Printed Page:- 03 **Subject Code:- ACSIOT0301**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: III - THEORY EXAMINATION (2023 - 2024)

Subject: Data Structures and Algorithms Design

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. Linear array are also called as? [CO1] 1

(a) Straight Line

(b) One Dimensional array

(c) Vertical array

(d) Horizontal array

1-b. The best data structure to check whether an arithmetic expression has balanced parentheses is a [CO1] 1

(a) Queue

(b) Stack

(c) Tree

(d) List

1-c. What is the main idea behind the divide and conquer approach? [CO2] 1

(a) Solving a problem by breaking into smaller sub-problems

(b) Generating all possible solutions and selecting the best one

(c) Repeating the same steps over and over until a solution is found

(d) Searching the solutions by gradually eliminating the possibilities

1-d. Which of the following algorithm design techniques is used in the quick sort algorithm?[CO2] 1

(a) Dynamic programming

(b) Backtracking
(c) Divide and conquer
(d) Greedy method

1-e. Which data structure is required to convert the infix to prefix notation?[CO3] 1

(a) Stack
(b) Linked list
(c) Binary tree
(d) Queue

1-f. Which of the following is not the correct statement for a stack data structure?[CO3] 1

(a) Arrays can be used to implement the stack
(b) Stack follows FIFO
(c) Elements are stored in a sequential manner
(d) Top of the stack contains the last inserted element

1-g. Which of the following is a true about Binary Trees?[CO4] 1

(a) Every binary tree is either complete or full.
(b) Every complete binary tree is also a full binary tree.
(c) Every full binary tree is also a complete binary tree.
(d) None of the above

1-h. The number of nodes in a full binary tree of depth 4 is:[CO4] 1

(a) 15
(b) 16
(c) 14
(d) 13

1-i. Time complexity of Dijkstra's algorithm is is [CO5] 1

(a) O((V+E) lg V)
(b) O(E + V lg V)
(c) O(V + V lg E)
(d) O(V lg E)

1-j. Breadth First Search algorithm uses which of the following data structures?[CO5] 1

(a) Fibonacci Heaps
(b) Linked List
(c) Min-Priority Queue
(d) Stack

2. Attempt all parts:-

2.a. What are the Asymptotic Notations?[CO1] 2

2.b. Define dynamic programming.[CO2] 2

2.c. List out the basic operations that can be performed on a stack.[CO3] 2

2.d.	Difference between B tree and B+tree.[CO4]	2
2.e.	Define an AVL tree.[CO5]	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Explain Selection Sort with the help of example.[CO1]	6
3-b.	Write in brief about recursion and its advantages.[CO1]	6
3-c.	Explain the divide and conquer strategy with examples.[CO2]	6
3-d.	Explain N-Queen problem with its complexity?[CO2]	6
3.e.	Write an algorithm to convert Infix expression into postfix expression.[CO3]	6
3.f.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example. [CO4]	6
3.g.	What is Graph? Explain matrix and linked list representation of a graph. Also give the application of Graph.[CO5]	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Explain working of linear search technique with example in details.[CO1]	10
4-b.	What do you mean by Array? Describe the storage structure of array. Also explain various types of array in detail.[CO1]	10

5. Answer any one of the following:-

5-a.	What is Backtracking? Discuss sum of subset problem with the help of an example.[CO2]	10
5-b.	Discuss Quick Sort Algorithm and Explain it with example. Derive Worst case and Average Case Complexity.[CO2]	10

6. Answer any one of the following:-

6-a.	Write an algorithm to insert new node at the beginning , at the middle position and at the end of a Singly linked list.[CO3]	10
6-b.	Write a program to implement stack by using linked list, where you will specify push and pop operation. Also include the condition to check full or empty.[CO3]	10

7. Answer any one of the following:-

7-a.	Define an AVL Tree . Starting with an empty tree, bulid the AVL tree by following sequence of insertion : D, J, A, M, J, O, F, N. Also label the rotation according to their types.[CO4]	10
7-b.	Consider the following Sequence of nodes and show the growth of the btree of order -4. Z, U, A, I W, L, P, X, C, J , D, M , T, B, Q, E, H, S, K, N, R, G, Y, F, O, Y [CO4]	10

8. Answer any one of the following:-

8-a.	Explain BFS with the help of a diagram? What is its worst case complexity.[CO5]	10
8-b.	Explain the term "minimum spanning tree". Implement Kruskal's algorithm to find minimum spanning tree and analyze its time complexity.[CO5]	10