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A Course on Finite Groups Character Theory of Finite Groups The Theory of Finite Groups Finite Groups Finite Groups Representation Theory of Finite Groups A Course on Finite Groups Finite Groups Representation Theory of Finite Groups Groups and Symmetries Representation Theory of Finite Groups: Algebra and Arithmetic Products of Finite Groups Finite Group Theory On Characters of Finite Groups Applications of Finite Groups K-Theory of Finite Groups and Orders Finite Groups of Mapping Classes of Surfaces The Finite Simple Groups Proceedings of the Conference on Finite Groups Theory of Finite Groups Projective Representations of Finite Groups Character Theory of Finite Groups Finite Groups II A Journey Through Representation Theory Unoriented Bordism and Actions of Finite Groups Characters of Finite Groups Theory and Applications of Finite Groups Representations of Finite Groups Finite Group Theory The classification of the finite simple groups Linear

Representations of Finite Groups Atlas of Finite Groups Representation Theory of Finite Groups Cohomology Rings of Finite Groups Classes of Finite Groups Volume 1 A Course in Finite Group Representation Theory The Arcata Conference on Representations of Finite Groups, Part 2 The Character Theory of Finite Groups of Lie Type Finite Simple Groups

During the last 40 years the theory of finite groups has developed dramatically. The finite simple groups have been classified and are becoming better understood. Tools exist to reduce many questions about arbitrary finite groups to similar questions about simple groups. Since the classification there have been numerous applications of this theory in other branches of mathematics. Finite Group Theory develops the foundations of the theory of finite groups. It can serve as a text for a course on finite groups for students already exposed to a first course in algebra. It could supply the background necessary to begin reading journal articles in the field. For specialists it also provides a reference on the foundations of the subject. This second edition has been considerably improved with a completely rewritten Chapter 15 considering the 2-Signalizer

Functor Theorem, and the addition of an appendix containing solutions to exercises. In February 1981, the classification of the finite simple groups (Dl)* was completed,t. * representing one of the most remarkable achievements in the history or mathematics. Involving the combined efforts of several hundred mathematicians from around the world over a period of 30 years, the full proof covered something between 5,000 and 10,000 journal pages, spread over 300 to 500 individual papers. The single result that, more than any other, opened up the field and foreshadowed the vastness of the full classification proof was the celebrated theorem of Walter Feit and John Thompson in 1962, which stated that every finite group of odd order (D2) is solvable (D3)-a statement expressi ble in a single line, yet its proof required a full 255-page issue of the Pacific 10urnal of Mathematics [93]. Soon thereafter, in 1965, came the first new sporadic simple group in over 100 years, the Zvonimir Janko group 1 , to further stimulate the 1 'To make the book as self-contained as possible. we are including definitions of various terms as they occur in the text. However. in order not to disrupt the continuity of the discussion. we have placed them at the end of the Introduction. We denote these definitions by

(DI). (D2), (D3). etc. These notes are from a course given at the University of Chicago. No pretense of completeness is made. A great deal of additional material may be found in Bass' book [BK] which gives a remarkably complete account of algebraic K-theory. The present notes, however, contain a number of recent results of Jacobinski [J] and Roiter [R]. An excellent survey of the theory of orders with detailed references may be found in Reiner's article [RS]. 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. Character theory is a powerful tool for understanding finite groups. In particular, the theory has been a key ingredient in the classification of finite simple groups. Characters are also of interest in their own right, and their properties are closely related to properties of the structure of the underlying group. The book begins by developing the module theory of complex group algebras. After the module-theoretic foundations are laid in the first chapter, the focus is primarily on characters. This enhances the accessibility of the material for students, which was a major consideration in the writing. Also with students in mind, a large number of problems are included, many of them quite challenging. In addition to the development of the basic theory (using a cleaner notation than previously), a number of more specialized topics are covered with accessible presentations. These include projective representations, the basics of the Schur index, irreducible character degrees and group structure, complex linear groups, exceptional characters, and a fairly extensive introduction to blocks and Brauer characters. This is a corrected reprint of the original 1976 version, later reprinted by Dover.

