multiplication, determinants, etc.) is necessary. A background in basic combinatorics is also desirable, but the author provides an Appendix section on this. Other background Appendix sections cover proof techniques and basic ideas concerning computational complexity.

The preface specifies four different types of possible readers for this book: non-math majors (who would be expected to omit proofs and concentrate on examples), math majors with minimal background, better prepared majors (who can skip the section on proof techniques and do some proofs informally) and graduate students (who would be expected to cover most of the text and do the exercises, marked with a plus sign (+), that are probably too difficult for undergraduates). While I have no hesitation in recommending this book for people in the last three categories, I have some reservations, given the succinctness of the author's writing style, regarding the book's suitability for non-majors. A more appropriate text for such a course might be *Introductory Graph Theory with Applications* by Buckley and Lewinter, which seems to me to be somewhat more accessible to students without experience reading mathematics textbooks.

The exercises in this book deserve special mention. As mentioned above, there are a lot of them (more than 1200, according to the preface), and quite a number seem to be novel. Some are fairly simple, but for others attribution to published work is given. There is a good division between those calling for proofs and those calling for computations. There are no back-of-the-book solutions (a pedagogical plus, in my view) and apparently no published solutions manual.

Another nice feature of the book is an excellent bibliography. It spans 16 pages (of small type) and provides references not only to the textbook literature but also to journal articles, some of them by the author.

The author has clearly given a lot of thought to the pedagogical aspects of this subject over the years. This is reflected in both an occasionally nonstandard approach to order of presentation of the material (the concept of graph isomorphism appears a bit later in the text than in most of the competition, for example) as well as in the inclusion of new approaches to the material and sometimes new proofs as well. It's always a pleasure to find a book with an interesting new point of view.

I will end this review as I began it: this is an attractive new addition to the upper-level undergraduate textbook literature on graph theory, and anybody planning to teach such a course should certainly make its acquaintance, as should anyone who wants a good graph theory reference. I'm glad it's on my shelf.

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Algorithms by Panos Louridas, pp. 312, $15.95 (paper), ISBN 978-0-26253-902-9, MIT Press (2020)

This is a short, accessible and well explained introduction to the world of algorithms. Louridas first takes us through the definition of an algorithm, giving us our first look into what sort of algorithms we will be considering. The set of instructions may initially seem somewhat abstract, but we discover that it has a solid mathematical purpose. The subsequent chapters take us through different types of algorithms, the three chief areas covered being classified as graphs, searching, and sorting. The material increases in complexity until at the end there are solid introductions to very deep concepts such as machine learning and PageRank algorithms. The epilogue to the book introduces but does not elaborate on some more advanced ideas in the study of algorithms such as quantum computing and more general computability theory.

For each chapter, the author takes the reader through some interesting historical context and some motivation towards the central ideas. He then uses that motivation to introduce the central ideas and then uses some examples to explain the concepts further. All this helps to engage readers and to ensure that by the end of the chapter they will have understood where the algorithm comes from, the processes that make up the algorithm and the way that it is relevant to real world applications.

There are few real prerequisites for the reader. I think it could be understood by a student before GCSE, but there is no reason why someone younger couldn't get a firm grasp on the relevant concepts. It might be useful to have met matrix multiplication before, but even that is not seen much in the book and only used in a chapter or so, and the author explains as much is needed to understand what is going on.

I recommend this book to anyone who wants an instructive first book on what algorithms are and how they are used in ways that affect readers' own lives. However, if they already have a good understanding of what an algorithm is then they might only be able to get much out of at most the last couple of chapters. Nevertheless these chapters might be useful in suggesting further reading and the next stages in the study of algorithms.

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The best writing on mathematics 2019 by Mircea Pitici (ed.), pp. 272, £20.00, ISBN 978-0-691-19835-4, Princeton University Press (2019)

This is the tenth annual volume of mathematical essays chosen by Mircea Pitici. In his introduction, the Editor says that the series should be judged in its entirety, rather than as individual volumes, and that the enterprise is to be treated 'not only an anthology of intriguing and stimulating readings', but also as 'a reference work meant to facilitate an easy introduction into the valuable literature on mathematics currently published'.

There are a number of interconnecting themes, but the one that stands out is 'big data'. This is not just the exposure of school pupils to large spreadsheets so that they can utilise them in project work. Increasingly much serious research in mathematics runs up against the issue that the numbers which arise are very big.

The first two contributions address the problem of *gerrymandering*—the drawing of electoral boundaries which result in unfair bias towards one of two interested parties. The contributions are distinctly different in flavour. The first explains that one cannot simply evaluate all possible ways of dividing an area into districts, because there are just too many ways of doing it. Instead of doing systematic enumeration, an approach known as the 'Markov chain Monte Carlo' method is employed. This provides p-values for the likelihood of undesirable outcomes as a result of undertaking large random simulations. The second essay tackles this topic in an entirely different way. The author explains how results such as the Borsuk-Ulam theorem can guarantee desirable outcomes about fairness in dividing a map. This is intriguing from a mathematical point of view—I have always enjoyed the ham sandwich theorem—but I suspect that it is not quite as pertinent as the work described in the first essay.

Other essays explore the way current mathematical research deals with the big data problem. Jeremy Avigad surveys the mechanisation of mathematics using the