

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/326477402>

# Design and Analysis of Algorithms

Book · July 2018

---

CITATIONS

2

---

READS

5,480

2 authors, including:



[Soumya Ranjan Jena](#)

Galgotias University

17 PUBLICATIONS 21 CITATIONS

SEE PROFILE

# CONTENTS

<i>Chapters</i>	<i>Page No.</i>
<i>Foreword</i> .....	(v)
<i>Preface</i> .....	(vi)
<b>0. READER'S MANUAL .....</b>	<b>1–6</b>
0.1 Objectives of Learning Algorithms .....	2
0.2 Why to Choose the Book .....	3
0.3 Organization of the Book .....	3
0.4 List of Important Notations .....	5
<b>1. OVERVIEW .....</b>	<b>7–11</b>
1.1 Introduction .....	8
1.2 Beginning Designing Algorithm .....	8
<i>Chapter Notes</i> .....	11
<i>Exercises</i> .....	11
<b>2. FRAMEWORK OF ALGORITHM ANALYSIS .....</b>	<b>12–21</b>
2.1 Introduction .....	13
2.2 The Basics .....	13
2.3 Definitions of Preliminary Terms .....	14
2.4 Phases of Algorithm Construction .....	15
2.5 Mathematical Model of a Computer: RAM Model .....	17
2.6 EM Model .....	19
2.7 PRAM Model .....	20
<i>Chapter Notes</i> .....	20
<i>Exercises</i> .....	21

<b>3.</b>	<b>ASYMPTOTIC NOTATION .....</b>	<b>22–39</b>
3.1	Introduction .....	23
3.2	Types of Notations .....	24
3.3	Relational Properties of Asymptotic Notations .....	26
3.4	Some Standard Notations and Common Functions .....	26
	Chapter Notes .....	39
	Exercises .....	39
<b>4.</b>	<b>SORTING ALGORITHMS .....</b>	<b>40–58</b>
4.1	Introduction .....	41
4.2	Insertion Sort .....	42
4.3	Bubble Sort .....	49
4.4	Selection Sort .....	51
4.5	Counting Sort .....	52
4.6	Radix Sort .....	54
4.7	Bucket Sort .....	56
	Chapter Notes .....	57
	Exercises .....	58
<b>5.</b>	<b>DIVIDE AND CONQUER APPROACH .....</b>	<b>59–71</b>
5.1	Introduction .....	60
5.2	Merge Sort .....	60
5.3	An $n \log n$ Lower Bound for Sorting .....	63
5.4	Pros and Cons of Merge Sort .....	64
5.5	Strassen's Matrix Multiplication .....	67
	Chapter Notes .....	71
	Exercises .....	71
<b>6.</b>	<b>RECURRENCES .....</b>	<b>72–107</b>
6.1	Introduction .....	73
6.2	Substitution Method .....	73
6.3	Recursion-Tree Method .....	83
6.4	Master Theorem .....	100
	Chapter Notes .....	106
	Exercises .....	107
<b>7.</b>	<b>BINARY SEARCH .....</b>	<b>108–113</b>
7.1	Introduction .....	109
7.2	Algorithm Steps .....	110

<i>Chapters</i>	<i>Page No.</i>
7.3 Pros and Cons of Binary Search .....	111
Chapter Notes .....	113
Exercises .....	113
<b>8. QUICKSORT .....</b>	<b>114–125</b>
8.1 Introduction .....	115
8.2 Quicksort Algorithm .....	116
8.3 Pros and Cons of Quicksort .....	117
8.4 Random Quicksort .....	120
Chapter Notes .....	124
Exercises .....	124
<b>9. ORDER STATISTICS .....</b>	<b>126–134</b>
9.1 Introduction .....	127
9.2 The Selection Problem .....	128
9.3 Algorithm for Finding Maximum and Minimum .....	128
9.4 Algorithm for Finding <i>i</i> th Smallest Element .....	129
Chapter Notes .....	134
Exercises .....	134
<b>10. HEAPSORT .....</b>	<b>135–158</b>
10.1 Introduction .....	136
10.2 Heaps .....	137
10.3 Types of Heaps .....	139
10.4 Algorithm for Max-Heapify .....	140
10.5 Algorithm for Building Max-Heap .....	144
10.6 Heapsort-Algorithms .....	149
10.7 Pros and Cons of Heapsort .....	157
Chapter Notes .....	158
Exercises .....	158
<b>11. PRIORITY QUEUES .....</b>	<b>159–169</b>
11.1 Introduction .....	160
11.2 Types of Priority Queues .....	160
11.3 Algorithm for Max-Priority Queue Operations .....	161
11.4 Different Applications of Priority Queue .....	162
Chapter Notes .....	168
Exercises .....	169

