REVIEW

Probability

by

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This book is published in the University Mathematical Texts series and the author is Senior Lecturer in Statistics at the University of St. Andrews. Readers will remember the author's lecture to the Faculty in November, 1960 on the subject of " Recurrence Relations and Generating Functions in Probability " and the book covers the subject matter of his lecture and more besides.

Chapter I deals with the formal rules of probability calculus. The author starts with the now accepted idea that the mathematical probability of an event is the theoretical equivalent of the relative frequency of occurrences of that event in a large number of trials. Going on to justify the addition axiom for mutually exclusive events, the author uses this axiom to arrive at the other mathematical method of assigning probability measure which can be used in symmetrical systems—based on equally likely events. There follows the multiplication axiom for independent events and the corresponding axioms for general events. Yet another method for solving the problem of derangements is shown with the help of the general addition theorem. Bayes' formula, used in problems involving inverse probability, and Waring's theorem, for the probability of exactly t general events, are developed.

Chapter II discusses integral-valued variates and the two most important properties of any variate, its average value and its variability, and introduces the reader to the idea of probability generating functions. The binomial and the Poisson distributions are investigated, as are chain distributions.

The next chapter goes on to continuous variates, probability density functions and gamma and normal distributions.

Most of Chapter IV is taken up with dealing with runs where the recurrence relation technique is used to solve the type of problem where a series of trials ends when there has been a specified number of consecutive successes. The chapter concludes with matching theory where the problem which can be described in terms of two (or more) packs of cards is that of finding the probability of a specified number of matches.

Chapter V deals with problems where a solution can be obtained directly from a recurrence relation without the need to introduce a generating function, and illustrates the power of this method. The author deals with the general solution of the type of linear difference equations with constant coefficients with which the student is familiar, and then proceeds to show how certain other common forms of difference equation can be solved. Several interesting examples are given, including the " gambler's ruin problem ".

The remaining three chapters deal with recurrent events, renewal processes, Markov chains and processes and queueing theory, the last being of use in dealing with such practical problems as congestion at telephone exchanges and in shops, at hospital out-patient departments, at sea and air terminals, and so on.

The book is very clearly written and the mathematics used should not be beyond the average reader, except in Chapter VII where matrix algebra is involved ; the reviewer found most difficulty in following the special notation required for the more involved problems.

Problems in probability are far less stereotyped than those in many other branches of mathematics and there is no short cut to the attainment of proficiency and confidence in working with probability —this can be achieved only through the practical experience obtained by working through many examples. The author caters for this by giving a set of exercises at the end of each chapter as well as several worked examples within the chapters. The exercises have been taken from examination questions of both the University of St. Andrews and the Faculty, as acknowledged by the author. Answers are given, but unfortunately only for the sixty exercises at the end of the first chapter.

Written as it is for university students, the scope of the book not unnaturally goes well beyond that required for the Faculty syllabus but the Faculty student will find parts of the first five chapters and the exercises of help ; the actuary who is interested in probability will find it interesting post-graduate reading.

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