Contents

1 A Short Story About the Development of Computer Science or Why Computer Science Is Not a Computer Driving Licence 1
1.1 What Do We Discover Here? 1
1.2 Fundamentals of Science 2
1.3 The End of Euphoria 19
1.4 The History of Computer Science 24
1.5 Summary 33

2 Algorithmics, or What Have Programming and Baking in Common? 37
2.1 What Do We Find out Here? 37
2.2 Algorithmic Cooking 38
2.3 What About Computer Algorithms? 45
2.4 Unintentionally Never-Ending Execution 61
2.5 Summary 69

3 Infinity Is Not Equal to Infinity, or Why Infinity Is Infinitely Important in Computer Science 73
3.1 Why Do We Need Infinity? 73
3.2 Cantor's Concept 77
3.3 Different Infinite Sizes 107
3.4 Summary 114

Bibliografische Informationen
http://d-nb.info/990736180

digitalisiert durch DEUTSCHE NATIONAL BIBLIOTHEK

4 Limits of Computability or Why Do There Exist Tasks That Cannot Be Solved Automatically by Computers 117
4.1 Aim 117
4.2 How Many Programs Exist? 118
4.3 YES or NO, That Is the Question 125
4.4 Reduction Method 133
4.5 Summary 155

5 Complexity Theory or What to Do When the Energy of the Universe Doesn't Suffice for Performing a Computation? 161
5.1 Introduction to Complexity Theory 161
5.2 How to Measure Computational Complexity? 163
5.3 Why Is the Complexity Measurement Useful? 169
5.4 Limits of Tractability 174
5.5 How Do We Recognize a Hard Problem? 178
5.6 Help, I Have a Hard Problem 190
5.7 Summary 195

6 Randomness in Nature and as a Source of Efficiency in Algorithmics 201
6.1 Aims 201
6.2 Does True Randomness Exist? 203
6.3 Abundant Witnesses Are Useful 210
6.4 High Reliabilities 228
6.5 What Are Our Main Discoveries Here? 234

7 Cryptography, or How to Transform Drawbacks into Advantages 239
7.1 A Magical Science of the Present Time 239
7.2 Prehistory of Cryptography 241
7.3 When Is a Cryptosystem Secure? 246
7.4 Symmetric Cryptosystems 249
7.5 How to Agree on a Secret in Public Gossip? 253
7.6 Public-Key Cryptosystems 260
7.7 Milestones of Cryptography 272

8 Computing with DNA Molecules, or Biological Computer Technology on the Horizon 277
8.1 The Story So Far 277
8.2 How to Transform a Chemical Lab into a DNA Computer 282
8.3 Adleman's Experiment 288
8.4 The Future of DNA Computing 296

9 Quantum Computers, or Computing in the Wonderland of Particles 299
9.1 Prehistory 299
9.2 The Wonderland of Quantum Mechanics 302
9.3 How to Compute in the World of Particles? 309
9.4 The Future of Quantum Computing 320

10 How to Make Good Decisions for an Unknown Future or How to Foil an Adversary 325
10.1 What Do We Want to Discover Here? 325
10.2 Quality Measurement of Online Algorithms 327
10.3 A Randomized Online Strategy 338
10.4 Summary 356

References 359

Index 361