Since 1976 it has become the standard reference for character theory, appearing in the bibliography of almost every research paper in the subject. It is largely self-contained, requiring of the reader only the most basic facts of linear algebra, group theory, Galois theory and ring and module theory. This updated edition of this classic book is devoted to ordinary representation theory and is addressed to finite group theorists intending to study and apply character theory. It contains many exercises and examples, and the list of problems contains a number of open questions. The classification of finite simple groups is a landmark result of modern mathematics. The original proof is spread over scores of articles by dozens of researchers. In this multivolume book, the authors are assembling the proof with explanations and references. It is a monumental task. The book, along with background from sections of the previous volumes, presents critical aspects of the classification. In four prior volumes (Surveys of Mathematical Monographs, Volumes 40.1, 40.2, 40.3, and 40.4), the authors began the proof of the classification theorem by establishing certain uniqueness and preuniqueness results. In this volume, they now begin the proof of a major theorem from the classification grid, namely Theorem ${\mathcal C 7$. The book is

suitable for graduate students and researchers interested in group theory. The theory of groups, especially of finite groups, is one of the most delightful areas of mathematics. Its proofs often have elegance and crystalline beauty. This textbook is intended for the reader who has been exposed to about three years of serious mathematics. The notion of a group appears widely in mathematics and even further afield in physics and chemistry, and the fundamental idea should be known to all mathematicians. In this textbook a purely algebraic approach is taken and the choice of material is based upon the notion of conjugacy. The aim is not only to cover basic material, but also to present group theory as a living, vibrant and growing discipline, by including references and discussion of some work up to the present day. 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. This book covers the latest achievements of the Theory of Classes of Finite Groups. It introduces some unpublished and fundamental advances in this Theory and provides a new insight into some classic facts in this area. By gathering the research of many authors scattered in hundreds of papers the book contributes to the understanding of the structure of finite groups by adapting and extending the successful techniques of the Theory of Finite Soluble Groups. 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. Provides an elementary introduction to the basic concepts of the theory of ordinary representations to finite groups with a minimum of prerequisites; explores the for the important special case of the symmetric groups S_n of permutations on n letters; and uses the preparatory material of the first two parts, coupled with the S_n theory, to do the same for some other important special groups. Through the fundamental work of Deligne and Lusztig in the 1970s, further developed mainly by Lusztig, the character theory of reductive groups over finite fields has grown into a rich and vast area of mathematics. It incorporates tools and methods from algebraic geometry, topology, combinatorics and computer algebra, and has since evolved substantially. With this book, the authors meet the need for a contemporary treatment, complementing in core areas the well-established books of Carter and Digne – Michel. Focusing on applications in finite group theory, the authors gather previously scattered results and allow the reader to get to grips with the large body of

literature available on the subject, covering topics such as regular embeddings, the Jordan decomposition of characters, d-Harish – Chandra theory and Lusztig induction for unipotent characters. Requiring only a modest background in algebraic geometry, this useful reference is suitable for beginning graduate students as well as researchers. This book presents a systematic account of this topic, from the classical foundations established by Schur 80 years ago to current advances and developments in the field. This work focuses on general methods and builds theory solidly on the study of modules over twisted group algebras, and provides a wide range of skill-sharpening mathematical techniques applicable to this subject. Offers an understanding of projective representations of finite groups for algebraists, number theorists, mathematical researchers studying modern algebra, and theoretical physicists. Thisbookisintendedasanintroductiontoall the?nitesimplegroups.During themonumentalstruggl etoclassifythe?nitesimplegroups(andindeedsince), a huge amount of information about these groups has been accumulated. Conveyingthisinformationtot henextgenerationofstudentsandresearchers, not to mention those who might wish to apply this knowledge, has become a major challenge. With

