

Representation Theory of Finite Groups: Algebra and Arithmetic

Steven H. Weintraub

Graduate Studies
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Representation Theory Of Finite Groups Algebra And Arithmetic

**Jon F. Carlson, Srikanth B. Iyengar, Julia
Pevtsova**



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Representation Theory of Finite Groups: Algebra and Arithmetic Steven H. Weintraub, 2003 We explore widely in the valley of ordinary representations and we take the reader over the mountain pass leading to the valley of modular representations to a point from which s he can survey this valley but we do not attempt to widely explore it We hope the reader will be sufficiently fascinated by the scenery to further explore both valleys on his her own from the Preface Representation theory plays important roles in geometry algebra analysis and mathematical physics In particular representation theory has been one of the great tools in the study and classification of finite groups There are some beautiful results that come from representation theory Frobenius s Theorem Burnside s Theorem Artin s Theorem Brauer s Theorem all of which are covered in this textbook Some seem uninspiring at first but prove to be quite useful Others are clearly deep from the outset And when a group finite or otherwise acts on something else as a set of symmetries for example one ends up with a natural representation of the group This book is an introduction to the representation theory of finite groups from an algebraic point of view regarding representations as modules over the group algebra The approach is to develop the requisite algebra in reasonable generality and then to specialize it to the case of group representations Methods and results particular to group representations such as characters and induced representations are developed in depth Arithmetic comes into play when considering the field of definition of a representation especially for subfields of the complex numbers The book has an extensive development of the semisimple case where the characteristic of the field is zero or is prime to the order of the group and builds the foundations of the modular case where the characteristic of the field divides the order of the group The book assumes only the material of a standard graduate course in algebra It is suitable as a text for a year long graduate course The subject is of interest to students of algebra number theory and algebraic geometry The systematic treatment presented here makes the book also valuable as a reference

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reasonable generality and then to specialize it to the case of group representations. Methods and results particular to group representations such as characters and induced representations are developed in depth. Arithmetic comes into play when considering the field of definition of a representation especially for subfields of the complex numbers. The book has an extensive development of the semisimple case where the characteristic of the field is zero or is prime to the order of the group and builds the foundations of the modular case where the characteristic of the field divides the order of the group. The book assumes only the material of a standard graduate course in algebra. It is suitable as a text for a year long graduate course. The subject is of interest to students of algebra, number theory and algebraic geometry. The systematic treatment presented here makes the book also valuable as a reference.

Representation Theory of Finite Groups Benjamin Steinberg, 2011-10-23. This book is intended to present group representation theory at a level accessible to mature undergraduate students and beginning graduate students. This is achieved by mainly keeping the required background to the level of undergraduate linear algebra, group theory and very basic ring theory. Module theory and Wedderburn theory as well as tensor products are deliberately avoided. Instead we take an approach based on discrete Fourier Analysis. Applications to the spectral theory of graphs are given to help the student appreciate the usefulness of the subject. A number of exercises are included. This book is intended for a 3rd/4th undergraduate course or an introductory graduate course on group representation theory. However it can also be used as a reference for workers in all areas of mathematics and statistics.

Representation Theory of Finite Groups and Associative Algebras Charles W. Curtis, Irving Reiner, 1966

Representation Theory of Finite Groups: a Guidebook David A. Craven, 2019-08-30. This book provides an accessible introduction to the state of the art of representation theory of finite groups. Starting from a basic level that is summarized at the start, the book proceeds to cover topics of current research interest including open problems and conjectures. The central themes of the book are block theory and module theory of group representations which are comprehensively surveyed with a full bibliography. The individual chapters cover a range of topics within the subject from blocks with cyclic defect groups to representations of symmetric groups. Assuming only modest background knowledge at the level of a first graduate course in algebra, this guidebook intended for students taking first steps in the field will also provide a reference for more experienced researchers. Although no proofs are included, end of chapter exercises make it suitable for student seminars.

Representing Finite Groups Ambar N. Sengupta, 2011-12-09. This graduate textbook presents the basics of representation theory for finite groups from the point of view of semisimple algebras and modules over them. The presentation interweaves insights from specific examples with development of general and powerful tools based on the notion of semisimplicity. The elegant ideas of commutant duality are introduced along with an introduction to representations of unitary groups. The text progresses systematically and the presentation is friendly and inviting. Central concepts are revisited and explored from multiple viewpoints. Exercises at the end of the chapter help reinforce the material. Representing

Finite Groups A Semisimple Introduction would serve as a textbook for graduate and some advanced undergraduate courses in mathematics Prerequisites include acquaintance with elementary group theory and some familiarity with rings and modules A final chapter presents a self contained account of notions and results in algebra that are used Researchers in mathematics and mathematical physics will also find this book useful A separate solutions manual is available for instructors

