

NOTES ON THE TRANSACTIONS OF THE FACULTY OF ACTUARIES

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ROSS, J. M., President. *Inaugural Address*, pp. 1-12. Considers the contribution of life assurance to national savings, and some aspects of the incidence of income tax on life assurance funds and on assurance and annuity policies.

The new Faculty Arms and Seal, pp. 13-14. A description of the new Arms recently granted, the previous design having been open to objection on heraldic grounds. A coloured reproduction of the Arms and Letters Patent is included.

ELPHINSTONE, M. D. W. *Summation and some other methods of graduation—the foundations of theory*, pp. 15-77. A general theory and comparison of methods of graduation involving linear operators of the form

$$\dots + \lambda_{-n}E^{-n} + \dots + \lambda_0 + \dots + \lambda_nE^n + \dots$$

Roughness (the converse of smoothness) and fidelity are discussed together in terms of the serial correlations of sequences of random errors and this leads to an examination of sequences by the methods of harmonic analysis. A graduation should suppress the short component waves in a sequence, and for every operator there is a 'characteristic function' which relates the ratio in which a wave is reduced to its frequency; a graph of this against the wavelength is called a 'periodogram' and this is used to study the effects of given operators. A random sequence of numbers is graduated by several different operators, most of which are shown to be unsatisfactory, but Whittaker's method, the only one based on a formal theory, effectively suppresses the short waves, as might be expected from its periodogram. Spencer's 21-term formula, which has a periodogram somewhat similar to Whittaker's, is almost alone among summation formulae in giving good results. In conclusion the author argues that graduation methods depending on operators are fundamentally sounder than curve-fitting methods, for they are based not on an arbitrary relation between successive graduated values but on an innate prejudice against short-period irregularities.

SCRIMGEOUR, D. A. B. *The use of 'Powers' cards for the calculation of repayment schedules under annuities-certain*, pp. 78-82.

Continuous Mortality Investigation: Assured lives 1944-48, pp. 83-101. The note printed in *J.I.A.* (LXXVII, 103).

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GRAY, PROFESSOR SIR ALEXANDER. *The Individual and the State*, pp. 119-44. A lecture delivered before the Faculty, on the economic philosophies of Adam Smith, traditionally the father of all Free Traders, and those of Friedrich List, the German thinker and administrator, best known by his book *The National System of Political Economy* (1841) and commonly regarded as the father of all Protectionists, whose ultimate vision, however, was of a world of universal Free Trade.

SCRIMGEOUR, D. A. B. *Widows' Funds: Some notes on theory and practice*, pp. 145-91. This paper, in addition to containing much of general application, has special reference to the problems which arise in the valuation of widows' funds of certain Scottish professional bodies, where the members are self-employed so that there can be no reliance on employers to make good any deficiencies. The author expresses, with reasons, a preference for the reversionary method of valuation as against the collective method, discusses marriage and mortality rates, in particular with regard to the suitability of the Scottish Bankers' experience 1923-43 (*T.F.A.* XIX, 149) for a collective valuation, and favours the construction of full tables rather than an attempt to adjust standard tables. The income tax position is described, and the all-important question of the rate of interest and the valuation of assets is discussed at length. Where the contributions are insufficient to support the benefits, a reserve for future entrants is necessary and this is liable to fluctuate widely if the valuation basis is changed; also when there is a surplus and it is intended to increase the benefits, a substantial part of the surplus must be retained to increase this reserve.

TURNER, N. C. *An Actuary in Commerce*, pp. 192-228. Reviews the growth of the actuarial profession in Britain and its expansion into new fields. The author describes the problems he has encountered in his capacity as statistician to a large company distributing food products through a chain of retail shops, and the methods by which these problems have been solved. While actuarial or statistical techniques are used in some cases, emphasis is laid on the value of the form of mental process inculcated by actuarial training rather than on the direct use of technique.

COOKSEY, W. J. *Nomograms*, pp. 229-61. A nomogram is a graphical method based on one or more 'scales'—straight lines or curves which are calibrated with values of a function corresponding to successive values of a variable. The theory is developed both geometrically and by means of determinants. Nomographic methods are then applied to the tabulation of paid-up amounts and surrender values based on various formulae. The method is effective and convenient where many numerical values are required and extreme accuracy is not essential.