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**NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA**  
**(An Autonomous Institute Affiliated to AKTU, Lucknow)**

**B.Tech**

**SEM: VI - THEORY EXAMINATION (2025 - 2026)**

**Subject: Data Structures**

**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:-

- (1.1) When new data are to be inserted into a data structure, but there is not available space; this situation is usually called \_\_\_\_\_ (CO1,K2) 1
- (a) Underflow
- (b) Overflow
- (c) Houseful
- (d) Saturated
- (1.2) Which of the following data structure is linear type? (CO1,K2) 1
- (a) Array
- (b) Tree
- (c) Graphs
- (d) Hierarchy
- (1.3) Process of inserting an element in stack is called \_\_\_\_\_ (CO2,K1) 1
- (a) Create
- (b) Push
- (c) Evaluation
- (d) Pop
- (1.4) Recursion is similar to which of the following? (CO2,K2) 1
- (a) switch case
- (b) loop
- (c) if-else
- (d) if elseif else

- (1.5) Height of a binary tree is (CO3,K1) 1
- (a)  $\text{MAX}(\text{Height of left Subtree}, \text{Height of right subtree})+1$
  - (b)  $\text{MAX}(\text{Height of left Subtree}, \text{Height of right subtree})$
  - (c)  $\text{MAX}(\text{Height of left Subtree}, \text{Height of right subtree})-1$
  - (d) None of the above
- (1.6) ..... node is called a leaf. (CO3,K2) 1
- (a) Terminal
  - (b) Internal
  - (c) External
  - (d) Both terminal and an external
- (1.7) Graphs are represented by cost adjacency matrices, where cost represents edge\_\_\_\_\_. (CO4,K2) 1
- (a) vertex
  - (b) point
  - (c) weight
  - (d) none
- (1.8) The spanning tree of connected graph with 10 vertices contains ..... (CO4,K2) 1
- (a) 9 edges
  - (b) 11 edges
  - (c) 10 edges
  - (d) 9 vertices
- (1.9) The worst-case occur in linear search algorithm when ..... (CO5,K2) 1
- (a) Item is somewhere in the middle of the array
  - (b) Item is not in the array at all
  - (c) Item is the last element in the array
  - (d) Item is the last element in the array or item is not there at all
- (1.10) The complexity of the sorting algorithm measures the ..... as a function of the number n of items to be sorted. (CO5,K2) 1
- (a) average time
  - (b) running time
  - (c) average-case complexity
  - (d) case-complexity

2. Attempt all parts:-

- (2.1) Define entity set. (CO1,K1) 2
- (2.2) Explain PUSH operation. Name the data structure for which it is used. (CO2,K2) 2
- (2.3) Define root node. (CO3,K1) 2
- (2.4) What do you mean by spanning tree? (CO4,K1) 2
- (2.5) What is sorting? Write the various types of sorting. (CO5,K1) 2

## **SECTION-B**

30

Answer any one of the following:-

- (3.1) Differentiate between singly linked list and a doubly linked list. (CO1,K2) 6
- (3.2) Express the following polynomials in array and linked list representation: a)  $p_1(x) = 23x^9 + 18x^7 + 41x^6 + 163x^4 + 3$  b)  $p_2(x) = 4x^6 + 10x^4 + 12x + 8$  (CO1,K3) 6

Answer any one of the following:-

- (3.3) Evaluate the following postfix expression step by step, showing the contents of the stack after each operation: (CO2,K3) 6  
Expression: 5 6 2 + \* 12 4 / -
- (3.4) Explain Priority Queue and Deque. Describe its working with example. (CO2,K2) 6

Answer any one of the following:-

- (3.5) Define an AVL tree and explain the concept of balance factor. Why is maintaining balance important? (CO3,K3) 6
- (3.6) What is threaded binary tree? Explain two-way threaded binary tree with an example. (CO3,K2) 6

Answer any one of the following:-

- (3.7) Write and explain the algorithm of Breadth First Search (BFS) with an example. (CO4,K2) 6
- (3.8) How to find Minimum Spanning Tree? Explain the Kruskal's Algorithm with example. (CO4,K2) 6

Answer any one of the following:-

- (3.9) List various fundamental file organization techniques and explain each in brief. (CO5,K2) 6
- (3.10) Explain Insertion Sort with example. (CO5,K2) 6

## **SECTION-C**

50

4. Answer any one of the following:-

- (4.1) An Array[20][15] is stored in the memory along the column with each element occupying 8 bytes of memory. Find out the Base address and address of the element Array [2][3], if the element Array [4][5] is stored at the address 1000. (CO1,K3) 10  
Note: Array[20][15] means valid row indices are 0 to 19 and valid column indices are 0 to 14.
- (4.2) What are Asymptotic Notations in Complexity Analysis of Algorithms? Explain each one with example. (CO1,K2) 10

5. Answer any one of the following:-

- (5.1) Write an algorithm to insert an element in circular queue. (CO2,K2) 10
- (5.2) Using the algorithm translate each infix expression into its equivalent postfix expression: (CO2,K3) 10  
a)  $(A-B)/((D+E)*F)$   
b)  $((A+B)/D)^{(E-F)*G}$

6. Answer any one of the following:-

- (6.1) Construct a binary tree if the in-order and pre-order traversal is given (CO3,K3) 10  
Inorder : 10, 15, 17, 18, 20, 25, 30, 35, 38, 40, 50  
Preorder: 20, 15, 10, 18, 17, 30, 25, 40, 35, 38, 50
- (6.2) Construct a Max-heap by using the following elements: 44, 33, 77, 11, 55, 88, 66. 10  
Do the pre-order, in-order and post order traversal for the same Max heap

tree. (CO3,K3)

7. Answer any one of the following:-

- (7.1) How does Prim's Algorithm ensure the selection of minimum cost edges? Explain with suitable illustration. (CO4,K2) 10
- (7.2) Explain the difference between single-source shortest path and all-pairs shortest path problems. Discuss Dijkstra's Algorithm as a solution for single-source shortest path. (CO4,K2) 10

8. Answer any one of the following:-

- (8.1) Write an algorithm to sort the data in ascending order using bubble sort and sort 32, 51, 27, 85, 66, 23, 13, 57. Show steps. (CO5,K3) 10
- (8.2) Write an algorithm to sort the data in ascending order using quick sort and sort 77, 33, 44, 11, 88, 22, 66, 55. Show steps. (CO5,K3) 10

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