Preface

After having mastered some high-level programming language and acquired knowledge in basic mathematics, it is time for a shift of attention. Instead of concentrating on the technical aspects of *how* to instruct a computer to perform a certain task, we switch to the more challenging question of *what* in fact should be done to solve a given problem. The aim of this book on data structures is to start acquainting the reader with the theoretical side of the art of writing computer programs. This may be considered as a first step in getting familiar with a series of similar fields, such as algorithms, complexity, and computability, that should be learned in parallel to improve practical programming skills.

The book is the result of several decades of teaching experience in data structures and algorithms. In particular, I have taught a course on Data Structures more than 30 times. The book is self-contained and does not assume any prior knowledge of data structures, just a comprehension of basic programming and mathematics tools generally learned at the very beginning of computer science or other related studies. In my university, the course is given in the second semester of the first year of the BSc program, with a prerequisite of Discrete Mathematics and Introduction to Programming, which are first-semester courses. The format is two hours of lecture plus two hours of exercises, led by a teaching assistant, per week.

I have tried to reproduce my oral teaching style in writing. I believe in associative learning, in which one topic leads to another, related one. Although this may divert attention from the central, currently treated subject, it is the cumulative impact of an entire section or chapter that matters. There was no intention to produce a comprehensive compendium of all there is to know about data structures but rather to provide a collection of what many could agree to be its basic ingredients and major building blocks, on which subsequent courses on algorithms could rely. In addition, many more advanced topics are mentioned.

Each chapter comes with its own set of exercises, many of which have appeared in written exams. Solutions to selected exercises appear in the appendix. There are short inserts treating some background concepts: they are slightly indented, set in another font, and separated from the main text by rules. Though each chapter could be understood on its own, even if it has pointers to earlier material, the book has been written with the intent of being read sequentially.

There is of course a long list of people to whom I am indebted for this project, and it is not possible to mention them all. Foremost, I owe all I know to the continuous efforts of my late father to offer me, from childhood on, the best possible education in every domain. This included also private lessons, and I am grateful to my teacher R. Gedalya Stein, who interspersed his Talmud lessons with short flashes to notions of grammar, history, and more, and thereby planted the seeds of the associative learning techniques I adopted later. There is no doubt that my high school mathematics teacher Fernand Biendel was one of the best; he taught us rigor and deep understanding, and the fact that more than half of our class ended up with a PhD in mathematics should be credited to him.

I wish to thank all my teachers at the Hebrew University of Jerusalem and at the Weizmann Institute of Science in Rehovot as well as my colleagues at Bar-Ilan University and elsewhere. Many of them had an impact on my academic career, especially the advisors for my theses, Eli Shamir and Aviezri Fraenkel. Amihood Amir is directly responsible for this book because he asked me, when he was department chair, to teach the course on Data Structures. Thanks also to Franya Franek for providing a contact at Cambridge University Press.

Last, but not least, I wish to thank my spouse and children, to whom this book is dedicated, for their ongoing encouragement and constructive comments during the whole writing period. As to my grandchildren, they have no idea what this is all about, so I thank them for just being there and lighting up my days with their love.