

Preface

When we wrote the first edition of this book back in 2004, topics from the social sciences had been gradually making their way into mathematics textbooks for about a decade. These topics remain popular nearly 15 years later, and a renewed interest in politics—sparked largely by the advent of social media and recent developments in both the United States and abroad—has provided a natural opportunity to revise, update, and expand on the material from the first edition.

At its core, this book remains a resource that can be used for independent study, as part of a liberal arts mathematics course, or for a stand-alone course on the mathematics of voting and elections. We and other users have had success in all three of these contexts.

Pedagogically, this book was inspired by our involvement with the Legacy of R. L. Moore Project and our ongoing use of inquiry-based learning in our own teaching. We aimed to capture the spirit of a Moore-style, inquiry-based approach, but we also wanted to make sure that the resulting text was accessible to a non-mathematical audience. To do so, we made a point of writing in a casual and non-threatening tone. We also tried to place each topic of study in its appropriate historical context—and to tell an interesting and engaging story through our investigations.

If you are accustomed to working with more traditional mathematics texts, you may notice several common features that are missing from this one. For one thing, we have not included any worked-out examples within the body of the text. Instead, we have provided “starred” questions whose answers appear in full or in part at the end of each chapter. These questions are intended to help the reader gauge their own understanding of foundational definitions and concepts before moving on to more difficult material. Thus, our starred questions play the same role as examples in other texts, but they do so in a way that forces the reader to more actively engage with the ideas being developed.

We have also not included any repetitious or skill-and-drill type problems, but have instead focused on asking questions that require in-depth analysis and critical thinking skills. In fact, we use these questions not only

to supplement material presented in the text, but also as an essential part of the development of the book's key concepts. For this reason, **it is important for readers to approach this book with pencil and paper close at hand, and to carefully work through each question within the main body of the text before moving on.** The only exceptions to this rule are the Questions for Further Study provided at the end of each chapter, which can be completed more selectively.

It would be difficult to cover all of the material in this book in a one-semester course on voting theory. Certain sections and chapters, however, can be omitted without loss of continuity. Specifically:

- Chapters 1–4 introduce the basics of mathematical voting theory up to Arrow's Theorem, and they should be covered in order. However, the proof of May's Theorem (beginning on page 7) can be omitted from Chapter 1 without causing any difficulties later on.
- Chapter 5 walks the reader through a proof of Arrow's Theorem and then discusses some options for resolving the difficulties revealed by the theorem. This entire chapter can be omitted, although it would be worthwhile to at least cover the section on approval voting (beginning on page 80).
- Chapter 6, which is new to the second edition, covers manipulation of voting systems, focusing mainly on a proof of the Gibbard-Satterthwaite Theorem. The content of this chapter is challenging at times and will appeal to more mathematically sophisticated readers. The entire chapter can be omitted, although the first few pages provide an accessible overview of strategic voting that is worth exploring if time permits.
- Chapters 7 and 8 go together and should be covered in order. They rely only casually on the material in Chapters 1–4.
- Chapters 9, 10, and 11 are essentially independent from the rest of the text and from each other; they can be covered in any order, or omitted. Chapter 9 uses some terminology from Chapters 7 and 8 (specifically, the language of coalitions and power indices) but requires only a surface-level understanding of these ideas.
- Chapter 12—also new to the second edition—covers a host of topics related to gerrymandering. Other than a few passing references, mainly to Chapter 11 (on apportionment), it does not rely heavily on the content of the preceding chapters.

Although our own approach to teaching with this book involves group work, student presentations, discussions, debates, and virtually no lecturing whatsoever, we would encourage instructors to experiment with other techniques and class formats as well. We hope that this book serves as a useful starting point for whatever your goals might be, and we look forward to hearing from you if you have any questions, comments, or suggestions.

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