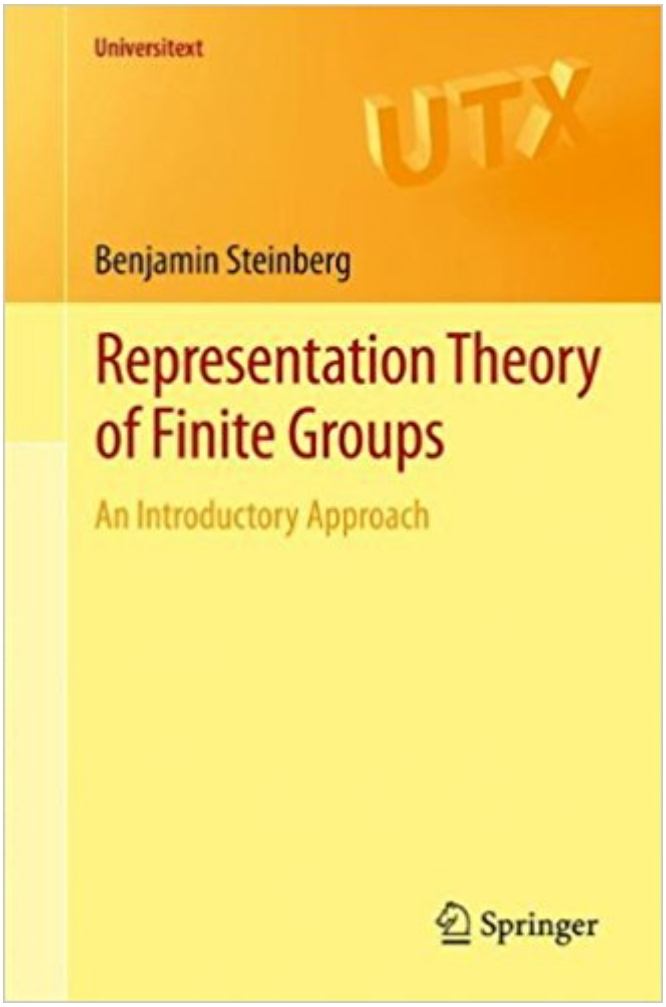
Representation Theory Of Finite Groups: An Introductory Approach (Universitext)



Synopsis

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.

Book Information

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Customer Reviews

From the reviews:Ã¢â ¬Å“The aim of the author is to give an introductory text on (ordinary) representation theory of finite groups which is accessible for advanced undergraduates already. And Steinberg manages this outstandingly well. Ã¢â ¬Â¦ a book which is ideally suited for beginners in math as well as physicists, engineers and so on, who need a concise, well conceived and easy comprehensible introduction into representation theory.Ã¢â ¬Â• (G. Kowol, Monatshefte fÃƒÂ r Mathematik, Vol. 167 (3-4), September, 2012)Ã¢â ¬Å“Steinberg Ã¢â ¬Â¦ provides a one-semester course on representation theory with just linear algebra and a beginning course in abstract algebra

(primarily group theory) as prerequisites. Ã¢â ¬Â¦ the author covers most of the standard introductory topics in representation theory. The exercises provide more examples and further common results. It is the applications that Steinberg uses to motivate the subject that make this text both interesting and valuable. Ã¢â ¬Â¦ Overall, a very user-friendly text with many examples and copious details. Summing Up: Recommended. Upper-division undergraduates through researchers/faculty.Ã¢â ¬Â• (J. T. Zerger, Choice, Vol. 49 (11), August, 2012)Ã¢â ¬Å“The book consists of 157 pages spread over 11 chapters. Ã¢â ¬Â¦ This book is an introductory course and it could be used by mathematicians and students who would like to learn quickly about the representation theory and character theory of finite groups, and for non-algebraists, statisticians and physicists who use representation theory.Ã¢â ¬Â• (Jamshid Moori, Mathematical Reviews, Issue 2012 j)Ã¢â ¬Å“The required background as to this introductory course on group representations, is in the level of linear algebra, group theory and some ring theory. Ã¢â ¬Â¦ the book under review is a welcome one for students at an advanced undergraduate or introductory graduate level course, also for those people like physicists, statisticians and non-algebraically oriented mathematicians who need representation theory in their work.Ã¢â ¬Â• (R. W. van der Waall, Zentralblatt MATH, Vol. 1243, 2012)Ã¢â ¬Å“The author has, by combining clear writing with an accessible and minimal-prerequisite approach to group representations, created a book that may well help bring group representation theory into the undergraduate curriculum. This is an impressive and useful text, and should be looked at by anybody with an interest in the subject.Ã¢â ¬Â• (Mark Hunacek, The Mathematical Association of America, February, 2012)

