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End Semester Examination, December 2024
Program – B.Tech CSE/CSE-AIML/Cyber Sec/DS/FSD/UX/UI
Data Structure (ENCS205)

Semester III

Time: 2.5 hrs.

Max Marks: **50**

PART-A

Q.1 Question No. 1 will consist of 7 small questions. Students are required to attempt any 5 questions **2x5**

1. (a) Select the appropriate answer

[CO-1] [L-1] 2

- (i) In a singly linked list containing 7 nodes, what is the space complexity required to insert a node at the beginning?
 - A) $O(1)$
 - B) $O(n)$
 - C) $O(\log n)$
 - D) $O(n^2)$
- (ii) Which of the following sorting algorithms is the fastest?
 - A) Merge sort
- (iii)
 - B) Shell sort
 - C) Insertion sort
 - D) Quick sort

(b) Give the term used for the following:

[CO-2] [L-1] 2

- (i) A tree structure where each node has a value greater than all values in its left subtree and less than all values in its right subtree.
- (ii) A data structure where each element points to the next and previous elements, allowing bidirectional traversal.

(c) Given the following sequence of stack operations, what is the top item on the stack when the sequence is complete? **[CO-3]**

[L-3] 2

M=Stack()
M.push('x')
M.push(y)
M.pop()
M.push('Z')
M.peak

(d) Find the time complexity of the below function:

[CO-2] [L-4] 2

```
function(int n) {  
    for (int i = 0; i < n; i++)  
        for (int j = i; j < i*i; j++)  
            if (j % i == 0){  
                for (int k = 0; k < j; k++)  
                    printf(" * ");  
            }  
}
```

(e) Evaluate the postfix expression

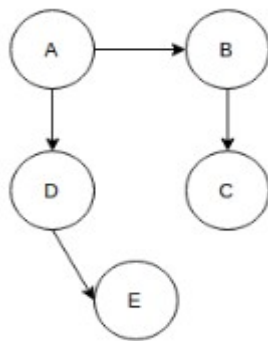
[CO-3] [L-3] 2

The following postfix expression with single digit operands is evaluated using a stack:

8 2 3 ^ / 2 3 * + 5 1 * -

(f) What would be the DFS traversal of the given Graph?

[CO-3] [L-3] 2



(g) The binary tree T has 9 nodes. The inorder and preorder traversal of T yields the following sequence of nodes:

[CO-4] [L-3] 2

In order: E A C K F H D B G

Pre order: F A E K C D H G B

Draw the tree T.

PART-B

It comprises of 5 questions. Each question will have internal choices.

Q.2 Explain the concepts of Big O, Big Theta, and Big Omega notations in the context of algorithms analysis. Provide definitions, graphical representations, and examples to illustrate their differences. Discuss how these notations help in evaluating the efficiency of algorithms particularly in data structures.

[CO-1] [L-2] 10

OR

Consider a 1-D Array storing n elements. Write an algorithm to perform the following operations:

- Inserting a new element in the array
- Deleting the existing element from the array

- c) If the base address is 2000 and each element takes 2 bytes, what is the address of the 10th element in the array?

Q.3 Implement a circular queue using an array with a capacity of 5 elements. Write enqueue algorithm and perform enqueue operations with values 2, 4, 6, and 8. Determine the front and rear indices of the queue after these operations.

OR

[CO-4] [L-3] **10**

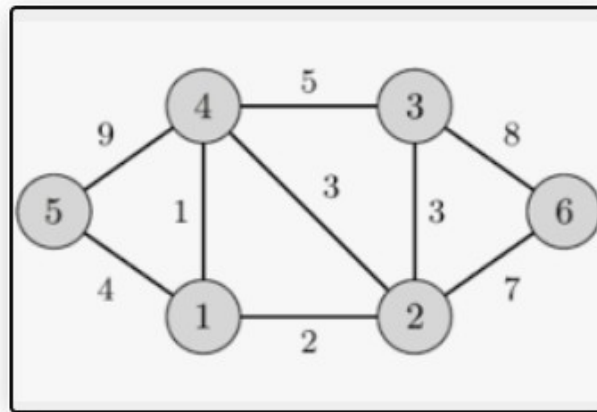
In a linear linked list write an algorithm for the following operations:

- a) Inserting a new node after the given node
- b) Deleting a node from the front
- c) Searching for a node

Q.4 For the given graph G shown below obtain the following

[CO-3] [L-5] **10**

- a) Minimum Spanning Tree by Kruskal Method
- b) Minimum Spanning Tree by Prim's Method



OR

Consider the following elements

33, 23, 40, 60, 45, 65

Insert these elements into binary search tree and write an algorithm for searching a node in the given Binary Search tree.

Q.5 Explain the Merge Sort algorithm. Provide a detailed description of how it works, including the divide-and-conquer approach, the merging process, and the time complexity analysis. Use this list [8, 2, 12, 4, 6, 10, 14], to demonstrate the sorting process using Merge Sort. Also, discuss the advantages of Merge Sort compared to other sorting algorithms.

[CO-2] [L-5] **10**

OR

Consider the following data elements.

[11, 22, 30, 33, 40, **44**, 55, 60, 66, 77, 80, 88, 99]

Using Binary Search, find element 44 from the list and write the algorithm for Binary Search (iterative and recursive). Also, compute the time complexity