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An invitation to abstract mathematics.

Undergraduate Texts in Mathematics. New York, NY: Springer (ISBN 978-1-4614-6635-2/hbk; 978-1-4614-6636-9/ebook). xiv, 406 p. (2013).

This textbook aims for the spot in many departments' curriculum where students are introduced to advanced mathematics. The book takes a somewhat novel approach of starting and ending with combinatorial games; Hackenbush games appear repeatedly as a motivating example, starting (and ending) with one named Aerion, on account of its horse-like shape. Despite the emphasis on abstract mathematics, as evidenced by the title, the author introduces the game in an applied setting that the reader will likely find both compelling and intriguing: a set of options for two corporations in competition. Those familiar with the surreal numbers will be glad to learn that they make an appearance at the end of the book. Many textbooks in this area straddle the bridge of a discrete mathematics course, and target an audience with interests in computer science. This text definitely focuses on mathematics. The material covers a wide range of material, probably more than most instructors will cover in one semester (such as those whose students come from especially weak backgrounds). The author advises against skipping very much material in the twenty-four chapters, as he believes in the "spiral" method, where topics are introduced in one chapter, then re-introduced in subsequent chapters, with deeper investigation and additional insights. Four appendices cover additional material, including "Famous conjectures in mathematics" and "A top 40 list of math theorems." As chapters vary in both length and difficulty, instructors must take care in their pacing. The style of writing is careful, but joyously enthusiastic; chapter titles feature puns ("Quantifier mechanics", "Order, please!"), some of which require some reading to comprehend ("Games are valuable!"). The author's clear attitude is that mathematics consists of problem solving, and that writing a proof falls into this category. Students of mathematics are, therefore, engaged in problem solving, and should be given problems to solve, rather than problems to imitate. The author attributes this approach to his Hungarian background, citing a "holy trinity" of Hungarian mathematicians within the first few pages (Pólya, Halmos, Erdős), and encourages students to embrace the challenge in the same way an athlete engages in vigorous practice.

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