

Table of Contents

Chapter 1: Introduction to Data Structures	1
1.1 Data Types in C++	2
Integer Types	2
Character Types.....	3
Floating-point Types	3
Variables Names	4
1.2 Arrays.....	4
Extraction and storing in an array	7
1.3 Linked List	8
1.4 Trees	8
1.5 Graphs.....	9
1.6 Structures	10
Specifying the Structure	11
Defining a Structure Variable	12
Accessing Structure Members	13
Initialization of Structure Variable	14
1.7 Iteration.....	15
1.8 Recursion.....	16
1.9 Fibonacci Numbers	20
1.10 Comparison of Recursion with Iteration	24
1.11 Tail Recursion.....	24
1.12 Advantage of Recursion	25
1.13 Pointers	25
1.14 Pass by Value and Pass by Reference.....	33
Pass by Value	33
Pass by Reference.....	34
Passing an Array to a Function	35
Passing a Structure to a function by the Value Method.....	36
Passing a Structure to the Function by Reference Method	37
Using a Pointer to a Structure	38
1.15 Classes.....	39
1.16 Static Memory Allocation	41
1.17 Dynamic Memory Allocation	41
New Operator	42
Delete Operator	42

Summary	43
Exercise	44
Chapter 2: Arrays	45
2.1 Row Major Representation.....	47
2.2 Column Major Representation	48
Summary	54
Exercise	54
Chapter 3: Linked List.....	55
3.1 Advantages of a Linked List	57
3.2 Disadvantages of a Linked List	57
3.3 Types of a Linked List.....	57
Singly Linked List	58
Doubly Linked list (Two-way Linked List)	74
Reversing a Singly Linked List.....	122
3.4 Header Linked List	128
3.5 Deleting a Node	133
3.6 Two-Way Header Lists	136
3.7 Reversing the Links of a Linked List	144
First method	144
Second Method	146
3.8 Sorting a Linked List	150
Summary	154
Exercises.....	154
Chapter 4: Stacks and Queues	155
4.1 Abstract Data Types (ADT).....	156
4.2 Implementing Stacks with Arrays	156
4.3 Algorithm for the Push Operation	157
4.4 Algorithm for the Pop Operation	158
4.5 Algorithm for the Peep Operation.....	158
4.6 Queue	161
Types of Queues	161
4.7 Circular Linked List.....	183
4.8 Sparse Matrix.....	187
Summary	202
Exercises.....	203
Chapter 5: Trees	205
5.1 Properties of a Tree	206
5.2 Types of Trees	206
5.3 Levels of a Tree	207
5.4 Converting a General Tree into a Binary Tree.....	207

5.5	Forest	209
5.6	Binary tree	210
	Complete Binary Tree.....	210
	Counting Binary Trees.....	212
5.7	Binary Search Tree.....	212
	Efficiency of Binary Search Tree Operations.....	213
5.8	Traversing Binary Trees	214
	Preorder Traversal	214
	Inorder Traversal	214
	Postorder Traversal	214
5.9	Describing Preorder Traversal	215
5.10	Describing Inorder Traversal	217
5.11	Describing Postorder Traversal.....	220
5.12	Algorithm to Create a Binary Tree	223
	Calling build(root,nn)function.....	224
5.13	Algorithm for the Inorder Traversal of a Tree	224
5.14	Algorithm for the Preorder Traversal of a Tree	225
5.15	Algorithm for the Postorder Traversal of a Tree	225
5.16	Sequential Representation of Binary Trees	244
5.17	Deleting a Node from a Binary Search Tree	253
	Algorithm to Delete a Node from a Binary Search Tree.....	257
5.18	Threaded Binary Tree.....	263
5.19	Types of Threaded Binary Trees	265
	Rightin Threaded Binary Tree.....	265
	InThreaded Binary Tree.....	272
5.20	Deleting a node From a Threaded Binary Tree	279
5.21	2-3 Trees	306
5.22	Height Balanced Trees (AVL Tree)	307
	Rotate Left	309
	Rotate Right.....	311
	Double Rotation.....	312
	Deletion From an AVL Tree.....	331
5.23	Red Black Tree	341
5.24	Multiway Search Tree.....	341
	Algorithm for Inserting Keys into a B-tree.....	342
	Deleting a Key From a B-tree.....	356
5.25	B+ tree.....	357
5.26	B*-tree.....	358
	Creating a Binary Tree When Two Traversal Orders are Given	358
5.27	Expression Tree.....	363
5.28	Decision Tree (Comparison tree)	366

