Preface to the Second Edition

There are certain rules that one must abide by in order to create a successful sequel.

— Randy Meeks, from the trailer to *Scream 2*

While we may not follow the precise rules that Mr. Meeks had in mind for successful sequels, we have made a number of changes to the text in this second edition. In the new edition, we continue to introduce new topics with concrete examples, we provide complete proofs of almost every result, and we preserve the book's friendly style and lively presentation, interspersing the text with occasional jokes and quotations. The first two chapters, on graph theory and combinatorics, remain largely independent, and may be covered in either order. Chapter 3, on infinite combinatorics and graphs, may also be studied independently, although many readers will want to investigate trees, matchings, and Ramsey theory for finite sets before exploring these topics for infinite sets in the third chapter. Like the first edition, this text is aimed at upper-division undergraduate students in mathematics, though others will find much of interest as well. It assumes only familiarity with basic proof techniques, and some experience with matrices and infinite series.

The second edition offers many additional topics for use in the classroom or for independent study. Chapter 1 includes a new section covering distance and related notions in graphs, following an expanded introductory section. This new section also introduces the adjacency matrix of a graph, and describes its connection to important features of the graph. Another new section on trails, circuits, paths, and cycles treats several problems regarding Hamiltonian and Eulerian paths in

graphs, and describes some elementary open problems regarding paths in graphs, and graphs with forbidden subgraphs.

Several topics were added to Chapter 2. The introductory section on basic counting principles has been expanded. Early in the chapter, a new section covers multinomial coefficients and their properties, following the development of the binomial coefficients. Another new section treats the pigeonhole principle, with applications to some problems in number theory. The material on Pólya's theory of counting has now been expanded to cover de Bruijn's more general method of counting arrangements in the presence of one symmetry group acting on the objects, and another acting on the set of allowed colors. A new section has also been added on partitions, and the treatment of Eulerian numbers has been significantly expanded. The topic of stable marriage is developed further as well, with three interesting variations on the basic problem now covered here. Finally, the end of the chapter features a new section on combinatorial geometry. Two principal problems serve to introduce this rich area: a nice problem of Sylvester's regarding lines produced by a set of points in the plane, and the beautiful geometric approach to Ramsey theory pioneered by Erdős and Szekeres in a problem about the existence of convex polygons among finite sets of points in the plane.

In Chapter 3, a new section develops the theory of matchings further by investigating marriage problems on infinite sets, both countable and uncountable. Another new section toward the end of this chapter describes a characterization of certain large infinite cardinals by using linear orderings. Many new exercises have also been added in each chapter, and the list of references has been completely updated.

The second edition grew out of our experiences teaching courses in graph theory, combinatorics, and set theory at Appalachian State University, Davidson College, and Furman University, and we thank these institutions for their support, and our students for their comments. We also thank Mark Spencer at Springer-Verlag. Finally, we thank our families for their patience and constant good humor throughout this process. The first and third authors would also like to add that, since the original publication of this book, their families have both gained their own second additions!

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