NATIONAL INSTITUTE OF TECHNOLOGY, JAMSHEDPUR
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester: Autumn Semester 2024-25 | **Examination:** Mid Semester
Course Title: Data Structure and Program Design | **Course Code:** CS1306
Full Marks: 30 | **Duration:** 2 Hrs.
Course Instructor: Divya Akancha | **Branch / Semester:** ECE 3rd Semester

---

Instructions: -
Attempt all questions and write your answer in the same sequence.
Draw neat and clean diagram, if needed.

Q1.(a) What is a full binary tree? How does it differ from a complete binary tree? Describe in-order, pre-order, and post-order traversal with example. (5)

Q1.(b) Write an algorithm for enqueue and dequeue operations in a queue. Differentiate between linear queue and circular queue. (5)

Q2.(a) Explain how to insert a node at the beginning, end a specific position in a doubly linked list. What are the necessary pointer adjustments? (5)

Q2.(b) State the steps and convert the following expression from infix to postfix notation using stack. (5)

$$Z + Y - X * W + (V \wedge U) * T / S / R * Q + P$$

Q3.(a) Write a program to create a stack using an array and perform the following operations: (6)

i) push
ii) pop
iii) peek

Q3.(b) Differentiate between linear data structure and non-linear data structure. (2)

Q3.(c) Consider the following arithmetic expression in postfix notation: (2)

7 5 2 + * 4 1 5 - / -

a) Find the value of the expression.
b) Find the equivalent prefix form of the above expression.
c) Find the value of the expression from its prefix notation.

NATIONAL INSTITUTE OF TECHNOLOGY, JAMSHEDPUR
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Semester: Autumn Semester 2024-25
Course Title: Data Structure and Program Design
Full Marks: 50
Course Instructor: Divya Akancha

Examination: End Semester
Course Code: CS1306
Duration: 3 Hrs.
Branch / Semester: ECE 3rd Semester

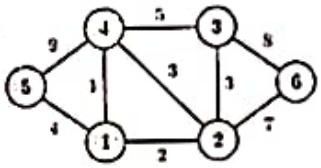
Instructions: -
Attempt all questions and write your answer in the same sequence.
Draw neat and clean diagram, if needed.

Q1.(a) Describe the four types of rotations in AVL trees with examples. Insert the following elements into an empty AVL tree in order: 15, 10, 20, 8, 12, 25, 16. Show the tree after each insertion and mention any rotations performed to maintain balance. **(2+3)**

Q1.(b) Describe the depth-first search (DFS) and breadth-first search (BFS) algorithms. How do these search techniques differ, and in what types of problems are they most effective? Provide examples of real-world applications where each technique would be appropriate. **(5)**

Q2.(a) What is a queue? Explain the basic operations of a queue, including enqueue, dequeue, and front. **(5)**

Q2.(b) Describe the steps involved in Prim's algorithm to find the Minimum Spanning Tree of a weighted graph. **(5)**



Q3.(a) Describe the steps involved in Dijkstra's algorithm. Provide the pseudocode for the algorithm. **(5)**

Q3.(b) What is a graph, and how is it represented? Explain the difference between a connected and an unconnected graph. **(5)**

Q4.(a) Explain the Selection Sort algorithm. How does it differ from Insertion Sort in terms of the number of comparisons and swaps? **(5)**

Q4.(b) What are the different types of tree traversals? How are they implemented for a Binary Search Tree. construct BST for the following elements:
50, 30, 20, 40, 70, 60, 80 **(5)**

Q5.(a) Discuss the best, worst, and average case time complexities of each algorithm. **(5)**

- Insertion Sort
- Selection Sort
- Merge Sort
- Quick Sort
- Bubble Sort

Q5.(b) What is a doubly linked list? How does it differ from a singly linked list in terms of structure and traversal? **(5)**

@@@All the Best@@@