

THE SYMMETRIC GROUP IN MATHEMATICS

The Theory of Group Characters and Matric Representations of Groups

By Dudley E. Littlewood. Pp. viii + 292. (Oxford : Clarendon Press ; London : Oxford University Press, 1940.) 20s. net.

REPRESENTATION theory is a subject of many aspects, having important contacts with several branches of mathematics and mathematical physics. Even if text-books were much commoner than they are, there would still be room for an introduction to the subject so admirable as this. The very diversity of the theory demands a specialized outlook from those who write concerning it, but within the limits that implies, the account given by Prof. Littlewood is excellent.

From the point of view here taken, the core of the theory is Frobenius's formula for the characters of the symmetric group. The general theory for a finite group is first developed as far as the proof of the orthogonal relations, and there follows a detailed discussion of the symmetric group. Schur functions are also discussed in detail, partly for their own sake, and partly for their applications to the representation theory of continuous groups. This is dealt with in the last two chapters of the book. In the first of these the algebraic representations of the full linear group are found directly ; in the second, the orthogonal relations for groups with closed manifolds are proved, and the characters of the unitary group and of the orthogonal and rotation groups are determined. There are also

an account of spin representations, and a brief indication of the necessary modifications for groups leaving invariant an indefinite quadratic form.

The methods employed are chiefly those of Frobenius and Schur. Some use is made of the theory of linear algebras, but the problem of a synthesis of these points of view remains unsolved. The exposition is clear and concise ; but occasionally a more explicit statement of what is being done might have helped. Thus, the work on pp. 51-52 amounts to a proof that any representation of a complete matric algebra is equivalent to a direct sum of identical representations, but this is nowhere stated.

The weakest chapter is an introductory one on linear algebras, which contains errors of fact. In particular, the assertion that the regular representation of an algebra is a simple isomorphism is made without the necessary proviso that the algebra possess a modulus. It is questionable whether the modern habit of including in advanced text-books chapters designed to make them self-contained is of real value. Certainly, a student who tackled the theory of characters without more knowledge of groups and matrices than can be given in such a chapter would be most unwise.

In a book dealing with a theory so largely formal as this, some errors inevitably escape the proof-reader's eye, but the number here is surprisingly small. Altogether, the book is a very welcome addition to the series of Oxford mathematical text-books.

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GEOLOGICAL BACKGROUND OF ENGINEERING

Geology and Engineering

By Prof. Robert F. Legget. Pp. xviii + 650. (New York and London : McGraw-Hill Book Co., Inc., 1939.) 22s. 6d. net.

TRUE engineering is the attainment of the economic solution to the problems faced, and . . . the civil engineer seeks the co-operation of the geologist so that the best advantage can be taken of the rocks to be encountered. . . . This quotation, which in the text refers to a particular branch of engineering construction, illustrates the author's point of view throughout his book. In order to demonstrate the value of geological and engineering co-operation, Prof. Legget has brought together for the civil engineer and the engineering

student a large amount of well-illustrated descriptive material relating to engineering works, from many sources—American, British and Continental. It is one of the most valuable aspects of the book that the assembling of this data in one volume renders easily accessible a body of related facts which, in a border-line subject where science and art overlap and where no two works of construction are exactly alike, must otherwise be sought through an extensive literature.

The book is divided into two parts : an introduction to geology, and geology applied to civil engineering. The first occupies less than a tenth of the whole work and is scarcely sufficient to do justice to the subject ; it seems to assume either some knowledge of geology on the part of the