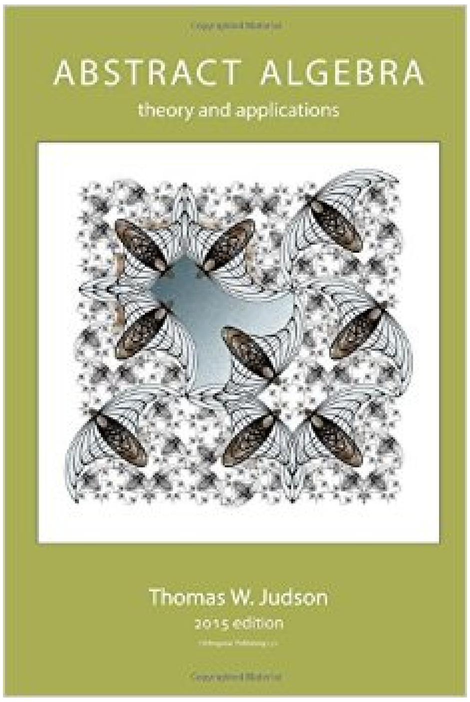
Abstract Algebra: Theory And Applications



Synopsis

Abstract Algebra: Theory and Applications is an open-source textbook that is designed to teach the principles and theory of abstract algebra to college juniors and seniors in a rigorous manner. Its strengths include a wide range of exercises, both computational and theoretical, plus many non-trivial applications. The first half of the book presents group theory, through the Sylow theorems, with enough material for a semester-long course. The second-half is suitable for a second semester and presents rings, integral domains, Boolean algebras, vector spaces, and fields, concluding with Galois Theory.

Book Information

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Customer Reviews

There are many reasons to love this book.PROS1. The author gives it away online, if you want, but the hardcover is so reasonably priced (compare to today’s textbook prices!) that having a printed book and supporting the author is the way to go.2. There is supplementary material at the author’s site, including applications with the incredible freeware math package Sage.3. The book is comprehensive, covering all of the usual theory but also including important modern applications to cryptography.4. The book is clearly written, and, with some diligence, suited to self-study.CONSVery small ones.1. There are a few editing issues (but nothing remotely serious).2. The typeface is small.3. The book takes no prisoners (see below).The book opens with the usual review of proofs, set theory, etc., and then gets into a very comprehensive treatment of groups. Rings are then covered and the book winds up with vector spaces and fields. All about what you’d expect, but the applications are there, especially to cryptography, and advanced stuff (think Galois and the like) is introduced. The problems range from pure exercises to serious challenge, and some solutions are available.The writing is good. The book is clear and lucid, though not wordy: you'll need to pay close attention especially if learning on your own.Above I mention that the book takes no prisoners. What I mean is that the author does not compromise. Nothing is "light" or "easy" or glossed over. The book demands much of the student and provides much in return. It is most definitely not for dabblers.

I think I would prefer Dummit and Foote's "Abstract Algebra" for a course on group/ring theory. In this book, you will be introduced to the notion of a group starting with sets and equivalence relations and then moving on to integer equivalence classes and symmetries. If you are not familiar with preliminary material specific to courses in number theory or cryptography, you will learn about modular arithmetic. Very briefly, two integers a and b are equivalent mod n if n divides a-b. Here, you will see that the integers mod n also partition Z into n different equivalence classes. You will also look at symmetries (I believe it has an example of a triangle or rectangle) and examine the permutations of the vertices and create a Cayley table. The chapter on groups concludes with a section on subgroups where you learn some basic properties and look at a few theorems and their accompanying proofs to get an idea of what is expected from this course.The next chapter on cyclic groups introduces a few basic theorems (i.e. every subgroup of a cyclic group is cyclic) and explores multiplicative group of complex numbers, which overlaps with some material you've seen from complex analysis. Next, you will learn definitions and notation associated with permutation groups and look at some pretty rigorous proofs (i.e. prove every permutation in Sn can be written as the product of disjoint cycles). You will also examine special types of permutation groups such as the dihedral group and investigate the groups of rigid motions of geometric objects other than a regular n-sided polygon. The material is presented well but I found the next chapter on cosets and Lagrange's Theorem to be quite short (a couple pages) with simply a list of important theorems (Lagrange, Fermat, Euler).

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