Preface

Many of the technological innovations and achievements of recent decades have relied on *algorithmic ideas*, facilitating new applications in science, medicine, production, logistics, traffic, communication, and, last but not least, entertainment. Efficient algorithms not only enable your personal computer to execute the newest generation of games with features unthinkable only a few years ago, but they are also the key to several recent scientific breakthroughs. For example, the sequencing of the human genome would not have been possible without the invention of new algorithmic ideas that speed up computations by several orders of magnitude.

Algorithms specify the way computers process information and how they execute tasks. They organize data and enable us to search for information efficiently. Only because of clever algorithms used by search engines can we find our way through the information jungle in the World-Wide Web. Reliable and secure communication in the Internet is provided by ingenious coding and encryption algorithms that use fast arithmetic and advanced cryptographic methods. Weather forecasting and climate change analysis rely on efficient simulation algorithms. Production and logistics planning employs smart algorithms that solve difficult optimization problems. We even rely on algorithms that perform GPS localization and routing based on efficient shortest-path computation for finding our way to the next restaurant or coffee shop.

Algorithms are not only executed on what people usually think of as computers but also on embedded microprocessors that can be found in industrial robots, cars and aircrafts, and in almost all household appliances and consumer electronics. For example, your MP3 player uses a clever compression algorithm that saves tremendous amounts of storage capacity. Modern cars and aircrafts contain not only one but several hundreds or even thousands of microprocessors. Algorithms regulate the combustion engine in cars, thereby reducing fuel consumption and air pollution. They control the braking system and the steering system in order to improve the vehicle's stability for your safety. In the near future, microprocessors might completely take over the controls, allowing for fully automated car driving in certain standardized

situations. In modern aircraft, this is already put into practice for all phases of a flight from takeoff to landing.

The greatest improvements in the area of algorithms rely on beautiful ideas for tackling or solving computational problems more efficiently. The problems solved by algorithms are not restricted to arithmetic tasks in a narrow sense but often relate to exciting questions of nonmathematical flavor, such as:

- How to find an exit from inside a labyrinth or maze?
- How to partition a treasure map so that the treasure can only be found if all parts of the map are recombined?
- How to plan a tour visiting several places in the cheapest possible order?

Solving these challenging problems requires logical reasoning, geometric and combinatorial imagination, and, last but not least, creativity. Indeed, these are the main skills needed for the design and analysis of algorithms.

In this book we present some of the most beautiful algorithmic ideas in 41 articles written by different authors in colloquial and nontechnical language. Most of the articles arose out of an initiative among German-language universities to communicate the fascination of algorithms and computer science to high-school students. The book can be understood without any particular previous knowledge about algorithms and computing. We hope it is enlightening and fun to read, not only for students but also for interested adults who want to gain an introduction to the fascinating world of algorithms.

Berthold Vöcking
Helmut Alt
Martin Dietzfelbinger
Rüdiger Reischuk
Christian Scheideler
Heribert Vollmer
Dorothea Wagner

http://www.springer.com/978-3-642-15327-3

Algorithms Unplugged

Vöcking, B.; Alt, H.; Dietzfelbinger, M.; Reischuk, R.;
Scheideler, C.; Vollmer, H.; Wagner, D. (Eds.)

2011, X, 406 p., Hardcover
ISBN: 978-3-642-15327-3