An invitation to combinatorics by Shariar Shahriari, pp 612, £36.99 (hard), ISBN 978-1-10847-654-6, Cambridge University Press (2021)

Combinatorial analysis is 'the branch of mathematics concerned with the theory of enumeration, or combinations and permutations, in order to solve problems about the possibility of constructing arrangements of objects which satisfy specified conditions' (Collins dictionary, accessed online 25/02/2023). As a mathematical discipline, it is relatively young—its origins are usually attributed to G.W. Leibniz's *Dissertatio de arte combinatoria* from 1666/1690—but with the ascent of discrete mathematics, there has been substantial progress since the 1950s. Teaching combinatorics can be difficult, and the title of Leibniz's tract highlights the problem: Combinatorics is more of an art (and a mindset) than a science; it is best taught at school and as early as possible. But, of course, combinatorics is part of every undergraduate curriculum and Shahriari's new textbook addresses this need. After a brief introduction on tools from discrete mathematics, a glimpse into Ramsey theory and the pigeon-hole principle (Chapters 1 & 2, 75 pages), the main part (Chapters 3–9, 280 pages) of the book is devoted to explaining the 'twelve-fold way' (the name is due to Joel Spencer, the classification system to Gian-Carlo Rota), that covers all enumeration problems between finite sets, placing (un-)distinguishable balls into (un-)distinguishable boxes with (or without) restrictions on the number of balls in any box; in fact, Shahriari expands the twelvefold way into a table with 16 fields. The last two chapters (160 pages) cover some applications in graph theory, posets, matchings and Boolean lattices. There are over 1200 exercises, of which about 240 have hints, 200 come with short answers, and 100 are fully solved. There are also more demanding exercises ('collaborative mini-projects' and 'scaffolded problems') for deeper engagement with the subject and, in the later chapters, collections of (open) problems to initiate undergraduate research. The book is deliberately written in classroom style, in the hope that this makes it more interesting and accessible to students. This, however, comes at a price: the pace is slow, sometimes circumstantial and not very systematic. It lacks the conciseness of Stanley (*Enumerative Combinatorics*, Wadsworth 1986, Cambridge 1997) or Riordan (*An Introduction to Combinatorial Analysis*, Princeton 1978), and the elegance and spirit of Bóna (A walk through combinatorics, World Scientific 2005). The *art* in combinatorics has had to make way for *didactical finesse*.

10.1017/mag.2024.147

RENÉ L. SCHILLING
Fakultät Mathematik Institut für Mathematische Stochastik
TU Dresden 1 D-01062 Dresden, Germany
e-mail: *rene.schilling@tu-dresden.de*

Published by Cambridge University Press on behalf of The Mathematical Association

Modern mathematical logic by Joseph Mileti, pp. 550, £49.99 (hard), ISBN 978-1-10883-314-1, Cambridge University Press (2022)

This is a new, quite sophisticated, introduction to mathematical logic at the upper undergraduate/beginning graduate level. It is nicely written, adaptable to both semester and year-long courses, and organizationally versatile, and it contains more applications to other branches of mathematics than is typical in books at this level. However, although the author makes a considerable effort to motivate the discussion, it is a demanding book, one that may be too demanding for undergraduates at an 'average' university.

I think of this book as comprising five parts. The first part, consisting of the first two chapters, is prefatory. Chapters 3 to 6 constitute a 'core' course in mathematical logic: propositional and first-order logic and their basic theorems (completeness,