Geometric and Topological Aspects of the Representation Theory of Finite Groups Jon F. Carlson, Srikanth B. Iyengar, Julia Pevtsova, 2018-10-04 These proceedings comprise two workshops celebrating the accomplishments of David J Benson on the occasion of his sixtieth birthday The papers presented at the meetings were representative of the many mathematical subjects he has worked on with an emphasis on group representations and cohomology The first workshop was titled Groups Representations and Cohomology and held from June 22 to June 27 2015 at Sabhal M r Ostaig on the Isle of Skye Scotland The second was a combination of a summer school and workshop on the subject of Geometric Methods in the Representation Theory of Finite Groups and took place at the Pacific Institute for the Mathematical Sciences at the University of British Columbia in Vancouver from July 27 to August 5 2016 The contents of the volume include a composite of both summer school material and workshop derived survey articles on geometric and topological aspects of the representation theory of finite groups The mission of the annually sponsored Summer Schools is to train and draw new students and help Ph D students transition to independent research

Linear Representations of Finite Groups Jean-Pierre Serre, 2012-12-06 This book consists of three parts rather different in level and purpose The first part was originally written for quantum chemists It describes the correspondence due to Frobenius between linear representations and characters This is a fundamental result of constant use in mathematics as well as in quantum chemistry or physics I have tried to give proofs as elementary as possible using only the definition of a group and the rudiments of linear algebra The examples Chapter 5 have been chosen from those useful to chemists The second part is a course given in 1966 to second year students of I Ecoie Normale It completes the first on the following points a degrees of representations and integrality properties of characters Chapter 6 b induced representations theorems of Artin and Brauer and applications Chapters 7 11 c rationality questions Chapters 12 and 13 The methods used are those of linear algebra in a wider sense than in the first part group algebras modules noncommutative tensor products semisimple algebras The third part is an introduction to Brauer theory passage from characteristic 0 to characteristic p and conversely I have freely used the language of abelian categories projective modules Grothendieck groups which is well suited to this sort of question The principal results are a The fact that the decomposition homomorphism is surjective all irreducible representations in characteristic p can be lifted virtually i e in a suitable Grothendieck group to characteristic 0

Modular Representation Theory of Finite Groups Peter Schneider, 2012-11-27 Representation theory studies maps from groups into the general linear group of a finite dimensional vector space For finite groups the theory comes in two distinct flavours In the semisimple case for example over the field of

complex numbers one can use character theory to completely understand the representations. This by far is not sufficient when the characteristic of the field divides the order of the group. Modular Representation Theory of finite Groups comprises this second situation. Many additional tools are needed for this case. To mention some there is the systematic use of Grothendieck groups leading to the Cartan matrix and the decomposition matrix of the group as well as Green's direct analysis of indecomposable representations. There is also the strategy of writing the category of all representations as the direct product of certain subcategories, the so called blocks of the group. Brauer's work then establishes correspondences between the blocks of the original group and blocks of certain subgroups, the philosophy being that one is thereby reduced to a simpler situation. In particular one can measure how nonsemisimple a category a block is by the size and structure of its so called defect group. All these concepts are made explicit for the example of the special linear group of two by two matrices over a finite prime field. Although the presentation is strongly biased towards the module theoretic point of view, an attempt is made to strike a certain balance by also showing the reader the group theoretic approach. In particular in the case of defect groups a detailed proof of the equivalence of the two approaches is given. This book aims to familiarize students at the masters level with the basic results, tools and techniques of a beautiful and important algebraic theory. Some basic algebra together with the semisimple case are assumed to be known, although all facts to be used are restated without proofs in the text. Otherwise the book is entirely self contained.

Representation Theory of Finite Groups Martin Burrow, 2014-05-10
Representation Theory of Finite Groups is a five chapter text that covers the standard material of representation theory. This book starts with an overview of the basic concepts of the subject including group characters, representation modules and the rectangular representation. The succeeding chapters describe the features of representation theory of rings with identity and finite groups. These topics are followed by a discussion of some of the application of the theory of characters along with some classical theorems. The last chapter deals with the construction of irreducible representations of groups. This book will be of great value to graduate students who wish to acquire some knowledge of representation theory.

A Journey Through Representation Theory Caroline Gruson, Vera Serganova, 2018-10-23
This text covers a variety of topics in representation theory and is intended for graduate students and more advanced researchers who are interested in the field. The book begins with classical representation theory of finite groups over complex numbers and ends with results on representation theory of quivers. The text includes in particular infinite dimensional unitary representations for abelian groups, Heisenberg groups and SL_2 and representation theory of finite dimensional algebras. The last chapter is devoted to some applications of quivers including Harish-Chandra modules for SL_2 . Ample examples are provided and some are revisited with a different approach when new methods are introduced leading to deeper results. Exercises are spread throughout each chapter. Prerequisites include an advanced course in linear algebra that covers Jordan normal forms and tensor products as well as basic results on groups and rings.

