(Fifth Semester)

Branch - **SOFTWARE SYSTEMS (Five Years Integrated)**

MAJOR ELECTIVE COURSE – I: DESIGN AND ANALYSIS OF ALGORITHMS

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (5 x 1 = 5)

1. The allowed balance factor values in an AVL tree are
   (i) -2, -1, 0, 1, 2 (ii) -1, 0, 1 (iii) 0, 1 (iv) Only 0
2. In a Splay Tree, after searching an element
   (i) It remains in the same position (ii) It is deleted
   (iii) It is moved to the root (iv) It becomes a leaf
3. Divide and Conquer is mainly used to
   (i) Simplify problems recursively (ii) Reduce memory
   (iii) Avoid recursion (iv) Increase complexity
4. The all-pairs shortest path problem is solved using:
   (i) Dijkstra's algorithm (ii) Floyd–Warshall algorithm
   (iii) Prim's algorithm (iv) Kruskal's algorithm
5. Objective of 0/1 Knapsack problem
   (i) Minimize weight (ii) Find shortest path
   (iii) Sort items (iv) Maximize profit within capacity

SECTION - B (15 Marks)

Answer **ALL** Questions

ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a. Apply Master's Theorem to solve the recurrence:
$T(n)=2T(n/2)+nT(n) = 2T(n/2) + nT(n)=2T(n/2)+n$

OR

b. Analyze the characteristics of AVL Tree

7. a. Given a Splay Tree, apply the search operation for an element and demonstrate the sequence of rotations (Zig, Zig-Zig, Zig-Zag).

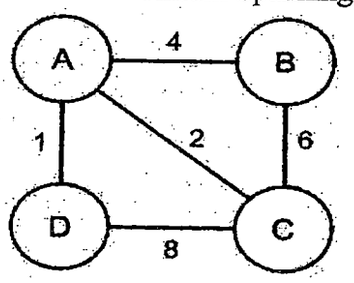
OR

b. Describe indexed sequential access with a suitable example and explain its working mechanism, advantages, and disadvantages.

8. a. Analyze the time complexity of Strassen's matrix multiplication and compare it with the standard matrix multiplication method.

OR

b. Apply Prim's algorithm to construct the Minimum Spanning Tree starting from vertex A.



9. a. Apply the dynamic programming approach to find the Longest Common Subsequence of the strings: X = "ABCBD" and Y = "BDC".

OR

b. Analyze the relationship between P, NP, NP-Complete.

Cont...

used to solve it.

OR

b. Explain the Branch and Bound approach for solving the Travelling Salesman Problem. Illustrate with the following 4-city cost matrix:

From \ To	A	B	C	D
A	∞	10	15	20
B	10	∞	35	25
C	15	35	∞	30
D	20	25	30	∞

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11 a. a Assess a scenario where Master's Theorem cannot be applied. Justify alternative approaches for solving such recurrences.

OR

b. Insert 1,2,3,4,5,6 and 7 in a empty AVL tree. Compare with Binary Search Tree

12 a. Assess the importance of amortized analysis in understanding the real performance of Splay Trees

OR

b. Insert the keys 12, 19, 15, 6, 35 into a B-Tree of order 3.

13. a Construct a Huffman tree for the given set of characters with frequencies: A: 4, B: 5, C: 9, D: 6, E: 3 and determine the Huffman codes for each character.

OR

b. Evaluate whether Merge Sort or Quick Sort is more suitable for large datasets and justify your answer.

14. a. Analyze how the Dynamic Programming approach reduces the complexity of the Traveling Salesman Problem

OR

b. Analyze the role of polynomial-time reductions in proving that a problem is NP-Complete.

15. a. Apply the dynamic programming approach to solve the **0/1 Knapsack problem** for the following data:

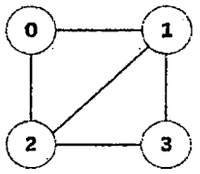
Item	Weight	Profit
1	1	8
2	3	18
3	4	20
4	2	12

Knapsack capacity = **5**

- Construct the DP table
- Determine the maximum profit

OR

b. Apply graph coloring to color the vertices of a given graph using the minimum number of colors



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