the publication of the two volumes by Aschbacher and Smith [12, 13] in 2004 we can reasonably regard the proof of the Classi?cation Theorem for Finite Simple Groups (usually abbreviated CFSG) as complete. Thus it is timely to attempt an overview of all the (non-abelian) ?nite simple groups in one volume. For expository purposes it is convenient to divide them into four basic types, namely the alternating, classical, exceptional and sporadic groups. The study of alternating groups soon develops into the theory of per- tation groups, which is well served by the classic text of Wielandt [170]and more modern treatments such as the comprehensive introduction by Dixon and Mortimer [53] and more specialised texts such as that of Cameron [19]. The study of finite groups factorised as a product of two or more subgroups has become a subject of great interest during the last years with applications not only in group theory, but also in other areas like cryptography and coding theory. It has experienced a big impulse with the introduction of some permutability conditions. The aim of this book is to gather, order, and examine part of this material, including the latest advances made, give some new approach to some topics, and present some new subjects of research in the theory of finite factorised groups.

Some of the topics covered by this book include groups whose subnormal subgroups are normal, permutable, or Sylow-permutable, products of nilpotent groups, and an exhaustive structural study of totally and mutually permutable products of finite groups and their relation with classes of groups. This monograph is mainly addressed to graduate students and senior researchers interested in the study of products and permutability of finite groups. A background in finite group theory and a basic knowledge of representation theory and classes of groups is recommended to follow it. Group cohomology has a rich history that goes back a century or more. Its origins are rooted in investigations of group theory and num ber theory, and it grew into an integral component of algebraic topology. In the last thirty years, group cohomology has developed a powerful con nection with finite group representations. Unlike the early applications which were primarily concerned with cohomology in low degrees, the in teractions with representation theory involve cohomology rings and the geometry of spectra over these rings. It is this connection to represen tation theory that we take as our primary motivation for this book. The book consists of two separate pieces. Chronologically, the first part was

the computer calculations of the mod-2 cohomology rings of the groups whose orders divide 64. The ideas and the programs for the calculations were developed over the last 10 years. Several new features were added over the course of that time. We had originally planned to include only a brief introduction to the calculations. However, we were persuaded to produce a more substantial text that would include in greater detail the concepts that are the subject of the calculations and are the source of some of the motivating conjectures for the com putations. We have gathered together many of the results and ideas that are the focus of the calculations from throughout the mathematical literature. This atlas covers groups from the families of the classification of finite simple groups. Recently updated incorporating corrections This book explores the classical and beautiful character theory of finite groups. It does it by using some rudiments of the language of categories. Originally emerging from two courses offered at Peking University (PKU), primarily for third-year students, it is now better suited for graduate courses, and provides broader coverage than books that focus almost exclusively on groups. The book presents the basic tools, notions and

theorems of character theory (including a new treatment of the control of fusion and isometries), and introduces readers to the categorical language at several levels. It includes and proves the major results on characteristic zero representations without any assumptions about the base field. The book includes a dedicated chapter on graded representations and applications of polynomial invariants of finite groups, and its closing chapter addresses the more recent notion of the Drinfeld double of a finite group and the corresponding representation of GL_2(Z). 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. The second part is a course given in 1966 to second-year students of l ' Ecole Normale. It completes in a certain sense the first part. The third part is an introduction to Brauer Theory. DIVConcise, graduate-level exposition covers representation theory of rings with identity, representation theory of finite groups, more. Exercises. Appendix. 1965 edition. /div ``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. This volume consists of the papers presented at a conference on finite groups which took place in Park City, Utah on February 10-13, 1975. The subjects discussed at the conference were in one of the five main areas of finite group theory, including characterizing simple groups, representations of simple groups, representations and characters of finite groups, permutation groups, and group theory. "The Classification Theorem is one of the main achievements of 20th century mathematics, but its proof has not yet been completely

