Registration No: - | 2 | 2 | 0 | 1 | 2 | 0 | 2 | 4 | 6 | 8 |

Total Number of Pages: 03 B.Tech / 22CM3ES01T

**3rd Semester Regular Examination: 2023-24**
**DATA STRUCTURE USING C**
**BRANCH: CE, CSE, CST, ECE, EE, EEE, ELC, IT, ME**
**Time: 3 Hours**
**Max Marks: 100**
**Q Code: P113**

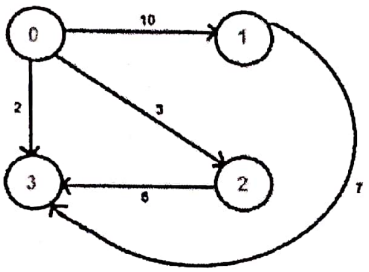
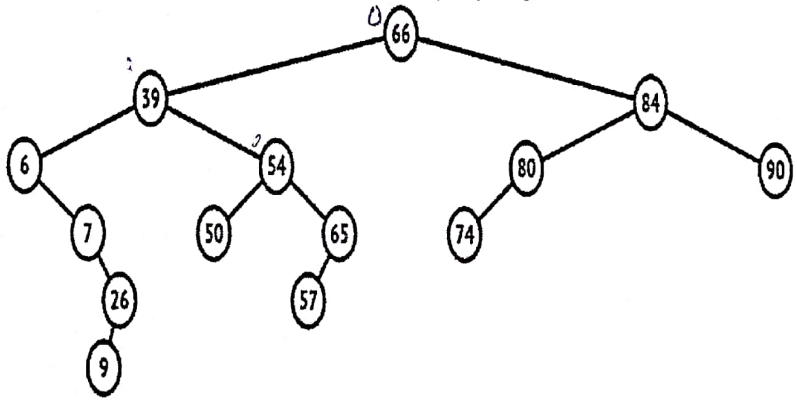
**Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.**
**The figures in the right hand margin indicate marks.**

## Part-I

| Q No. | | CO | Level | | |
|---|---|---|---|---|---|
| Q1 | | | | **Short Answer Type Questions (Answer All-10)** | (02x10) |
| | a) | 1 | 1 | Define Abstract Data Type (ADT) and Data Structure. | 2 |
| | b) | 1 | 1 | Define circular queue with suitable diagram. | 2 |
| | c) | 2 | 1 | Define the structure of a double linked list node. | 2 |
| | d) | 3 | 3 | Write down the isEmpty function of a Circular Queue. | 2 |
| | e) | 2 | 4 | Differentiate between linked list and array in detail. | 2 |
| | f) | 4 | 1 | Define and differentiate between binary tree and binary search tree. | 2 |
| | g) | 4 | 2 | What are LL and RR rotations of an AVL Tree? | 2 |
| | h) | 4 | 2 | Explain Height balanced Tree with a suitable example. | 2 |
| | i) | 4 | 2 | Define parallel edges and self-loop in graphs with suitable diagram. | 2 |
| | j) | 4 | 4 | Illustrate the difference between DFS and BFS | 2 |

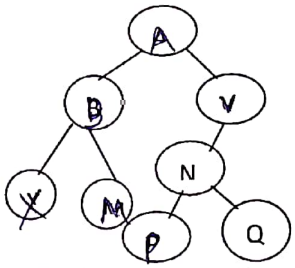
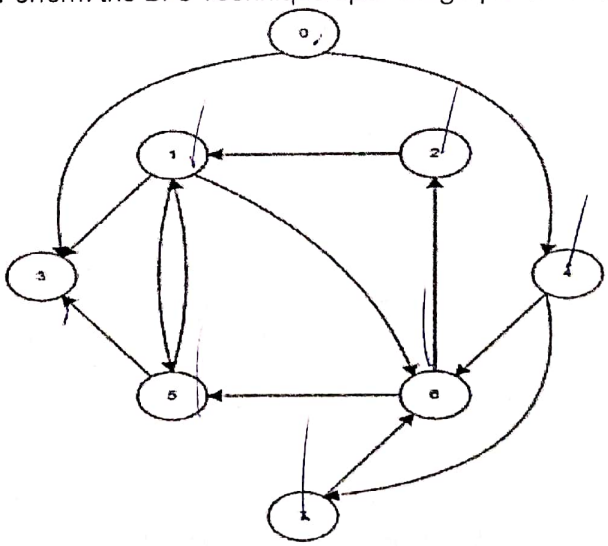
## Part-II

