

# Preface

This book is intended as an homage to Prof. Rolf H. Möhring, an accomplished leader in the field of combinatorial optimization and graph algorithms. We contacted his former advisees who have successfully launched their own academic careers. We asked them each to pick a topic that they thought would be both interesting and accessible to a wide audience with a basic knowledge of graphs, algorithms, and optimization. The result is this collection of beautiful results.

The reader can learn about the connection between shortest paths and mechanism design, about the interplay of priority rules in scheduling and the existence of pure-strategy Nash equilibria in weighted congestion games, about the critical role played by matroids in the existence of pure-strategy Nash equilibria in resource-buying games, about some geometric commonality between proportional resource allocation and selfish flows, about using the gasoline puzzle and the adjacency structure of the matching polytope to solve the budgeted matching problem, about the relation between the knotting graph and the linear structure of graphs, about convex programming relaxations and randomized rounding in scheduling, about the significance of motifs in network analysis, about the analogy between contraction hierarchies used for fast shortest path computations and (perfect) elimination orderings in graphs, about universally good algorithms for the knapsack problem with varying capacity and for a scheduling problem, about the pivotal role of Hanan grids for the minimum Steiner tree problem for rectilinear distances, about a linear-time algorithm that computes the longest tour for points in the plane under the taxicab distance, and about a characterization of certain rectangular dissections with surprising applications.

Each chapter can easily be used as the basis for a lecture or two in an advanced undergraduate course or in a graduate course on graph algorithms, combinatorial optimization, algorithmic game theory, or computational geometry. For improved readability, citations within a chapter are kept to a minimum, but each chapter concludes with a discussion of the relevant literature and provides pointers for further reading.

We are indebted to all the contributors for their enthusiasm about our idea and the time and care they put into preparing their chapters. We also wish to thank Martin Peters for his excitement about our proposal and for making this book possible and Ruth Allewelt for all her support and helpful guidance during the various phases of this project. Finally, on behalf of all his former advisees, we would like to express our deep gratitude to Rolf Möhring. Learning from and working with him has sharpened and broadened our minds. The topics covered in this book are reflective of his wide interests. He has been a wonderful mentor and a true source of inspiration in all these years.

Andreas S. Schulz  
Martin Skutella  
Sebastian Stiller  
Dorothea Wagner

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Schulz, A.S.; Skutella, M.; Stiller, S.; Wagner, D. (Eds.)

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