

# CONTENTS

## Chapter 1. Shortest Paths

1.1 Graph Terminology .....	1
1.2 Shortest Path .....	3
1.3 Multiterminal Shortest Paths.....	10
1.4 Decomposition Algorithm .....	17
1.5 Acyclic Network .....	23
1.6 Shortest Paths in a General Network .....	24
1.7 Minimum Spanning Tree.....	27
1.8 Breadth-first-search and Depth-first-search .....	30

## Chapter 2. Maximum Flows

2.1 Maximum Flow .....	40
2.2 Algorithms for Max Flows .....	46
2.2.1 Ford and Fulkerson .....	46
2.2.2 Karzanov's Algorithm.....	53
2.2.3 MPM Algorithms.....	56
2.2.4 Analysis of Algorithms .....	58
2.3 Multi-terminal Maximum Flows .....	60
2.3.1 Realization .....	62
2.3.2 Analysis .....	63
2.3.3 Synthesis .....	76
2.3.4 Multi-commodity Flows .....	82
2.4 Minimum Cost Flows.....	83
2.5 Applications.....	86

## CONTENTS

2.5.1 Sets of Distinct Representatives .....	87
2.5.2 PERT .....	89
2.5.3 Optimum Communication Spanning Tree .....	94

## Chapter 3. Dynamic Programming

3.1 Introduction.....	107
3.2 Knapsack Problem.....	113
3.3 Two-dimensional Knapsack Problem.....	121
3.4 Minimum-Cost Alphabetic Tree.....	127
3.5 Summary .....	132

## Chapter 4. Backtracking

4.1 Introduction.....	138
4.2 Estimating the Efficiency of Backtracking .....	145
4.3 Branch and Bound .....	147
4.4 Game-tree .....	151

## Chapter 5. Binary Tree

5.1 Introduction.....	162
5.2 Huffman's Tree .....	164
5.3 Alphabetic Tree.....	171
5.4 Hu-Tucker Algorithm.....	173
5.5 Feasibility and Optimality.....	180
5.6 Garsia and Wachs' Algorithm .....	188
5.7 Regular Cost Function .....	191
5.8 T-ary Tree and Other Results.....	195

## CONTENTS

### Chapter 6. Heuristic and Near Optimum

6.1 Greedy Algorithm .....	202
6.2 Bin-packing.....	209
6.3 Job-scheduling.....	222
6.4 Job-scheduling (tree-constraints) .....	229

### Chapter 7. Matrix Multiplication

7.1 Strassen's Matrix Multiplication.....	240
7.2 Optimum Order of Multiplying Matrices.....	241
7.3 Partitioning a Convex Polygon .....	242
7.4 The Heuristic Algorithm .....	254

### Chapter 8. NP-complete

8.1 Introduction.....	273
8.2 Polynomial Algorithms.....	275
8.3 Nondeterministic Algorithms .....	278
8.4 NP-complete Problems.....	279
8.5 Facing a New Problem .....	282