

### Introduction to the Theory of Probability and Statistics

By Prof. Niels Arley and Prof. K. Rander Buch. (Applied Mathematics Series.) Pp. xi+236. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1950.) 32s. net.

THIS translation of the third edition of the Danish text can be recommended as a useful and lucid introduction to the elementary mathematical theory of probability for the theoretical physicist. For those who wish to handle experimental observations, however, it provides a less complete account; for it touches but lightly upon regression analysis, sampling, estimation theory and significance tests, and omits the analysis of variance and the design of experiments. The reader is assumed to have an elementary knowledge of calculus, while a short appendix caters for such matrix algebra as is needed in the later chapters.

The first three chapters lay out the foundations of the theory of probability and are outstanding for the perspective in which they place the subject. Chapter 4 deals with random variables and stochastic processes. Chapters 5 and 6 concern means, moments and characteristic functions. Chapter 7 discusses the normal distribution, and the  $\chi^2$ ,  $t$ - and  $F$ -distributions. Chapter 8 outlines some limit theorems, including the central limit theorem. Chapters 9 and 10 consider the practical application of the theory, especially the fitting of distributions to observations, but with only a brief discussion on estimation. Chapter 11 deals with the theory of errors, and mentions tolerance limits and fiducial limits without going into the difficulties that arise in interpreting such concepts. The twelfth and last chapter is on least-squares adjustments.

The book is well printed and misstatements and misprints are rare: page 64 wins the prize for the jolliest misprint with "piecewise continuity".

J. M. HAMMERSLEY

### Chemical Engineering Plant Design

By Dr. Frank C. Vilbrandt. (McGraw-Hill Chemical Engineering Series.) Third edition. Pp. x+608. (New York and London: McGraw-Hill Book Co., Inc., 1949.) 51s.

FOR the benefit of British readers unfamiliar with the earlier editions of this work, it should be explained that 'plant', in the United States, does not refer to single items such as heat exchangers or centrifugals for which the term 'equipment' is used, and consequently this book refers only to the design, construction and location of a complete plant for conducting specified operations. General matter is contained in chapters headed foundations, drainage, piping installation, pumps and pumping, the building, power and power transmission, all of which abound in useful information. Sixty-three pages are devoted to a very full discussion of the construction and use of flow diagrams, and forty to the development of the design. As regards equipment, designers of plant are advised very wisely to make use of standard equipment whenever possible, and a long chapter gives a comprehensive survey of most of the main types of equipment, their relative merits for different applications and their performance data.

The British nation has been frequently accused of failing to develop commercially its scientific ideas. Chemical engineers are well aware that one of the

main bottlenecks in this process is the difficulty of obtaining even approximate costs for the equipment they may require and its operation. Following an appeal for data of this type in the United States, many papers were published, and much of the information given is reproduced in the 130-page chapter on preconstruction cost estimating, which is thoroughly up to date and perhaps the best in the book. Its contents are of great value even to British chemical engineers. Is it too much to hope that something similar, with costs in Great Britain, will one day be available?

H. E. WATSON

### The Mathematical Theory of Communication

By Claude E. Shannon and Warren Weaver. Pp. v+117. (Urbana, Ill.: University of Illinois Press, 1949.) 2.50 dollars.

THE first ninety pages of this small book contain in highly concentrated form a part of the contribution which Dr. Claude E. Shannon, of the Bell Telephone Laboratory, New York, has made during the past few years to the theory of communication. The remaining pages are devoted to a descriptive treatment of the subject by Dr. Warren Weaver, and most readers will find it advantageous, if not necessary, to give this section prior attention.

In brief, Dr. Shannon establishes a means of measuring the information content of messages and discusses how the statistical structure of language may be changed so as to increase the information content per symbol. He then deals systematically with the encoding process by which messages are changed into suitable signals for electrical transmission, with assessment of the capacity of a channel for transmitting these signals and with the effect of noise on this capacity.

The book is written from the point of view of the electrical communication engineer; but, as revealed in a recent symposium on information theory (see *Nature*, January 6, p. 20), its contents have a much wider significance and are likely to exercise an important influence on work in several other branches of science. Few will find it easy to read, but many should make the attempt.

W. J.

### Smithsonian Institution

United States National Museum. Bulletin 50: The Birds of North and Middle America. By Herbert Friedmann. Part 11. Pp. xiii+793. (Washington, D.C.: Government Printing Office, 1950.) 4 dollars.

THIS Part of Smithsonian Institution Bulletin No. 50 deals with the birds of prey, many of which are not easy to identify on account of the different stages of plumage they pass through before becoming fully adult. A golden eagle, for example, does not assume the adult plumage until it is from four to four and a half years old; sparrow-hawks, buzzards and others take about half that time. A few, however, moult straight from the juvenile plumage to that of the adult. In addition, certain species vary much in colour, and in some kinds of buzzard there is a pale, a dark, and a rufous phase of plumage. All this adds to the difficulties of identification; but Dr. Herbert Friedmann has clearly described all the different sequences of plumage and variation in colour. Though the work is restricted to North and Middle America, the author has included in the keys to species some extra-limital forms, which may occur as vagrants. This is an innovation which should add much to the usefulness of this valuable work.