
Representations of Finite Groups.
C. Musili. Hindustan Book Agency, 17
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pp.

Representation theory of groups is a vast and rich subject which plays a very important role in several branches of mathematics like harmonic analysis, number theory, probability and also in mathematical physics. Representations of the groups T^n and \mathbb{R}^n lie at the heart of the theory of Fourier series and Fourier transform. As is well known, Fourier analysis is one of the most powerful techniques mathematics has contributed towards the advancement of science.

Representations of the groups like T^n and \mathbb{R}^n (which are abelian) go under the name of multiplicative characters (or simply characters) which are homomorphisms of T^n (or \mathbb{R}^n) into the multiplicative group of complex numbers of absolute value one. Such multiplicative characters have appeared in the works of Euler, Gauss, Dedekind and Weber. They were formally introduced by Weber in 1882 for arbitrary finite abelian groups. Multiplicative characters themselves form a group called the dual group and they play an important role in exploiting the group of symmetries. As long as the group is abelian, multiplicative characters are very useful.

When we leave the territory of abelian groups, the multiplicative characters are

of less use. In fact, there are nonabelian groups for which there is no nontrivial multiplicative character. To do harmonic analysis on such non-abelian groups one introduces a generalization of the multiplicative characters, the group representations. For finite groups, representations are homomorphisms of the group into the group of invertible finite matrices. Group representations are defined even when the underlying group is non compact in which case the representations become operator valued.

The present book under review deals with representations of finite groups. The book is based on an expanded version of the class notes of a course of lectures the author gave to the MPhil students of the University of Hyderabad. As the author says in the preface, the main goal of this book is to give an elementary introduction to the basic concepts of the theory of representations of finite groups. The author succeeds in attaining this goal: every student with basic knowledge of linear algebra, groups, rings and modules can read through the book without much difficulty. These basic materials are covered in the first two chapters of the book (which form part I).

In part II of the book the author introduces and studies important properties of representations of finite groups. The useful technique of inducing representations is well explained. In part III the author goes on to study the main theme of the book, viz. to study the representations of

the symmetric groups S_n rather explicitly and quickly. In this theory the author explains several different approaches like Frobenius, Frobenius-Young, Specht and abstract methods, all leading to the same concrete realizations of the irreducible representations of S_n . In the last part the author uses the preparatory material and the S_n theory to develop the representation theory of other important groups such as the alternating group and hyperoctahedral group.

This book is one of the interesting books that has come out in the TRIM series published by the Hindustan Book Agency. The main idea behind this series is to publish reasonable text books in mathematics at affordable prices. This is a well-written book. The book abounds in exercises which are 'class tested', according to the author. This book can be used by post-graduate and research students of our universities. Any reader who has seriously gone through the book will be in a position to explore more interesting frontiers of the theory. By writing this nice book Prof. C. Musili has done a good service to the students of mathematics in the country.

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