Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sanskya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination December 2024

Roll no.....

Name of the Course and semester: MCA (III)
Name of the Paper: DESIGN AND ANALYSIS OF ALGORITHM
Paper Code: TMC 301
Time: 3-hour
Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks)

a. Draw the tree of recursive calls made by tower of Hanoi for n=3, where n is number of disks. Also find its time and space complexity. (CO1)

b. Discuss the general plan for analyzing the efficiency of a recursive algorithm. Suggest a recursive algorithm to find factorial of number. Derive its efficiency. (CO1)

c. State and explain Master Theorem for both dividing and difference algorithm. For $T(n)=7T(n/2)+18n^2$ Solve the recurrence relation and find the time complexity using Master Theorem. (CO1)

Q2. (2X10=20 Marks)

a. Outline an algorithm with an example to find maximum and minimum of n elements and obtain its time complexity using divide and conquer. (CO2)

b. Design merge sort algorithm. Write a descriptive note on its best case, average case, and worst-case time efficiency. (CO2)

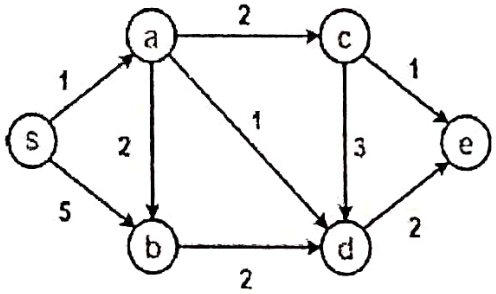
c. Discuss the concept of Divide and Conquer. Write the recursive algorithm to perform binary search on list of elements and also obtain its time complexity. (CO2)

Q3. (2X10=20 Marks)

a. Consider five items along with their respective weights and values
I = < i1, i2, i3, i4, i5 >
w = < 5, 10, 20, 30, 40 >
v = < 30, 20, 100, 90, 160 >
The capacity of the knapsack W = 60. Find the solution for the fractional knapsack problem. (CO3)

b. Write the problem statement for job sequencing with deadline? Let n=5, profits (10, 3, 33, 11, 40) and deadlines (3, 1, 1, 2, 2). Find the optimal sequence of execution of job solution using greedy algorithm. (CO3)

c. Design Dijkstra's algorithm and apply the same to find single source shortest path for the given graph by considering 'S' as the source vertex. (CO3)



Q4. (2X10=20 Marks)

a. Apply Floyd's Warshall algorithm to find all pair shortest path for the graph given below. (CO4)

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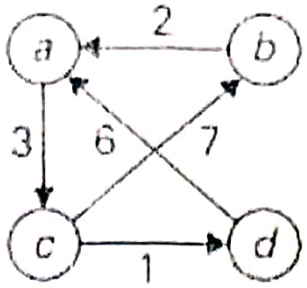
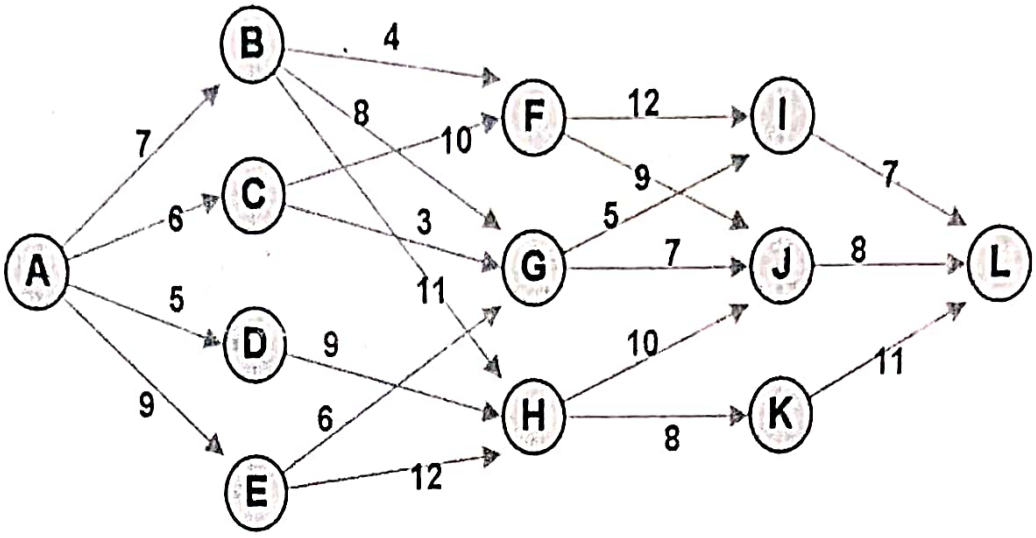


b. Construct an optimal binary search tree for the following four-key set: (CO4)

Key	A	B	C	D
Probability	0.1	0.2	0.4	0.3

c. Discuss multistage graph with their characteristics and apply the same to find shortest path for the given graph by considering 'A' as the source vertex and 'L' as the destination vertex. (CO4)

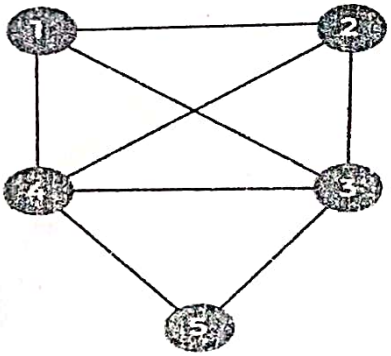


Q5. (2X10=20 Marks)

a. Illustrate N Queen's Problem using backtracking to solve 4 Queen's problem. (CO5)

b. Discuss the central principle of backtracking? Apply backtracking to solve the below instance of sum of subset problem S = {5, 10, 12, 13, 15, 18} and d = 30. Construct a state space tree. (CO5)

c. Solve the Travelling Salesman Problem for the following graph using branch and bound concept. Graph and adjacency matrix is given below: (CO5)



	1	2	3	4	5
1	∞	20	30	10	11
2	15	∞	30	10	11
3	3	5	∞	2	4
4	19	6	18	∞	3
5	16	4	7	16	∞