<b>12.</b>	<b>DYNAMIC PROGRAMMING .....</b>	<b>170–189</b>
12.1	Introduction .....	171
12.2	Longest Common Subsequence (LCS) .....	172
12.3	Chain Matrix Multiplication .....	177
	Chapter Notes .....	188
	Exercises .....	189
<b>13.</b>	<b>GREEDY ALGORITHMS .....</b>	<b>190–206</b>
13.1	Introduction .....	191
13.2	Activity Selection Problem/Activity Scheduling .....	192
13.3	Elements of Greedy Strategy .....	194
13.4	Knapsack Problem (Rucksack Problem) .....	195
13.5	Huffman Coding .....	197
	Chapter Notes .....	205
	Exercises .....	206
<b>14.</b>	<b>ELEMENTARY GRAPH ALGORITHMS .....</b>	<b>207–277</b>
14.1	Introduction .....	208
14.2	Representation of Graphs and Digraphs .....	210
14.3	Graph Traversal Techniques .....	212
14.4	Breadth-First Search (BFS) .....	213
14.5	Depth-First Search (DFS) .....	226
14.6	Applications of DFS .....	240
14.7	Minimum Spanning Tree .....	245
14.8	Kruskal's Algorithm .....	248
14.9	Prim's Algorithm .....	252
14.10	Single Source Shortest Paths .....	260
14.11	Dijkstra's Algorithm .....	261
14.12	The Bellman-Ford Algorithm .....	264
14.13	All-Pairs Shortest Paths .....	268
14.14	Floyd-Warshall Algorithm .....	269
	Chapter Notes .....	276
	Exercises .....	276
<b>15.</b>	<b>BACKTRACKING .....</b>	<b>278–284</b>
15.1	Introduction .....	279
15.2	N-Queens Problem .....	279
15.3	Subset Sum Problem .....	282

<i>Chapters</i>	<i>Page No.</i>
15.4 Graph Coloring Problem .....	283
<i>Chapter Notes</i> .....	284
<i>Exercises</i> .....	284
<b>16. STRING MATCHING .....</b>	<b>285–298</b>
16.1 Introduction .....	286
16.2 Brute-Force String Matching Algorithm .....	288
16.3 Rabin-Karp String Matching Algorithm .....	292
<i>Chapter Notes</i> .....	298
<i>Exercises</i> .....	298
<b>17. NP-COMPLETENESS AND APPROXIMATION ALGORITHMS .....</b>	<b>299–333</b>
17.1 Introduction .....	300
17.2 Matching Problem .....	302
17.3 Reductions and its Applications .....	303
17.4 The Classes : P and NP .....	306
17.5 NP-hard and NP-complete .....	309
17.6 Satisfiability (SAT) .....	310
17.7 Cook's Theorem .....	311
17.8 Common NP-complete Problems with Proofs .....	312
17.9 Other Useful NP-complete Problems .....	321
17.10 Other Important Complexity Classes .....	322
17.11 Approximation Algorithms .....	323
17.12 Different Approximation Schemes .....	331
17.13 History of NP-completeness .....	332
<i>Chapter Notes</i> .....	332
<i>Exercises</i> .....	333
<b>APPENDIX-I : Mathematical Background .....</b>	<b>334–338</b>
<b>APPENDIX-II : Table for Time Complexity of Algorithms .....</b>	<b>339–341</b>
<b>APPENDIX-III : Solved University Question Papers .....</b>	<b>342–378</b>
<b>APPENDIX-IV : Chapterwise Short Type Questions with Answers .....</b>	<b>379–410</b>
<b>APPENDIX-V : Brain Teasers from GATE (Solved) .....</b>	<b>411–426</b>
<b>APPENDIX-VI : Model Question Papers for Practice .....</b>	<b>427–432</b>
<b>FURTHER READINGS .....</b>	<b>433</b>
<b>INDEX .....</b>	<b>433–437</b>