference to the problem of equal policy values by different tables could easily give the incorrect impression that, when the problem is limited to a range of ages, the necessary condition can be shown to be sufficient by merely reversing the steps in the proof, without resorting to any form of induction. As the reviewer points out in the very next sentence, the two conditions are not identical, since the sufficient condition requires the additional hypothesis that the relation $\ddot{a}_x = (1+k) \ddot{a}'_x$ holds for some one age in the range. I think the point the reviewer wishes to make is that it is unnecessarily repetitious to give a fresh proof of the sufficient condition, since all the steps but one can be reversed, and that one can be taken care of by merely citing the additional hypothesis that the relation just mentioned holds for the next higher or the next lower age. In this connexion, it is interesting to note that the demonstration of the sufficient condition given in the Institute's new book, *Life and Other Contingencies*, Vol. 1 (of which the reviewer is a joint author), parallels closely

Jordan's demonstration of the necessary condition. Finally, I should like to point out (since a reader of the review might assume otherwise) that my discussion to which reference is made deals with the sufficient condition only, as I considered that the necessary condition had been correctly established by Spurgeon and others.

Yours faithfully,

T. N. E. GREVILLE

Institute of Inter-American Affairs

Caixa Postal 1530

Rio de Janeiro, Brazil

2 January 1954

(To the Editors of the Journal of the Institute of Actuaries)

DEAR SIRs,

Thank you for giving me this opportunity of commenting on the letter which Mr Greville has written to you. I should also like to express my appreciation of the courtesy which Mr Greville has extended to me by sending me, in advance, a draft of his letter.

I should be very sorry to think that anything I said in my review was unjust either to Prof. Jordan or to Mr Greville. However, I still think that the wording on page 29 of the book gives the student the impression that the l_{25} individuals who survive to age 25 out of the $l_{[20]}$ lives at age 20 are identical with the l_{25} individuals who survive to age 25 out of the $l_{[22]}$ at age 22. I must admit that in my reference to the problem of equality of policy values I did not express myself very clearly; as Mr Greville points out, the necessary condition cannot be proved sufficient without some form of induction. What I should have said was that the additional proof which Prof. Jordan introduces with the words 'We proceed by induction' could have been avoided.

I should like to add that these two matters, on which Mr Greville has so nobly taken up the cudgels on Prof. Jordan's behalf, are very small ones. The general impression which I experienced on reading the book (and which I hope I conveyed by my review) was one of admiration for the painstaking thoroughness with which the author demonstrated all the proofs. However, when a reviewer sees (or thinks that he sees) small blemishes in an otherwise excellent book, it is his duty to draw attention to them. I have no doubt that *Life and Other Contingencies* contains blemishes too, and that I shall before long receive the retribution that comes to glasshouse dwellers who throw stones.

As Mr Greville has penetrated the partial anonymity conferred by my initials, I may as well sign myself,

Yours faithfully,

P. F. HOOKER

1 Bartholomew Lane
London, E.C.2

5 May 1954