

Contents

<i>Foreword by Richard M. Karp</i>	<i>page</i> vii
<i>Preface to the Second Edition</i>	ix
<i>Preface to the First Edition</i>	xi
1 Paths in Graphs	1
1.1 Introduction to Graph Theory	1
1.2 Computer Representation of Graphs	3
1.3 Euler Graphs	6
1.4 De Bruijn Sequences	9
1.5 Shortest-Path Algorithms	11
1.6 Problems	22
2 Trees	29
2.1 Tree Definitions	29
2.2 Minimum Spanning Tree	31
2.3 Cayley's Theorem	34
2.4 Directed Tree Definitions	37
2.5 The Infinity Lemma	39
2.6 Problems	42
3 Depth-First Search	46
3.1 DFS of Undirected Graphs	46
3.2 Algorithm for Nonseparable Components	52
3.3 DFS on Directed Graphs	57
3.4 Strongly Connected Components of a Digraph	58
3.5 Problems	62
4 Ordered Trees	65
4.1 Uniquely Decipherable Codes	65

vi	<i>Contents</i>	
	4.2 Positional Trees and Huffman's Optimization Problem	69
	4.3 Application of the Huffman Tree to Sort-by-Merge Techniques	75
	4.4 Catalan Numbers	77
	4.5 Problems	82
5	Flow in Networks	85
	5.1 Introduction	85
	5.2 The Algorithm of Ford and Fulkerson	87
	5.3 The Dinitz Algorithm	94
	5.4 Networks with Upper and Lower Bounds	102
	5.5 Problems	109
	5.6 Notes by Andrew Goldberg	115
6	Applications of Network Flow Techniques	117
	6.1 Zero-One Network Flow	117
	6.2 Vertex Connectivity of Graphs	121
	6.3 Connectivity of Digraphs and Edge Connectivity	129
	6.4 Maximum Matching in Bipartite Graphs	135
	6.5 Two Problems on PERT Digraphs	137
	6.6 Problems	141
7	Planar Graphs	146
	7.1 Bridges and Kuratowski's Theorem	146
	7.2 Equivalence	157
	7.3 Euler's Theorem	158
	7.4 Duality	159
	7.5 Problems	164
8	Testing Graph Planarity	168
	8.1 Introduction	168
	8.2 The Path Addition Algorithm of Hopcroft and Tarjan	169
	8.3 Computing an st-Numbering	177
	8.4 The Vertex Addition Algorithm of Lempel, Even, and Cederbaum	179
	8.5 Problems	185
	<i>Index</i>	187