TERM END EXAMINATIONS (TEE) – August 2024

Programme	: B.Tech, Int. M.Tech	Semester	: Fall Semester 2024-2025
Course Title	: Data Structures And Algorithms	Course Code	: CSE2002
Date / Session	: 20 Aug 2024 / Session-I	Slot	: A11+D11+A12+D12+A13
Time	: 3 Hrs.	Max. Marks	: 100

Answer ALL the Questions

Marks

Q. No.

Question Description

PART A – (60 Marks)

1 (a) Represent the following functions with Big Oh-O, omega-Ω and Theta-Θ notations: 12
    (i) $T(n) = 3n+2$　　(ii) $T(n) = 10n^2+2n+1$

OR

(b) What are the properties of a recursive algorithm? Design a recursive 12
algorithm/pseudocode to find the sum of the first n natural numbers. Also, analyse
its space and time complexity.

2 (a) Design algorithms/pseudocodes for Insertion sort and Selection sort to arrange the 12
given list of elements in ascending order. Provide the sorted array in ascending order
as the final result for the following input:

[5, 1, 6, 2, 4, 3].

Provide the intermediate state of the array after each pass of both algorithms.
Include both the pass number and the array state.

OR

(b) Demonstrate using the Divide and Conquer approach to obtain the sorted array in 12
ascending order for the input $A = [50, 30, 10, 90, 80, 20, 40, 70]$ using Quick sort
algorithm. Write the Recursive algorithm for the same and recurrence relation to
analyse its time complexity in best case.

3 (a) Write a menu driven Program to implement doubly linked list for following 12
operations:
    (i)　Insertion at specific location.
    (ii)　Deletion at specific location.
    (iii)　Display of doubly linked list.

OR

(b) How can you make insertions for the following data structures? 12
    (i)　Node at the beginning of Singly Linked List
    (ii)　Node at the beginning of Doubly Linked List

(iii) Element in Circular Queue as array.

Support your answer with the required code snippets.

4 (a) Consider the In-order and Post-order traversal sequences of a binary tree as follows: 12
   In-order: 10, 4, 18, 22, 9
   Post-order: 10, 18, 9, 22, 4
   (i) Illustrate the step-by-step construction of the binary tree using the given traversals.
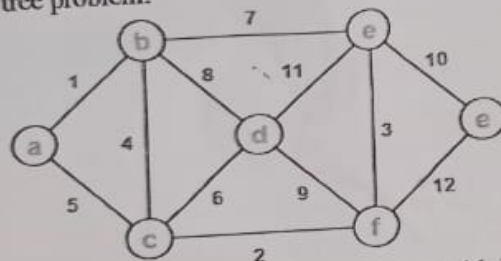   (ii) Determine Pre-order and Level-order traversals for the constructed tree.

OR

   (b) Consider the following keys to store in a hash table of size m (m =10). 12
   9, 19, 29, 39, 49, 59, 71
   Employ the division method with a hash function h(k) = k mod 10, where k is key value to compute the location for a key to be stored in hash table. Apply open addressing with quadratic probing as collision resolution technique. Also determine the average number of probes per key to store in hash table.
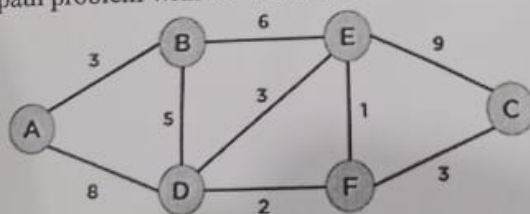
5 (a) Apply Prim's algorithm to solve the following instance of the minimum spanning 12
   tree problem:

Demonstrate the step-by-step process with intermediate graphs.

OR

   (b) Apply Dijkstra's algorithm to solve the following instance of single-source shortest 12
   path problem with 'A' as the source:

Represent the shortest path from source A to C.

PART B – (40 Marks)

6 Analyse the recurrence relation T(n) = 2T(n-1) +1 for the Tower of Hanoi problem. 8

7 Apply the Bubble sort algorithm to get the resultant array in descending order for the 8
   given array [540, 840, 410, 950, 680] Provide the intermediate state of the array after each pass of the algorithm.

8 Write the algorithm to convert an infix to postfix expression using stack. Convert the 8
   given infix expression to postfix using stack.
   Given expression: - A + (B * C - (D / E ^ F) *G) *H

9

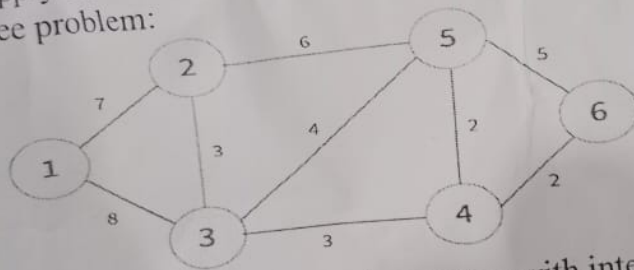Construct an AVL tree with the following key values:

21, 26, 30, 9, 4, 14, 28, 18, 15, 10, 2, 3, 7

Demonstrate the step-by-step process for insertion of each key in the AVL tree.

8

10

Apply Kruskal's algorithm to solve the following instance of the minimum spanning tree problem:

8

Demonstrate the step-by-step process with intermediate graphs.

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