Representation Theory of Finite Groups presents group representation theory at a level accessible to advanced undergraduate students and beginning graduate students. The required background is maintained to the level of linear algebra, group theory, and very basic ring theory and avoids prerequisites in analysis and topology by dealing exclusively with finite groups. Module theory and Wedderburn theory, as well as tensor products, are deliberately omitted. Instead, an approach based on discrete Fourier Analysis is taken, thereby demanding less background from the reader.The main topics covered in this text include character theory, the group algebra and Fourier analysis, Burnside’s pq-theorem and the dimension theorem, permutation representations, induced representations and Mackey’s theorem, and the representation theory of the symmetric group. For those students who have an elementary knowledge of probability and statistics, a chapter on random walks on finite groups serves as an illustration to link finite stochastics and representation theory. Applications to the spectral theory of graphs are given to help the student appreciate the

usefulness of the subject and the author provides motivation and a gentle style throughout the text. A number of exercises add greater dimension to the understanding of the subject and some aspects of a combinatorial nature are clearly shown in diagrams.This text will engage a broad readership due to the significance of representation theory in diverse branches of mathematics, engineering, and physics, to name a few. Its primary intended use is as a one semester textbook for a third or fourth year undergraduate course or an introductory graduate course on group representation theory. The content can also be of use as a reference to researchers in all areas of mathematics, statistics, and several mathematical sciences.

I did a reading project on representation theory in my final year as an undergraduate math student. I found some of the resources often recommended such as the Etingof notes/text difficult to understand and I eventually came across this text. The book is easy to understand and well written with some nice applications. It’s a very nice resource for a first look at representation theory, although it skips important concepts such as modules and tensors. I found that the text by Curtis and Reiner was a nice follow up to Steinberg’s text for those interested in pursuing the topic further.

Readable, accessible to the undergraduate. Really appreciate the worked out proofs. Highly recommend this book as the logical next step after abstract linear algebra and modern algebra

Representation theory of finite groups has historically been a subject withheld from the mathematically non-elite, a subject that one can only learn once you’ve completed a laundry list of prerequisites. This is an absolute shame. It is a shame that a subject so beautiful, intuitive, and with such satisfying results so close to the surface, is not accessible to a wider audience. In particular, I think it would go a long way to helping undergraduate math students see the beauty in mathematics if they were able to get a taste of representation theory. Moreover, teaching representation theory to undergraduates helps them understand an important concept in mathematics that is not said often enough: one should study a class of objects, by their actions on other objects. Sadly, as I have said, historically this subject has had an alienating list of prerequisites (comfort with module theory, ring theory, and more specifically group rings).A big part of the reason for this alienation is the supply of textbooks on the representation theory of finite groups. Classically there are only two "real" textbooks: Serre’s ’Linear Representations of Finite Groups’ and the glib beginning of Fulton and Harris’s ’Representation Theory: A First Course’. Both of these are just too advanced for and undergraduate to comfortably digest.Luckily, all is not lost thanks to Dr. Steinberg. This book is

precisely the missing key to being able to successfully hold an undergraduate course in representation theory. Dr. Steinberg has struck the perfect balance between requiring little prior knowledge (really, one just needs to understand basic group theory and linear algebra, the notion of the tensor product isn't even needed) and covering all the important results. Dr. Steinberg achieves this by a hands-on, no-index-spared approach. In other words, the true character (no pun intended) of the constructions aren't hidden behind some compactified notation, they are fully written out for the world to see. Not only does this lessen the prerequisite knowledge, but it is also (in my opinion) the correct approach for a first time introduction to representation theory. Dr. Steingberg's text doesn't shy away from computations (something a lot of representation theory books tend to do--they often give a character table and say "which is easily derivable"), it encourages them via a plethora of examples and general techniques for such computations.Ok, besides the methodological reasons Dr. Steinberg's book is great, here are some particular aspects of the book that make it a valuable resource:-An explicit statement of Mackey's Irreducibility Criterion, which is proved in a user friendly way. It's hard to find this statement proved in an understandable way. It's in Isaac's character theory book, but it's hard to follow.-A palatable introduction to the representation theory of the symmetric group. It's no Sagan, but it's not supposed to be. It still introduces all the necessary concepts (e.g. polytabloids, Ferrer's diagrams, etc.) and shows the beautiful interplay between combinatorics and representation theory.-A proof of the most fundamental application of rep theory to finite group theory: Burnside's Theorem. Dr. Steinberg takes the time (there's an entire chapter devoted to it) to build up to the proof, leaving no detail or lemma for the reader to fill in (and for such an important result, this is a good thing).-An introduction to the Fourier analysis of finite groups including an application to graph theory, in the form of the Cayley graph.-An introduction to random walks on groups.All in all, while I can't say that Dr. Steinberg's book is perfect, I think that it is the first viable choice as a textbook for the undergraduate rep theory course, that I think is so sorely needed.

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