Total No. of Questions : 8]

SEAT No. :

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[Total No. of Pages :3

[6263]-81

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 Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Assume suitable data if necessary.***
4) ***Figures to the right indicate maximum marks.***

Q1) a) Write a control abstraction for greedy method. Comment on the time complexity of this abstraction? **[6]**

b) Find an optimal solution for the following knapsack instance using greedy method. Number of objects n = 5. Capacity of knapsack m = 100. **[8]**

Objects	Weight	Profit
01	20	10
02	30	20
03	66	30
04	40	40
05	60	50

c) Comment on the statement "Problem which does not satisfy the principle of optimality cannot be solved by dynamic programming". **[4]**

OR

Q2) a) Write a control abstraction for dynamic programming strategy. Comment on the time complexity of this abstraction? **[8]**

b) Consider 4 matrices A1, A2, A3 and A4. The orders of these matrices are given below: **[10]**

Matrix	Order
A1	3×5
A2	5×4
A3	4×2
A4	2×4

Find the optimal sequence of chain matrix multiplication of these matrices using dynamic programming approach. Clearly give the final sequence and total number of multiplications involved.

P.T.O.

Q3) a) Assume that a graph with n vertices is represented by an adjacency matrix G. Let there be "m" number of colours available. Write a recursive backtracking algorithm to colour all the vertices of the graph. What is the time complexity of this algorithm? **[8]**

b) Consider three items along with respective weights and value as **[9]**

	Weight	Value	Value/Weight
O1	5	6	6/5 = 1.2
O2	4	5	5/4 = 1.25
O3	3	4	4/3 = 1.3

Assume the Knapsack capacity m = 7. Solve this 0/1 Knapsack problem using LC branch and bound method.

OR

Q4) a) Compare backtracking with branch and bound method with respect to: search technique, exploration of state space tree and king of problems that can be solved. **[8]**

b) Consider set A of five numbers {5,10,15,20.25}. We wish to find the subset of A such that sum of the numbers in this subject is equal to 30. Solve this problem to find the first solution using backtracking approach. Show space tree being created. **[9]**

Q5) a) What are randomized algorithms? Enlist and explain in brief the primary reasons for using randomized algorithms. **[8]**

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

OR

Q6) a) Explain the methods of amortized analysis. Give suitable example. **[8]**

b) Suppose you are working on an embedded system for a medical device that monitors patient vital signs. The device continuously collects data from various sensors and needs to process and display this information in real-time. The data includes timestamps, temperature readings, heart rate, and blood pressure measurements. Suggest suitable sorting algorithm for this scenario. Clearly justify your answer with respect to key factors. **[9]**

Q7) a) Write a Rabin-Karp string matching algorithm. 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) Write multi-threaded merge sort algorithm. Briefly discuss how does it differ from conventional merge sort. **[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) What do you understand by spawn and sync keywords used in multithreaded programming? Explain with the help of suitable example. **[8]**