CBCS SCHEME

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18CS42

Fourth Semester B.E. Degree Examination, June/July 2023
Design and Analysis of Algorithms

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define Algorithm. Summarize the properties which make the algorithm best. **(08 Marks)**

b. Write an algorithm to find the sum of first and last digit of a given number. **(04 Marks)**

c. Define program basic operation. Write an algorithm to find the sum of n numbers, also find the program step count for the above algorithm using step count method. **(08 Marks)**

OR

2 a. Write the Recursive algorithm for Tower of Hanoi. Prove that the time complexity is exponential. **(08 Marks)**

b. What are Asymptotic Notations? How these are related to time complexity. Give example for each. **(06 Marks)**

c. Discuss the important problem types, with one example for each. **(06 Marks)**

Module-2

3 a. Discuss the General Method of Divide and Conquer along with control abstraction. **(06 Marks)**

b. Write an algorithm for MergeSort. Also demonstrate the applicability of Master's theorem to compute the time complexity of MergeSort. **(06 Marks)**

c. Sort the below given array of elements using QuickSort. Mention Time Complexity.

2	6	4	3	9	1	7

(08 Marks)

OR

4 a. What are the disadvantages of Divide and Conquer approach? **(04 Marks)**

b. Discuss decrease and conquer algorithmic technique. Explain its variations. **(06 Marks)**

c. Write an algorithm for the below given problems in divide and conquer approach:
(i) Strasson's matrix multiplication
(ii) Finding maximum and minimum element in an array. **(10 Marks)**

Module-3

5 a. Apply Greedy technique to solve the following instance of knapsack problem:

$$n = 3,\ M = 20,\ \begin{matrix} W_1 W_2 W_3 = (18,15,10) \\ V_1 V_2 V_3 = (30,21,18) \end{matrix}$$

(08 Marks)

b. Differentiate between Prim's and Kruskal's algorithm. **(04 Marks)**

c. Solve the below instance of Prim's algorithm to compute minimum cost spanning tree. Mention Time Complexity. **(08 Marks)**

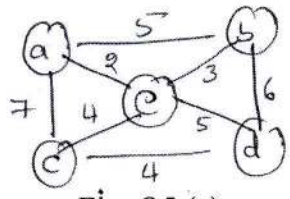

Fig. Q5 (c)

OR

6 a. Find the shortest path for the given input using Dijikstra's algorithm. Consider source node as 'g'. **(08 Marks)**

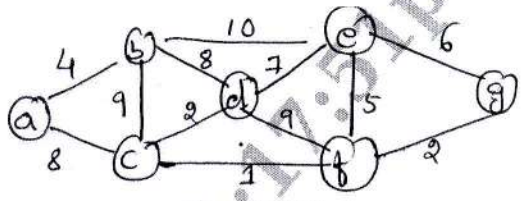

Fig. Q6 (a)

b. Define Heap. Write Bottom-up Heap construction algorithm. **(06 Marks)**

c. Write job sequencing with deadline algorithm. Also obtain an optimal schedule for the following jobs with n = 5. Profits = [10, 3, 3, 11, 40] and deadlines = [3, 1, 1, 2, 2] respectively. **(06 Marks)**

Module-4

7 a. Compare dynamic programming and greedy techniques. **(04 Marks)**

b. With an Algorithm, solve the below given graph to compute transitive closure. **(06 Marks)**

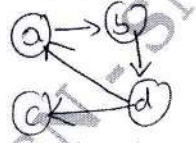

Fig. Q7 (b)

c. Solve the below Travelling salesperson problem using Dynamic Programming Technique. Also write on algorithm and mention the time complexity.

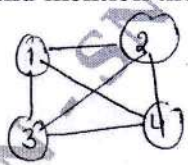

Fig. Q7 (c)

$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

(10 Marks)

OR

8 a. Construct an optimal Binary search, tree for the following four-key set:

A_1	A_2	A_3	A_4
1	4	2	1

(06 Marks)

b. Write an algorithm for (Floyd's) computing all-pairs shortest path. Derive its time complexity. **(06 Marks)**

c. Write a note on : (i) Reliability design (ii) Multi-stage graphs. **(08 Marks)**

Module-5

9 a. Give the control abstraction of Back tracking. Apply Back tracking technique to solve the sum of subset problem for the given instance. S = {5, 10, 12, 13, 15, 18} and d = 30. Illustrate with possible state space tree. **(08 Marks)**

b. Write an algorithm to generate the possible Hamiltonian cycles using Back Hacking method and solve the below instance to generate possible Hamiltonian cycles. **(08 Marks)**

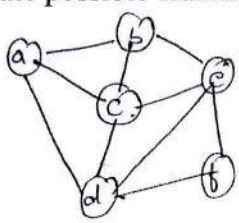

Fig. Q9 (b)

c. Compare Branch and Bound and Back Hacking algorithm design techniques. **(04 Marks)**

OR

10 a. Solve the below instance of Job Assignment problem using Branch and Bound.

Job1	Job2	Job3	Job4	
10	2	7	8	Person a
6	4	3	7	Person b
5	8	1	8	Person c
7	6	10	4	Person d

(08 Marks)

b. Solve the below given instance of 0/1 knapsack problem using Branch and Bound technique.

Item	Weight	Value
1	4	$40
2	7	$42
3	5	$25
4	3	$12

(08 Marks)

c. Write a note on NP-Hard and NP complete problems. **(04 Marks)**

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