PREFACE

In the winter of 1978, Professor George Pólya and I jointly taught Stanford University's introductory combinatorics course. This was a great opportunity for me, as I had known of Professor Pólya since having read his classic book, *How to Solve It*, as a teenager. Working with Pólya, who was over ninety years old at the time, was every bit as rewarding as I had hoped it would be. His creativity, intelligence, warmth and generosity of spirit, and wonderful gift for teaching continue to be an inspiration to me.

Combinatorics is one of the branches of mathematics that play a crucial role in computer science, since digital computers manipulate discrete, finite objects. Combinatorics impinges on computing in two ways. First, the properties of graphs and other combinatorial objects lead directly to algorithms for solving graph-theoretic problems, which have widespread application in non-numerical as well as in numerical computing. Second, combinatorial methods provide many analytical tools that can be used for determining the worst-case and expected performance of computer algorithms. A knowledge of combinatorics will serve the computer scientist well.

Combinatorics can be classified into three types: enumerative, existential, and constructive. Enumerative combinatorics deals with the counting of combinatorial objects. Existential combinatorics studies the existence or nonexistence of combinatorial configurations. Constructive combinatorics deals with methods for actually finding specific configurations (as opposed to merely demonstrating their existence theoretically). The first two-thirds of our course, taught by Professor Pólya, dealt with enumerative combinatorics, including combinations, generating functions, the principle of inclusion and exclusion, Stirling numbers, and Pólya's own theory of counting. The last third of the course, taught by me, covered existential combinatorics, with an emphasis on algorithmic graph theory, and included matching, network flow, Hamiltonian and Eulerian paths, and planar graphs.

Donald Woods, our teaching assistant, was not only invaluable in helping us give the course but also was able to prepare readable and comprehensive course notes, which he has edited to form the present book. Don did a masterful job in making sense out of our

ramblings and adding observations and references of his own. Were I to teach the course again these notes would be indispensable. I hope you will enjoy them.

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