Total No. of Questions : 8]

SEAT No. :

PC-2368

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[6354]-485
B.E. (Computer Engineering)
DESIGN AND ANALYSIS OF ALGORITHMS
(2019 Pattern) (Semester - VII) (410241)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data if necessary.***
4) ***Figures to the right indicate full marks.***

Q1) a) You are given a set of tasks, each with a deadline and a penalty for missing the deadline. The objective is to schedule these tasks in a way that minimizes the total penalty incurred. However, you can only work on one task at a time, and once a task is started, it must be completed before moving on to the next task. Additionally, you can't start a task after its deadline has passed. Design a greedy algorithm to efficiently schedule these tasks to minimize the total penalty and prove its correctness. **[8]**

b) Suppose we have a knapsack with a maximum weight capacity of 15 units, and we have the following items with their respective weights (Wi) and values (Vi) :

Objects	Weight	Value
O1	8	10
O2	6	8
O3	4	3
O4	2	4

Use greedy approach to maximize the total value of items we can put into the knapsack without exceeding its weight capacity. **[8]**

c) With respect to dynamic programming, what do you understand by optimal substructure? **[2]**

OR

P.T.O.

Q2) a) We are given the sequence {4, 10,3, 12,20, and 7}. We are given with five matrices of the size 4 × 10, 10 × 3,3 × 12, 12 × 20,20 × 7 respectively. Use dynamic programming to solve chain matrix multiplication. **[10]**

b) Under what situation do you think the dynamic programming approach for solving a knapsack problem might struggle to find the optimal solution? Briefly explain. **[4]**

c) Enlist the uses of writing control abstraction for any algorithmic strategies. **[4]**

Q3) a) Consider a graph represented by the adjacency matrix given below :

	A	B	C	D	E	F	G
A	0	1	1	0	0	0	0
B	1	0	0	1	1	0	0
C	1	0	0	0	0	1	1
D	0	1	0	0	0	0	0
E	0	1	0	0	0	0	0
F	0	0	1	0	0	0	0
G	0	0	1	0	0	0	0

Use a recursive backtracking algorithm to colour this graph with three colours R,G,B **[8]**

b) Consider three items along with respective weights and value as

	Weight	Value
O_1	10	12
O_2	8	10
O_3	6	8

Assume the Knapsack capacity m = 14. Solve this 0/1 Knapsack problem using LC branch and bound method. **[9]**

OR

Q4) a) We have a salesman who needs to visit four cities (A, B, C, D) and return to the starting city. The distances between these cities are as follows :

Distance from A to B: 10 units

Distance from A to C: 15 units

Distance from A to D: 20 units

Distance from B to C: 35 units

Distance from B to D: 25 units

Distance from C to D: 30 units

Find the shortest possible route that visits each city exactly once and returns to the starting city. Use branch and bound method to find the optimum route for traveling salesman, assume A as a starting point of the tour. **[8]**

b) Write a short note on LC branch and bound method. **[5]**

c) What are the drawbacks of branch and bound method? **[4]**

Q5) a) What are the advantages and disadvantages of : **[8]**

i) Aggregate Analysis

ii) Accounting Method

b) What are approximation algorithms? Based on the approximation ratio, classify the approximation algorithms. **[9]**

OR

Q6) a) Why potential function method cannot be used for analysing binary counter? Explain **[8]**

b) Comment on the following statements : **[9]**

i) "The knapsack problem is NP-hard"

ii) "Boolean Satisfiability Problem (SAT) is NP-complete"

iii) "Minimum spanning tree is tractable problem"

Q7) a) Write a Rabin-Karp string matching algorithm. Let input to the algorithm be Original text "t" of length n and pattern text being matched is "p" of length m. What is the expected runtime and worst–case runtime of this algorithm? **[10]**

b) Briefly explain performance measures – speedup, efficiency, throughput, contention, and latency of rnultithreaded algorithms. **[8]**

OR

Q8) a) Consider the graph represented by an adjacency matrix : **[10]**

	A	B	C	D	E	F	G
A	0	1	1	0	0	0	0
B	1	0	0	1	1	0	0
C	1	0	0	0	0	1	1
D	0	1	0	0	0	0	0
E	0	1	0	0	0	0	0
F	0	0	1	0	0	0	0
G	0	0	1	0	0	0	0

Show stepwise process how the distributed breadth first search algorithm works on the above graph.

b) If we have two matrices of the order m x n and n x p then what will be the time complexity of multiplying these matrices in conventional approach and in multithreaded approach. Discuss. **[8]**

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