Blocks of Finite Groups and Their Invariants Benjamin Sambale, 2014-11-19
Providing a nearly complete

selection of up to date methods and results on block invariants with respect to their defect groups this book covers the classical theory pioneered by Brauer the modern theory of fusion systems introduced by Puig the geometry of numbers developed by Minkowski the classification of finite simple groups and various computer assisted methods In a powerful combination these tools are applied to solve many special cases of famous open conjectures in the representation theory of finite groups Most of the material is drawn from peer reviewed journal articles but there are also new previously unpublished results In order to make the text self contained detailed proofs are given whenever possible Several tables add to the text s usefulness as a reference The book is aimed at experts in group theory or representation theory who may wish to make use of the presented ideas in their research

Representing Finite Groups Ambar N. Sengupta,2011-12-08 This graduate textbook presents the basics of representation theory for finite groups from the point of view of semisimple algebras and modules over them The presentation interweaves insights from specific examples with development of general and powerful tools based on the notion of semisimplicity The elegant ideas of commutant duality are introduced along with an introduction to representations of unitary groups The text progresses systematically and the presentation is friendly and inviting Central concepts are revisited and explored from multiple viewpoints Exercises at the end of the chapter help reinforce the material

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Representation Theory of Finite Groups and Finite-Dimensional Algebras 3Island Press,1991-04-01

Groups and Symmetries Yvette Kosmann-Schwarzbach,2009-10-16 Combines material from many areas of mathematics including algebra geometry and analysis so students see connections between these areas Applies material to physics so students appreciate the applications of abstract mathematics Assumes only linear algebra and calculus making an advanced subject accessible to undergraduates Includes 142 exercises many with hints or complete solutions so text may be used in the classroom or for self study

The Arcata Conference on Representations of Finite Groups, Part 1 Paul Fong,1987 The papers in these proceedings of the 1986 Arcata Summer Institute bear witness to the extraordinarily vital and intense research in the representation theory of finite groups The confluence of diverse mathematical disciplines has brought forth work of great scope and depth Particularly striking is the influence of algebraic geometry and cohomology theory in the modular representation theory and the character theory of reductive groups over finite fields and in the general modular representation theory of finite groups The continuing developments in block theory and the general character theory of finite groups is noteworthy The expository and research aspects of the Summer Institute are well represented by these papers

Integral Representations I. Reiner,K.W. Roggenkamp,2006-11-15

Algebra - Representation Theory Klaus W.

Roggenkamp, Mirela Stefanescu, 2001-08-31 Over the last three decades representation theory of groups Lie algebras and associative algebras has undergone a rapid development through the powerful tool of almost split sequences and the Auslander Reiten quiver Further insight into the homology of finite groups has illuminated their representation theory The study of Hopf algebras and non commutative geometry is another new branch of representation theory which pushes the classical theory further All this can only be seen in connection with an understanding of the structure of special classes of rings The aim of this book is to introduce the reader to some modern developments in Lie algebras quantum groups Hopf algebras and algebraic groups non commutative algebraic geometry representation theory of finite groups and cohomology the structure of special classes of rings

Representation Theory of Symmetric Groups Pierre-Loic Meliot, 2017-05-12 Representation Theory of Symmetric Groups is the most up to date abstract algebra book on the subject of symmetric groups and representation theory Utilizing new research and results this book can be studied from a combinatorial algorithmic or algebraic viewpoint This book is an excellent way of introducing today's students to representation theory of the symmetric groups namely classical theory From there the book explains how the theory can be extended to other related combinatorial algebras like the Iwahori Hecke algebra In a clear and concise manner the author presents the case that most calculations on symmetric group can be performed by utilizing appropriate algebras of functions Thus the book explains how some Hopf algebras symmetric functions and generalizations can be used to encode most of the combinatorial properties of the representations of symmetric groups Overall the book is an innovative introduction to representation theory of symmetric groups for graduate students and researchers seeking new ways of thought

Finite Groups II B. Huppert, N. Blackburn, 2012-12-06 17 t L It CIFDr wei unsre Weisheit Einfalt ist From Lohengrin Richard Wagner At the time of the appearance of the first volume of this work in 1967 the tempestuous development of finite group theory had already made it virtually impossible to give a complete presentation of the subject in one treatise The present volume and its successor have therefore the more modest aim of giving descriptions of the recent development of certain important parts of the subject and even in these parts no attempt at completeness has been made Chapter VII deals with the representation theory of finite groups in arbitrary fields with particular attention to those of non zero characteristic That part of modular representation theory which is essentially the block theory of complex characters has not been included as there are already monographs on this subject and others will shortly appear Instead we have restricted ourselves to such results as can be obtained by purely module theoretical means

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