Department of Computer Science and Engineering

NATIONAL INSTITUTE OF TECHNOLOGY, SRINAGAR

MAJOR EXAMINATION

Course: Design and Analysis of Algorithms | Semester: 5th | Time Allotted: 3 hours

Dated: | Course Code: CSE501 | Max Marks: 90

Course Outcomes:

CO1	Understand asymptotic notations to analyze the performance of algorithms
CO2	Understand and apply various problem solving techniques such as divide and conquer, greedy algorithm, dynamic programming, etc.
CO3	Solve given problem by selecting the appropriate algorithm design technique and justify the selection
CO4	Know the concepts of P, NP, NP-hard and NP-complete problems

Note: Attempt any 5 Questions

Q No1: [CO1,CO2] [6,12]

a) Given a sorted list of integers A[1…n],determine if an entry '**X**' exists, return the index '**i**', otherwise, return null.(**Use divide-and-conquer**).

b) Discuss the backtracking algorithm **NQueens(K ,n)** for solving the 8-Queens problem. Explain the Place(**k, i**) function in detail:

Q No 2: [CO1,CO2,CO3] [8,10]

a) Write the general Quick sort algorithm.What are the best and the worst case partitioning in quick sort?Write down the equations for both the partition cases and find out (by solving) the run time for each. What is Randomized Quick sort.

OR

Solve the following recurrences using Masters Theorem Show that your solution is correct.

(i) $T(n) = 4T(n/4) + n/2$

(ii) $T(n) = 3T(n/3) + n/6$

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b) For the below given 6 matrices with the corresponding dimensions using dynamic programming find the optimal cost to multiply them. Also find the difference in the costs if dynamic programming is not used.

A0	A1	A2	A3	A4	A5
[4 5]	[5 6]	[6 7]	[7 8]	[8 3]	[3 9]

Q No 3: [CO1,CO2,CO3] [10,8]

a) State the longest common subsequence problem and the recursive equation for finding the same.For the words"**HUG**" and "**HUNG**",find out the longest common subsequence from the mathematical equation by constructing both the tables as mentioned in the equation

b) What is Hamiltonian cycle? State the travelling salesman problem and give the mathematical description of the problem. Solve the problem for the graph given by the adjacency matrix from city '1'.

C	1	2	3	4
1	0	10	15	20
2	5	0	9	10
3	6	13	0	12
4	8	8	9	0

Q No 4: [CO1,CO2,CO3] [8,10]

a) Find the optimal solution to the knapsack(0/1) instance with capacity 15,number of objects 7 with profits and weights as below using dynamic programming approach. (p1,p2,p3,……,p7) = (10,5,15,7,6,18,3) and (w1,w2,……..,w7) = (2,3,5,7,1,4,1).

b) Explain what is branch and bound algorithm and solve the below problem of a travelling salesman using branch and bound algorithm. Consider node **0** as source node.

	0	1	2	3	4
0	0	2	3	4	5
1	4	0	5	7	6
2	5	8	0	6	7
3	6	14	12	0	8
4	7	11	23	16	0

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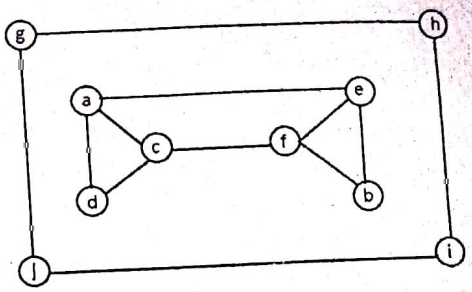
Q No 5: [CO2,CO3] [8,3,7]

a) Write and apply the **Depth-first Search** algorithm to the following graph. Also show the DFS-forest thus obtained. How does BFS differ from DFS?



b) What is the difference between Bellman ford algorithm and Floyd-Warshall algorithm for graphs.

c) Write the **Dijkstra's** algorithm for the single-source shortest paths problem. Also mention its complexity

Q No 6: [CO2,CO3,CO4] [8,(2x5)]

a) Write down the Floyd Warshall Algorithm for finding all pairs shortest paths between the vertices of a graph.Explain in detail all the entities used in the algorithm to represent the graph and the shortest paths.How is the shortest path constructed between two vertices of the graph at the end of the algorithm? Explain.

b) **Explain any five With Examples**

(i) Polynomial time problems.
(ii) Master Theorem
(iii) Big-o and Small-o Notation
(iv) Greedy nature of Activity selection problem
(v) Topological sort
(vi) Types of Branch and Bound

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