## Contents

Preface	ix
Acknowledgments	xv
Chapter 8. Trees and Binary Trees	1
8.1. Introduction	1
8.2. Trees: definition and basic terminologies	1
8.2.1. Definition of trees	1
8.2.2. Basic terminologies of trees	2
8.3. Representation of trees	3
8.4. Binary trees: basic terminologies and types	6
8.4.1. Basic terminologies.	6
8.4.2. Types of binary trees.	7
8.5. Representation of binary trees.	8
8.5.1. Array representation of binary trees	8
8.5.2. Linked representation of binary trees	10
8.6. Binary tree traversals	11
8.6.1. Inorder traversal.	12
8.6.2. Postorder traversal	16
8.6.3. Preorder traversal	19
8.7. Threaded binary trees	22
8.7.1. Linked representation of a threaded binary tree	24
•	
8.7.2. Growing threaded binary trees	24

8.8. Applications	25
8.8.1. Expression trees	26
8.8.2. Traversals of an expression tree	27
8.8.3. Conversion of infix expression to postfix expression	27
8.8.4. Segment trees	31
8.9. Illustrative problems	42
Chapter 9. Graphs	61
9.1. Introduction	61
9.2. Definitions and basic terminologies	63
9.2. Definitions and basic terminologies	03 75
9.3.1. Sequential representation of graphs	76 80
	80 81
9.4. Graph traversals	81
9.4.1. Breadth first traversal	
9.4.2. Depth first traversal	83
9.5. Applications	87
9.5.1. Single source shortest path problem	87
<ul><li>9.5.2. Minimum cost spanning trees</li></ul>	90 97
	21
Chapter 10. Binary Search Trees and AVL Trees	115
10.1. Introduction	115
10.2. Binary search trees: definition and operations.	115
10.2.1. Definition.	115
10.2.2. Representation of a binary search tree.	116
10.2.2. Retrieval from a binary search tree.	117
10.2.4. Why are binary search tree retrievals more efficient	11/
than sequential list retrievals?	118
10.2.5. Insertion into a binary search tree	120
10.2.6. Deletion from a binary search tree	120
10.2.7. Drawbacks of a binary search tree	125
10.2.8. Counting binary search trees	123
10.3. AVL trees: definition and operations	120
10.3.1. Definition	130
10.3.2. Retrieval from an AVL search tree.	131
10.3.3. Insertion into an AVL search tree	132
10.3.4. Deletion from an AVL search tree	133
10.3.5. R category rotations associated with the delete operation	141
10.3.6. L category rotations associated with the delete operation	
ro.s.o. is callegoly rotations associated with the delete operation	150

10.4.1. Representation of symbol tables in compiler design.	151 151
10.5. Illustrative problems	154
Chapter 11. B Trees and Tries	175
11.1. Introduction	175
11.2. <i>m</i> -way search trees: definition and operations	176
11.2.1. Definition	176
11.2.2. Node structure and representation	176
11.2.3. Searching an <i>m</i> -way search tree	178
11.2.4. Inserting into an <i>m</i> -way search tree	178
11.2.5. Deleting from an <i>m</i> -way search tree	179
11.2.6. Drawbacks of <i>m</i> -way search trees	184
11.3. B trees: definition and operations	184
11.3.1. Definition	184
11.3.2. Searching a B tree of order <i>m</i>	186
11.3.3. Inserting into a B tree of order $m$	186
11.3.4. Deletion from a B tree of order $m$	190
11.3.5. Height of a B tree of order <i>m</i>	194
11.4. Tries: definition and operations	195
11.4.1. Definition and representation	195
11.4.2. Searching a trie	197
11.4.3. Insertion into a trie	197
11.4.4. Deletion from a trie	197
11.4.5. Some remarks on tries	200
	200
11.5. Applications.	200
11.5.1. File indexing	
11.5.2. Spell checker	203 204
11.6. Illustrative problems	204
Chapter 12. Red-Black Trees and Splay Trees	215
12.1. Red-black trees.	215
12.1.1. Introduction to red-black trees	215
12.1.2. Definition.	216
12.1.2. Definition of a red-black tree	219
12.1.4. Searching a red-black tree	219
12.1.4. Searching a red-black tree	220
12.1.5. Deleting from a red-black tree	220
12.1.0. Deteting from a red-black free	220
on a red-black tree	236

12.2. Splay trees.12.2.1. Introduction to splay trees12.2.2. Splay rotations.12.2.3. Some remarks on amortized analysis of splay trees12.3. Applications.12.4. Illustrative problems.	236 236 237 242 244 245
References	261
Index	263
Summaries of other volumes	265