| Q No. | | CO | Level | | |
|---|---|---|---|---|---|
| Q2 | | | | **Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** | (06x08) |
| | a) | 1 | 3 | Define Stack. Declaring structure of an integer stack, write push, pop, isFull() and isEmpty() functions. Write an algorithm using pseudo/ c code to check whether a string is a palindrome or not. Use a stack of character for the same. | 6 |
| | b) | 1 | 3 | An expression contains operands, operators, parentheses, braces and brackets. Write an algorithm/ program to check whether the placement of parentheses, braces and brackets are proper or not. Do all possible cross checks. | 6 |
| | c) | 2 | 3 | What is a sparse matrix? How do you represent it in memory? Write a function that converts a sparse matrix from 2 D array to (k+1)x3 form.(3 Tuple form) | 6 |
| | d) | 2 | 4 | Simulate insertion sort using a singly linked list. Write a (pseudo)C function to reverse a singly linked list without allocating any extra space. | 6 |

| | | | | |
|---|---|---|---|---|
| e) | 2 | 4 | We want to store a polynomial of a single variable into a linked list. Write algorithm (using pseudo code in C) that stores a polynomial into a singly linked list. Write an algorithm to add two polynomials where each polynomial is stored in a linked list. | |
| f) | 2 | 4 | Write functions in C to insert a node in the beginning, insert a node at the end and Traversal of a Singly Linked List (SLL). | 6 |
| g) | 4 | 3 | Consider an unsorted list of integers: 23, 15, 7, 27, 8, 38, 7, 45, 27.Perform themerge sort on them to sort. | 6 |
| h) | 3 | 3 | Write a program to implement binary search in an integer array. | 6 |
| i) | 4 | 4 | Write the structure of a binary search tree where each node would contain one integer as the only information in it. Write algorithm to insert a key in a BST. Write a function to count the total number of leaf nodes in a binary tree. | 6 |
| j) | 4 | 3 | What is a tree? What is a binary tree? Why we call a binary tree a nonlinear structure? In any binary tree show that $n_0=n_2+1$. Find out the number of NULL links in a binary tree with n nodes. | 6 |
| k) | 4 | 3 |   Observe the directed graph shown above. Find the adjacent matrix and adjacency list of the above graph. | 6 |
| l) | 4 | 3 | Check the following tree is AVL Tree or not. If it is not an AVL tree, reconstruct the tree to attain AVL tree property.   After reconstruction perform the following operation (i) Insert (12) (ii) Insert (56) | 6 |

## Part-III

| Q No. | | CO | Level | | |
|---|---|---|---|---|---|
| | | | | **Long Answer Type Questions (Answer Any Two out of Four)** | (02x16) |
| Q3 | a) | 1 | 3 | Define a queue. Declaring structure of a Linear queue, write insertion and deletion functions of Linear Queue. What are the possible disadvantages of maintaining a linear queue? | 8 |

| | | | | | |
|---|---|---|---|---|---|
| | b) | 1 | 4 | What are the disadvantages of processing an infix expression? Write an algorithm to convert an infix expression into its corresponding postfix form. Convert the given infix to postfix equivalent. (a+b/m+c*d)^(e – f). Show all steps clearly. | 8 |
| Q4 | a) | 1 | 3 | Can we simulate a queue using a number of stacks? Justify your answer. How many number of stacks would be required if the simulation is possible. Write functions to implement enque() and deque() of a queue using the push, pop functions. | 8 |
| | b) | 4 | 4 | Consider the list of integer elements: 10, 20, 30, 40, 50, 100, 90, 80, 70, 60.Insert the individual elements into an AVL tree. Show each step of the insertion explicitly. | 8 |
| Q5 | a) | 3 | 3 | Write an algorithm and C code to evaluate a postfix expression with a suitable example. | 8 |
| | b) | 4 | 4 | Construct a BST from the data 50,25,36,100,120,87,98,101,34,76,190,175. Delete nodes with info 87,25 and 101.Show all steps clearly. Write an algorithm to convert a binary tree into its corresponding "mirror similar" tree. | 8 |
| Q6 | a) | 4 | 3 | What is the basic necessary assumption we make for all types of traversal in a binary tree? Construct the tree whose inorder and preorder traversals are F D G B E A C and A B D F G E C respectively. What will be the result of inorder, preorder and postorder traversal of the tree below   | 8 |
| | b) | 4 | 3 | Perform the BFS Technique upon thegraph shown below   | 8 |