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**BOOK REVIEW**

*The Mathematical Sciences, A Collection of Essays*, Edited by the National Research Council's Committee on Support of Research in the Mathematical Sciences, pp. 271, The M.I.T. Press, 1969, \$8.50.

by E. H. Wells

This collection of 22 essays written for persons of mathematical interests covers developments in a variety of mathematical fields, in relation to their applications to the sciences.

The essays are not written in "popular" style, but they require a minimum of advanced mathematics, well within the range of a mathematics major. Each essay starts at the foundations of its subject, and carries the reader through intermediate historical steps to modern research developments. Frequently unsolved problems and the most probable conjectures are cited. Each author is a recognized expert in the specialty under consideration.

As a sampling of the essays the following four may be of most general interest to actuaries:

1. Probability—Mark Kac (Rockefeller Univ.)

Starting with the intuitive approach of Laplace, the author traces the origin of the normal curve, which reappears often as an empirical law describing variability of population parameters. The author progresses to the relationship of probability to Brownian motion, Bertrand's paradox, Buffon's needle problem, and a number of other classical items. It is, however, only in this century that probability theory has become respectable, through a proper rigorous treatment, vindicating Laplace's insight when he wrote: "The most important questions of life, for the most part, are really only problems of probability."

2. Numerical Analysis—Philip J. Davis (Brown Univ.)

Commencing with the early determination of Archimedes that  $\pi$  has a value between 3-10/71 and 3-10/70, the author progresses through the pre-electronic techniques of Whitta-

ker and Robinson, and others, using differential and difference equations, matrices, approximation of roots, interpolation, and infinite series methods. From this background, he describes the vast growth of techniques resulting from analog computers and electronic digital computers in very recent times. The name "Numerical Analysis" is itself new, dating from about 1950.

3. Statistical Inference—Jack Kiefer (Cornell Univ.)

Inverting probability, statistical inference starts with the observed result and guesses the model. Various interesting simple examples are given, showing that the guesses are not unique. Modern developments of the subject started from Karl Pearson, at the turn of the century, through the work of R. A. Fisher and Neyman to Wald's approach (1939).

4. Prospects of Computer Science—Jack Schwartz (NYU)

The author describes many remarkable improvements in computer hardware, reducing costs, and increasing speeds. These developments have been paralleled by software break-throughs, involving source languages. There is a discussion of the computer as an artificial intelligence. The present state of comparison is represented as: brain is to computer as diamond mining is to coal mining; but additional computer progress is foreseen.

Any reader getting through these four essays, or others that he might prefer, would find it difficult to lay the book down. Could he resist temptation he would suffer the misfortune of missing reading about the Continuum hypothesis; Complex analysis in relation to elementary particles; the role of mathematics in economics, the social sciences, and the physical sciences; three essays on various facets of topology; vector spaces; and the applications of set theory and group theory—to mention a few of the remaining essays. □

**Mortality Studies**

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cause of the general impression that term insurance will give a poorer mortality. On the other hand, the practice of the individual companies may impose a stricter selection upon term insurance. The figures are given by individual companies and make interesting reading as do the tables showing variations in Mortality Ratios by Companies.

**Lapse Study**

For the first time a Lapse Study was made as a by-product of the mortality investigation. This probably explains why we have Lapse Rates by Amount which have never seemed to this reviewer to be of much value. It is to be hoped, however, that future studies will continue to provide Lapse Rates. There seems to be a definite shortage of information here.

The first year Lapse Rates were highest for conversions from Term Plans providing automatic conversion. This result might have been expected. For conversions from other forms of Term insurance, the first year Lapse Rates which were low, were in many instances about 50% higher than the second year rate. A relatively constant Lapse Rate might have been expected from this group. The Duration 1 Lapse Rates showed a wide variation by company ranging from 3.1% to 11.6%.

These results and the mortality results show how important it is for each company to keep tabs on its own experience.

**Further Studies**

There are two special studies in process: 1) mortality under individual immediate annuities and 2) mortality under policies for large amounts. The results are scheduled for publication in the 1969 Reports Number.

The Committee is preparing a pamphlet entitled "Statistical Records of Individual Policies for Mortality Studies" to serve as a guide for preparing and maintaining records for future studies. The methods suggested in this pamphlet will be of help to companies of all sizes who wish to investigate their own experience. □

**ACTUARIAL BOOKS**

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