Sub Code: BCST 503 **ROLL NO……..……..**

ODD SEMESTER EXAMINATION, 2024 – 25

III Year (V Sem) B.Tech.: CS&E/IT

Design and Analysis of Algorithms

Duration: 3:00 hrs **Max Marks: 100**

Note: - Attempt all questions. All Questions carry equal marks. In case of any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q 1. Answer any two parts of the following. (10x2= 20)

a) (i) Define algorithm and its performance analysis. (5 marks)

(ii) Explain the concept of randomized algorithm with a suitable example (5 marks)

b) Explain the working of merge sort algorithm. Assume that a merge sort algorithm in the worst case takes 30 seconds for an input size 64. Describe the maximum input size (approximated) of a problem that can be solved in 6 minutes. (10 marks)

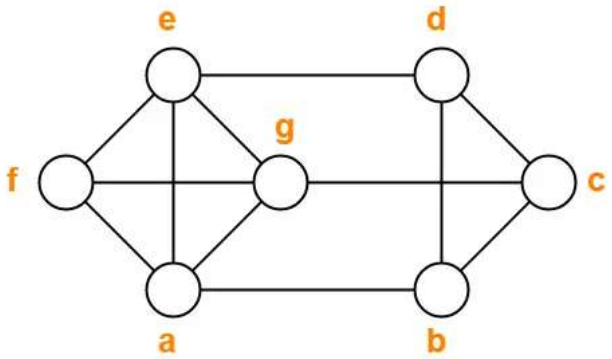
c) Explain the worst and best case time complexity of Quick sort. Consider the Quick Sort algorithm with the last element chosen as the pivot. If the goal is to sort the given a=[30,40,50,60,70,80] array a=[30,40,50,60,70,80] in ascending order, how many swaps will occur during the execution of the algorithm? (10 marks)

Q 2. Answer any two parts of the following. (10x2= 20)

a) (i) Describe the algorithms of union and find operations. (5 marks)

(ii) Describe the ways to determine Hamiltonian cycle in a graph. (5 marks)

b) Define graph coloring problem. Describe the chromatic number required using graph coloring technique of the given connected graph. (10 marks)



c) Define backtracking technique of algorithm. Describe the concept of N-Queen problem with a suitable example. (10 marks)

Q 3. Answer any two parts of the following. (10x2= 20)

a) (i) Define minimum cost spanning tree with a suitable example. (5 marks)

(ii) Describe the edge relaxation in dijkstra algorithm. (5 marks)

b) Consider the jobs, their deadlines and associated profits as shown in table-

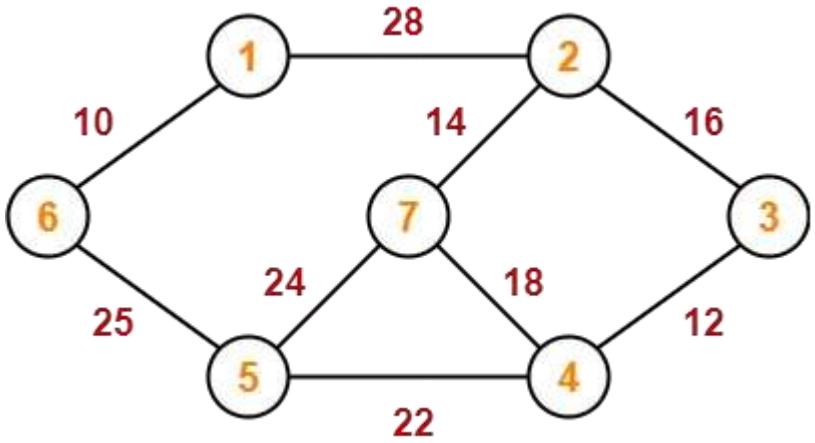
Jobs	J1	J2	J3	J4	J5	J6
Deadlines	5	3	3	2	4	2
Profits	200	180	190	300	120	100

Describe the following :

i. Optimal schedule to obtain the maximum profit.

ii. Maximum earned profit. (10 marks)

c) Describe the order of vertices of minimum spanning tree (MST) for the given graph using Prim's and Kruskal algorithm. (10 marks)



Q 4. Answer any two parts of the following. (10x2= 20)

a) (i) Differentiate between greedy and dynamic programming approach in algorithms. (5 marks)

(ii) Describe the working of all pairs shortest path problem. (5 marks)

b) Define optimal binary search tree with recurrence relation. Consider the keys and frequency as mentioned below:

Keys	10	20	30	40
Frequency	4	2	6	3

Describe optimal binary search tree (BST) using dynamic programming approach. (10 marks)

c) Describe chained matrix multiplication recurrence relation. Consider A1, A2, A3 and A4 be four matrices of dimensions 10×5, 5×20, 20×10 and 10×5, respectively. Describe the minimum number of scalar multiplications required to find the product A1A2A3A4 using the chained matrix multiplication method. (10 marks)

Q 5. Answer any two parts of the following. (10x2= 20)

a) (i) Define Cook's theorem. (5 marks)

(ii) Describe computability classes of problems. (5 marks)

b) Explain LC and FIFO Branch and Bound techniques with a suitable example. (10 marks)

c) Consider the profits and weight (in kgs) of the four objects as mentioned in table:

Objects	ob1	ob2	ob3	ob4
Profit	10	10	12	18
Weight	2	4	6	9

Describe the order of weights to be used in 0/1 knapsack problem using branch and bound technique. (10 marks)

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