(c) Generate the Hoffman Code for the following data by comprising the alphabet and its frequency. 4

a:1, b:1, c:2, d:3, e:5, f:8, g:13, h:21

8. (a) Find the shortest path applying Warshall-Floyd algorithm of the following graph (Figure 4) 7

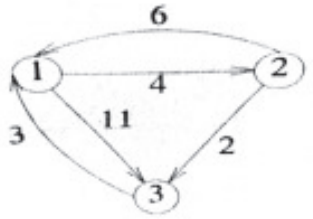

Fig.-4

(b) Apply Greedy method for the following instance of Knapsack problem. Given : Knapsack capacity (M)=15. 7

Item	1	2	3	4	5	6	7
Weight	2	3	5	7	1	4	1
Profit	$10	$5	$15	$7	$6	$18	$3

UNIT-V

9. (a) What is Convx hull? Discuss the Graham's Sacan algorithm to find the Convex-hull with a suitable example. 2+5=7

(b) Explain the Stable matching problm. 7

10. (a) What is a Bipartitie graph? Explain the maximum bipartite matching problem with a suitable example. 2+5=7

(b) Difference between NP-hard and NP-complete problems with examples. 7

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UG/Integrated Even Semester Examination, 2025

COMPUTER SCIENCE

(2nd Semester)

Course No.: MCA-553

(Design and Analysis of Computer Algorithm)

Full Marks: 70

Pass Marks: 28

Time: 3 hours

The figures in the right margin indicate full marks for the question.
Answer any five questions selecting one from each unit.

UNIT-I

1. (a) Calculate the running time of the Insertion-Sort Algorithm. 4

(b) Prove that $max(f(n), g(n)) = \Theta(f(n) + g(n))$ 4

(c) Evaluate the following recurrences completely (i) T(n)= T(n/2)+1, where n=2k for all k>0 (ii) T(n)= T(n/3) + T(2n/3) + cn, where 'c' is a constant and 'n' is the input size. 2x3=6

2. (a) Define big oh(O), Big omega (Ω) and big theta (Θ) notations. 6

(b) Evaluate the following equalities are correct. 2x3=6

(i) $5n^2 - 6n - \Theta(n^2)$ (ii) $n^3 - 10^6n^2 - \Theta(n^3)$

(b) What is recurrence? 2

UNIT-II

3. (a) Explain the divide and Conquer method for Merge sort. Discuss the time complexity of the Merge sort method. 4+3=7

   (b) Explain Strassen' algorithm for matrix multiplication. 7

4. (a) Apply the Quick Sort algorithm to the following set of numbers. 65, 70, 75, 80, 85, 60, 55, 50, 45 6

   (b) Explain the heap sort algorithm by tracing the following elements stepwise 3, 5, 9, 7, 1, 4, 6, 8, 2. 5

   (c) Construct a Binary Search Tree by inserting the elements in the following order: 3

   8, 3, 10, 1, 6, 14, 4, 7, 13

UNIT-III

5. (a) What is a minimum spanning tree? Apply Kruhkal's algorithm to compute the cost of minimum spanning tree of the following graph (Figure-1). 2+6=8

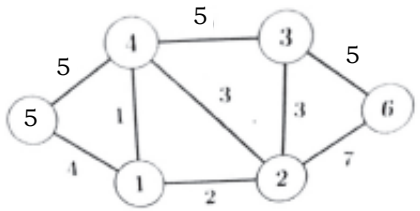

Fig-1

   (b) Write down the algorithm of Depth-First Search (DFS. 4

   (c) What is tree edge and cross edge? 2

6. (a) Apply Dijkstra's algorithm to the given graph (Figure-2) by considering 'a' as source. 5

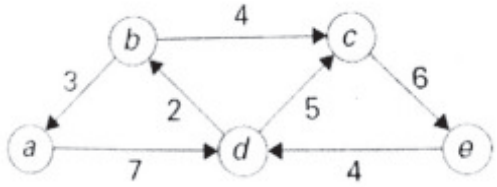

Fig.-2

   (b) Discuss the limitations of the Bellman-Ford algorithm with an example. 4

   (c) Perform Topological sort on the following graph (Figure 3) 5

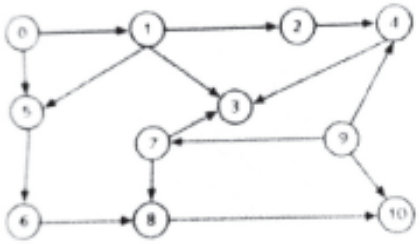

Fig.-3

UNIT-IV

7. (a) Construct an Optimal Binary Search Tree for the given data : n=4 (a1, a2, a3, a4)= (do, if, int, while) p(1:4)= (3, 3, 1, 1), q(0:4)= (2, 3, 1, 1,1) 7

   (b) What is the difference between the dynamic programming and the divide and conquer method? 3