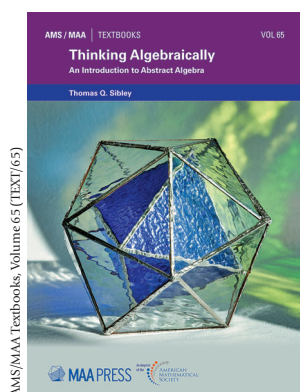




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AMS/MAA Textbooks, Volume 65 (TEXT/65)

Thinking Algebraically by Thomas Q. Sibley

When looking for a textbook for the undergraduate abstract algebra course probably the first thing you ask is groups-first or rings-first. Your preference says something about your philosophical stance on teaching and learning. Groups are simple, more fundamental, and ubiquitous. If you value systematically building logical structures and

starting from the simplest possible place, then you do groups first. On the other hand, rings have a more complicated algebraic structure but every number system your students know and have experience with, starting with the integers, is a ring. If you think that building intuition on a student's existing mental conceptions is important and pedagogically effective, then you'll lean towards rings-first.

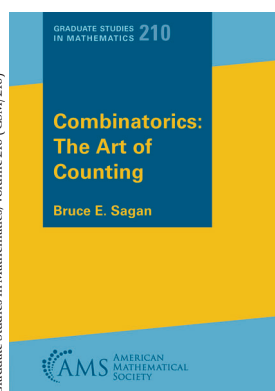
So, step one in teaching abstract algebra is to make a choice. And, like most choices, it's a trade-off. To put it starkly—either you choose logical purity, mathematical elegance, and simplicity, or you choose to allow your students to access their already existing deep intuitions about familiar algebraic structures.

At least, that's what I used to think. Then I read Tom Sibley's *Thinking Algebraically*. Here groups and rings are defined nearly simultaneously and illustrated by a plethora of examples starting with examples the students will find familiar. Sibley begins by treating groups and rings at the same time, introducing and analyzing a variety of structures common to both: isomorphisms and homomorphisms, direct products, and substructures. The idea is that readers are thinking about structures and that this mode of thinking has evolved naturally from the rules-based symbol pushing of high school algebra.

At some point, of course, one has to dive in and start investigating groups and rings in depth, at which point it

makes sense to abandon the simultaneous approach. Eventually we get separate chapters devoted to groups (first) and rings, but by now the students have developed a degree of intuition, they know where the ideas came from, they know how those ideas connect to what came before, and they see the analogies—they are thinking algebraically.

And, even then, Sibley's commitment to building intuition comes through in the exercises. There are hundreds of get-your-hands-dirty-with-concrete-examples exercises, deep project-type exercises, and invitations to undergraduate research. The book is titled perfectly, the student who reads it, and works these beautiful intuition-building exercises, is indeed going to be thinking algebraically.



Graduate Studies in Mathematics, Volume 210 (CSM/210)

Combinatorics: The Art of Counting

by Bruce E. Sagan

Sagan, like Sibley, is laser-focused on building intuition. The exposition in this book is welcoming and packed with motivating examples and clear-eyed descriptions of how to think about the concepts and structures of combinatorics. The book is intended for a first-year graduate or advanced undergraduate course in combinatorics with an emphasis on counting. All the standard things are counted: graphs, trees, partitions, paths, patterns, and permutations. And all the standard techniques are here, and some uncommon ones as well: cyclic sieving, pattern avoidance, combinatorial reciprocity, quotient posets. The prerequisite bar is low, requiring only a thorough grounding in linear algebra, some exposure to abstract algebra, and a modest amount of mathematical maturity. The problems are compelling and intriguing. The great strength of the book is the effort extended by the author not just to show readers the ideas, but to help them learn how to think about the structures and see thematic strands in the subject. In his preface the author uses the word "leisurely" to describe his approach, I think I would say "inviting."

The AMS Bookshelf is prepared bimonthly by AMS Acquisitions Specialist for MAA Press titles Stephen Kennedy. His email address is skennedy@amsbooks.org.