

Preface

The best way to get to know Yosemite National Park is to walk through it, on many different paths. In the optimal case, the gorgeous sights provide ample compensation for our sore muscles. In this book, we intend to explain the basics of Combinatorics while walking through its beautiful results. Starting from our very first chapter, we will show numerous examples of what may be the most attractive feature of this field: that *very* simple tools can be *very* powerful at the same time. We will also show the other side of the coin, that is, that sometimes totally elementary-looking problems turn out to be unexpectedly deep, or even unknown.

This book is meant to be a textbook for an introductory combinatorics course that can take one or two semesters. We included a very extensive list of exercises, ranging in difficulty from “routine” to “worthy of independent publication”. In each section, we included exercises that contain material not explicitly discussed in the text before. We chose to do this to provide instructors with some extra choices if they want to shift the emphasis of their course.

It goes without saying that we covered the classics, that is, combinatorial choice problems, and graph theory. We included some more elaborate concepts, such as Ramsey theory, the Probabilistic Method, and Pattern Avoidance (the latter is probably a first of its kind). While we realize that we can only skim the surface of these areas, we believe they are interesting enough to catch the attention of some students, even at first sight. Most undergraduate students enroll in at most one Combinatorics course during their studies, therefore it is important that they see as many captivating examples as possible. It is in this spirit that we included two new chapters in the second edition, on Algorithms, and on Computational Complexity. We believe that the best undergraduate students, those who will get to

the end of the book, should be acquainted with the extremely intriguing questions that abound in these two areas.

We wrote this book as we believe that combinatorics, researching it, teaching it, learning it, is always fun. We hope that at the end of the walk, readers will agree.

Exercises that are thought to be significantly harder than average are marked by one or more + signs. An exercise with a single + sign is probably at the level of a harder homework problem. The difficulty level of an exercise with more than one + sign may be comparable to an independent publication.

We provide Supplementary Exercises without solutions at the end of each chapter. These typically include, but are not limited to, the easiest exercises in that chapter. A solution manual for the Supplementary Exercises is available for Instructors.