Preface

When elementary courses in discrete and combinatorial mathematics first became popular, they usually covered a broad spectrum of pure and applied topics. Most of the students taking such courses were from mathematics and computer science, with a handful of brave souls from other disciplines. Those other students usually found the courses quite difficult. However, the applications were useful in a number of areas.

The teaching of discrete topics has evolved into two streams. The more mathematical parts are studied in courses called *Discrete Mathematics*, and more advanced, more rigorous courses called *Combinatorics*, or named for specific areas (*Graph Theory*, *Combinatorial Designs*, *Cryptography*, and so on). Introductions to those areas of applicable discrete mathematics used by students in business, management and the social sciences are usually called *Finite Mathematics*, and elementary courses on this material are now standard at many colleges and universities. These courses are typically offered at the freshman level although many students take them later in their careers.

This book is designed for a one-semester course in finite mathematics and applications. Often this course will be the student's first mathematical experience at the college level, so I have tried to avoid too much sophistication. Those seeking a more mathematical course should look elsewhere, at the many books on the market that are named *Introduction to Discrete Mathematics* or *Introduction to Combinatorics*.

Outline of Topics

The first chapter contains a brief survey of numbers, equations and elementary set theory, including Venn diagrams. I have also defined averages (means, medians); these concepts are omitted by some authors while others define them after discussing probability, but I find that they fit in naturally as properties of sets of numbers.

Counting is covered in Chapter 2. We discuss selections (combinations) and arrangements (permutations), and the binomial theorem for positive integer index; the

proof of the binomial theorem could be omitted on a first reading. Only the most elementary parts of this topic are covered; readers wanting more details should look in books on discrete mathematics (such as my *A Beginner's Guide to Discrete Mathematics*, Second Edition, also published by Birkhäuser) or combinatorics.

Counting leads naturally to probability theory. In Chapter 3, I have included the main ideas of discrete probability, up to Bayes' theorem. A brief coverage of random variables and expected values (using the discussion of means in Chapter 1) follows, but this may be omitted.

Chapter 4 starts with a section on relations and functions. Most students can skim this material, reading only the subsection *First definitions* and the first paragraph on functions and working the first couple of exercises in each set, but a few instructors prefer to include the harder material. Then we study graph theory, including Euler and Hamilton cycles and coloring problems. This area is omitted from some finite mathematics courses, and the ideas in this chapter are not covered elsewhere in the book, so the whole chapter could be skipped if desired.

Matrices and vectors are defined and discussed briefly in Chapter 5. This course is not the place for algebraic studies, but matrices are useful for studying systems of linear equations, and are also used for input-output models.

In Chapter 6, we discuss linear programming, including the simplex method. Matrices are again useful in this chapter, providing a concise way of representing the calculations. We include a discussion of the two-phase simplex method ("big M method") for solving linear programming problems in which a basic feasible starting point is not obvious.

This is where the first edition ended. However, a number of users asked for some further material. Those who were teaching stronger students wanted a discussion of two-player, zero-sum games. This is an important application of linear programming. So Chapter 7 is now an introduction to the theory of games.

Some other colleagues suggested that beginning business majors would benefit from a discussion of elementary financial mathematics, compound interest and such. So I added a chapter on this area. I have broadened this slightly to include two other areas—population growth and radioactive decay—so that students can see that the mathematics of compounding has applications outside finance.

Problems and Exercises

A number of worked examples, called Sample Problems, are included in the body of each section. Most of these are accompanied by a practice exercise labeled "Your Turn", designed primarily to test the reader's comprehension of the ideas being discussed. It is recommended that students work all of these exercises; complete solutions are provided at the end of the book.

The book contains a large selection of exercises, collected at the end of sections. There should be enough for students to practice the concepts involved; most of the

problems are quite easy. In a departure from the usual method of providing answers to odd-numbered exercises, I have divided the exercises for each section into two sets of roughly the same difficulty, A and B, and provided answers to set A only.

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