Summary	366
Exercises	367
Chapter 6: Graphs	369
6.1 Types of Graphs	370
Complete Graphs	370
Regular Graphs.....	370
Tree Graphs	371
Sub Graphs	371
6.2 Application of Graphs	372
6.3 Methods of Representing Graphs	375
Adjacency Matrix	375
Adjacency List	379
6.4 Types of Traversals.....	392
Breadth First Traversal	392
Depth First Traversal	397
6.5 Spanning Trees.....	402
Minimum Spanning Trees.....	403
6.6 Kruskal Algorithm	405
6.7 Prim's Algorithm	411
6.8 Huffman Algorithm.....	417
6.9 Warshall's Algorithm for Transitive Closure	420
Summary	421
Exercises	422
Chapter 7: Searching and Sorting	423
7.1 Efficiency of an Algorithm.....	423
7.2 Big O Notation.....	424
7.3 Searching Types and Algorithms.....	426
Linear Search	426
Binary Search.....	427
7.4 Internal/External Sorting	431
Bubble Sort	431
Insertion Sort.....	435
Simple Selection Sort	440
Straight Selection Sort	440
7.5 Divide and Conquer Method For Sorting.....	444
Quick sort.....	444
Merge Sort	453
Comparison of Merge Sort with Quick Sort	454
Merge sort: Recursive Method	459
7.6 Heap Sort	466
Heap and Its Construction	466

Algorithm for Heap Sort	477
7.7 Radix Sort	484
7.8 Shell Sort	487
7.9 Comparison of Sorted Algorithms	491
Summary	493
Exercises.....	493
Chapter 8: Hashing.....	495
8.1 Hash Table	496
8.2 Methods of Hashing.....	496
Division Method.....	496
Mid Square Method.....	496
Folding Method.....	496
8.3 Collision Resolution Methods.....	497
Open Addressing.....	497
Chaining.....	498
Summary	500
Exercise	500
Chapter 9: Dynamic Memory Management.....	501
9.1 Methods of Dynamic Memory Allocation	502
Methods for Allocating Memory	502
Methods of Freeing the Memory	505
9.2 Buddy System	506
9.3 Boundary Tag Method	510
Summary	511
Exercises.....	512
Chapter 10: Miscellaneous	513
10.1 Algorithm for Pattern Matching.....	515
10.2 Knuth Morris Pratt Algorithm	517
Algorithm for Pattern Matching by KMP	518
10.3 Polish Notation	521
10.4 Infix, Prefix, Postfix.....	521
Converting from Infix to Postfix.....	522
Algorithm for Converting the Infix Form into the Postfix Form.....	523
Algorithm for Converting the Infix into Prefix Form	530
Algorithm for Converting the Postfix Form into the Prefix Form.....	536
Algorithm for Converting the Postfix Form to Infix Form.....	539
10.5 Evaluating a Postfix Expression.....	542
10.6 Evaluating a Polynomial	548
10.7 Skip List	556
10.8 Trie.....	556
10.9 Searching for a key (word)	557

10.10 Dictionary.....	558
Adding the Numerical Values of the Corresponding Characters.....	558
Multiplying the Numerical Values of the Characters by the Power of 10 corresponding to its position	558
10.11 Unrolled linked lists	559
10.12 Tower of Hanoi	561
10.13 Parentheses Matching	567
Parentheses Matching Algorithm.....	567
10.14 Algorithm Writing and Convention.....	568
Conventions Used in an Algorithm.....	569
Analysis of Algorithm	570
Analysis of Algorithm in Linear Search.....	571
Algorithm for Linear Search in an Array.....	571
10.15 Associative Array	572
10.16 Grafting.....	572
10.17 Bounded Queue.....	574
10.18 Methods of Designing a System	574
Top-Down Design.....	574
Bottom-Up Design	575
Summary	575
Exercises.....	576
Model Paper 1 to 3.....	577
Index	581
What's on the CD ROM	588