extricated from the journal literature in which it first appeared. This is the second volume in a series devoted to the presentation of a reorganized and simplified proof of the classification of the finite simple groups. The authors present (with either proof or reference to a proof) those theorems of abstract finite group theory, which are fundamental to the analysis in later volumes in the series. This volume provides a relatively concise and readable access to the key ideas and theorems underlying the study of finite simple groups and their important subgroups. The sections on semisimple subgroups and subgroups of parabolic type give detailed treatments of these important subgroups, including some results not available until now or available only in journal literature. The signalizer section provides an extensive development of both the Bender Method and the Signalizer Functor Method, which play a central role in the proof of the Classification Theorem. This book would be a valuable companion text for a graduate group theory course."--Publisher's website Applications of Finite Groups focuses on the applications of finite groups to problems of physics, including representation theory, crystals, wave equations, and nuclear and molecular structures. The book first elaborates on matrices,

groups, and representations. Topics include abstract properties, applications, matrix groups, key theorem of representation theory, properties of character tables, simply reducible groups, tensors and invariants, and representations generated by functions. The text then examines applications and subgroups and representations, as well as subduced and induced representations, fermion annihilation and creation operators, crystallographic point groups, proportionality tensors in crystals, and nonrelativistic wave equations. The publication takes a look at space group representations and energy bands, symmetric groups, and applications. Topics include molecular and nuclear structures, multiplet splitting in crystalline electric fields, construction of irreducible representations of the symmetric groups, and reality of representations. The manuscript is a dependable source of data for physicists and researchers interested in the applications of finite groups. The text begins with a review of group actions and Sylow theory. It includes semidirect products, the Schur-Zassenhaus theorem, the theory of commutators, coprime actions on groups, transfer theory, Frobenius groups, primitive and multiply transitive permutation groups, the simplicity of the PSL

groups, the generalized Fitting subgroup and also Thompson's J-subgroup and his normal p-complement theorem. 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 charac teristic. 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. This graduate-level text provides a thorough grounding in the representation theory of finite groups over fields and rings. The book provides a balanced and

comprehensive account of the subject, detailing the methods needed to analyze representations that arise in many areas of mathematics. Key topics include the construction and use of character tables, the role of induction and restriction, projective and simple modules for group algebras, indecomposable representations, Brauer characters, and block theory. This classroom-tested text provides motivation through a large number of worked examples, with exercises at the end of each chapter that test the reader's knowledge, provide further examples and practice, and include results not proven in the text. Prerequisites include a graduate course in abstract algebra, and familiarity with the properties of groups, rings, field extensions, and linear algebra. Introduces the richness of group theory to advanced undergraduate and graduate students, concentrating on the finite aspects. Provides a wealth of exercises and problems to support self-study. Additional online resources on more challenging and more specialised topics can be used as extension material for courses, or for further independent study. From reviews of the German edition: "This is an exciting text and a refreshing contribution to an area in which challenges continue to flourish and to captivate the

viewer. Even though representation theory and constructions of simple groups have been omitted, the text serves as a springboard for deeper study in many directions." Mathematical Reviews The aim of the series is to present new and important developments in pure and applied mathematics. Well established in the community over two decades, it offers a large library of mathematics including several important classics. The volumes supply thorough and detailed expositions of the methods and ideas essential to the topics in question. In addition, they convey their relationships to other parts of mathematics. The series is addressed to advanced readers wishing to thoroughly study the topic. Editorial Board Lev Birbrair, Universidade Federal do Cear á , Fortaleza, Brasil Victor P. Maslov, Russian Academy of Sciences, Moscow, Russia Walter D. Neumann, Columbia University, New York, USA Markus J. Pflaum, University of Colorado, Boulder, USA Dierk Schleicher, Jacobs University, Bremen, Germany Introduces the richness of group theory to advanced undergraduate and graduate students, concentrating on the finite aspects. Provides a wealth of exercises and problems to support self-study. Additional online resources on more challenging and more specialised topics can be

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