observations had been made, and with so little time for digestion, the content appears remarkably good. As might be expected from the numbers involved in this major scientific onslaught on Antarctica, the problems tackled are extraordinarily diversified—one dare not say comprehensive: there is, for example, little about oceanography or the sub-antarctic sea ice, though there is some interesting material for considering the role of the stratosphere; and, of course, local effects could only be sampled.

The forty papers printed were distributed between sessions on (1) local effects, (2) synoptic analysis and forecasting, (3) synoptic influences on lower latitudes, (4) general atmospheric circulation, (5) snow and ice characteristics, (6) heat and mass exchanges, and (7) climatology. In some of these fields, including both synoptic meteorology and the antarctic stratosphere, the book provides by far the richest reference material so far in print; the synoptic examples are, of course, largely drawn from a period far too short to be fully representative, and some of the contributors (if given longer experience in antarctic meteorology) might with advantage have drawn more on comparisons with earlier published synoptic situations. The work of Meinardus, Simpson, Palmer and Ramage—to quote a few—seems under-represented in the references used.

Until recent years only one or two general reference books existed from which the meteorologist working in antarctic regions, or his colleague concerned with antarctic effects on the weather and climate of the southern hemisphere homelands, could obtain guidance. The present work will be a very valuable addition to the libraries which such workers can consult—though for this purpose a book should have an index. It seems likely to take its place, for several years to come, among the four or five most used works on antarctic meteorology.

H. H. LAMB

MATHEMATICS AND LANGUAGE

Type-Token Mathematics

A Textbook of Mathematical Linguistics. By Dr. Gustav Herdan. (Janua Linguarum, Series Maior, Vol. 4.) Pp. ii+448. (The Hague: Mouton and Co., 1960.) 54 guilders.

THE application of statistical methods to linguistic problems goes back at least as far as Malone's suggestion (in 1778) that the order of writing of Shakespeare's plays might be ascertained by such tests. In the past fifteen years it has gained additional interest from the developments of 'information theory' and projects for mechanical translation. Various methods have been evolved, and some quite novel statistical techniques discovered: but a laborious search of both statistical and linguistic publications is needed to discover what has been done. A book which attempts a survey of the whole of this field therefore deserves some welcome.

Type-Token Mathematics has much the same scope as Dr. Herdan's earlier book *Language as Choice and Chance* (1956). It is considerably more than a rewritten and enlarged version, as it contains both new ideas and new material; several chapters are reprints of recent papers by the author. Its material falls into two parts (closely commingled): mathematical and philosophical. The mathematical parts

are vitiated, unfortunately, by the extreme shakiness of Dr. Herdan's statistical technique: the innocent linguist must be urgently warned not to adopt any procedure that he recommends without advice from a statistician. Two examples will suffice to put the statistician on his guard: it is not true that if we use a significance test at the 1 per cent level "we shall be wrong once in 100 times with our assumption of a real difference" (page 105); and it is not true that "deviations [from the mean] exceeding three times the standard deviation" are very unlikely to occur by chance (page 287) when we are considering a variate which has (approximately) a Poisson distribution with an expectation of less than one (as on page 290). In the latter passage, it is regrettable that Dr. Herdan gives unreliable formulæ for α (the expected frequency in a second sample of a word occurring a small number of times in the first) and its variance, as the techniques for making reasonably accurate estimates form one of the most interesting developments of statistics applied to language. Dr. Herdan nowhere mentions these techniques, although his bibliography includes the paper containing them (Good, 1953).

The philosophical portions of the book are occasionally stimulating, but more often irritatingly vague and confused. A fairly extensive bibliography is given; unfortunately it fails to include several of the references in the text, leaving the reader to search for, for example, "Oettinger, 1957", with no further clue. In view of the sub-title it should be added that the book is essentially an exposition of Dr. Herdan's own, generally controversial, views—a perfectly proper purpose for a book in general, but most inappropriate for a 'text-book'.

A reader whose knowledge of both statistics and information theory is sufficiently sound to save him from being misled or confused may find some interesting material and some interesting ideas in the book, but is unlikely to find it good value for money. The beginner in these fields must be, reluctantly, warned to keep off it.

G. H. TOULMIN

MATHEMATICS AND QUEUEING

Mathematical Methods in the Theory of Queueing
By A. Y. Khintchine. Translated by D. M. Andrews and M. H. Quenouille. (Griffin's Statistical Monographs and Courses, No. 7.) Pp. 120. (London: Charles Griffin and Co., Ltd., 1960.) 32s.

THIS beautiful little book breathes reason and modesty from cover to cover. It is written somewhat in the style of the classical French texts of fifty and more years ago—a style which allowed sufficient space for an honest exposition, and was not cramped by the present-day fashion for condensation and the pressure of costs. The publisher and the translators are to be congratulated for introducing the work to the English-speaking world, and the book will be of undoubted value to every mathematician interested in the theory of queues. A particularly pleasing feature is the way in which the results are developed; the mathematics is 'done', not merely indicated, and nowhere does the author state a result and refer the reader elsewhere for the details. Thus there is a satisfying aspect of completion about the exposition.

Part 1 is devoted to the theory which depends only on the arrivals and not on the nature of the service-