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Paper Code : MCAN-303 Design and Analysis of Algorithm
UPID : 003881

MCA

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :   [1 x 10 = 10]

   (I)   Which method is used for solving the N Queens Problem?

   (II)   Tight bound is denoted as _____.

   (III) Out of best case and complexity, which is not a criteria of algorithm?

   (IV)   What is the worst case time complexity of the nondeterministic dynamic knapsack algorithm?

   (V)   Let there be an array of length 'N', and the selection sort algorithm is used to sort it, how many times a swap function is called to complete the execution?

   (VI)   How do you determine the cost of a spanning tree?

   (VII) The 0/1 knapsack problem can be solved using _____ Algorithm.

   (VIII) Which design strategy stops the execution when it finds the solution otherwise starts the problem from top?

   (IX)   What is trivial lower bound? Give suitable example.

   (X)   If a graph G = (N, E), where E= {f}, then the corresponding adjacency matrix is MAN

   (XI)   The time complexity of Matrix Chain Multiplication algorithm using dynamic programming is _____

   (XII) Let G be a simple graph with 20 vertices and 100 edges. The size of the minimum vertex cover of G is 8. Then, the size of the maximum independent set of G is_____

Group-B (Short Answer Type Question)

Answer any three of the following :   [5 x 3 = 15]

2. Construct the recurrence relation of Strassen's Matrix Multiplication and analyze its complexity.   [5]

3. Explain P, NP, NPH and NPC in brief with suitable diagram.   [5]

4. Apply Substitution Method to calculate the complexity of $T(n) = 2T(n-1) + 1$ where n>1 with initial condition $T(1) = 1$.   [5]

5. Explain Graph Coloring Problem using Backtracking.   [5]

6. Explain the difference between Prims and Kruskal Algorithm with suitable example.   [5]

Group-C (Long Answer Type Question)

Answer any three of the following :   [15 x 3 = 45]

7. (a) Analyze the time complexity of Max-Min problem using Divide and Conquer approach.   [5]

   (b) Apply Fractional Knapsack Problem using greedy method to generate optimal solution among all possible solutions (to earn maximum profit) using the dataset given below:
   Knapsack Capacity: 20KG, Profits: {25, 24, 15}, Wights in KG: {18, 15, 10}.   [7]

   (c) Analyze the complexity of Fractional Knapsack Problem.   [3]

8. (a) Apply Matrix Chain Multiplication algorithm to construct minimum cost of multiplication of the matrix chain with dimension sequences <5, 6, 7, 8, 9, 10>. Show optimal parenthesis sequence.   [10]

   (b) Explain 0/1 Knapsack Problem using dynamic programming.   [5]

9. (a) Explain Travelling Salesperson Problem with suitable example.   [10]

   (b) How do we judge two queens with chess board positions (i, j) and (k, l) are attacking each others diagonally in N-Queens problem?   [3]

   (c) Define Chromatic Number in graph coloring problem.   [2]

10. (a) Explain Masters' Theorem.   [3]

    (b) Apply Masters' Theorem to analyze the worst case complexity of Merge Sort Algorithm.   [5]

    (c) Apply recursion tree method to calculate the complexity of $T(n) = T(n/3) + T(2n/3) + cn$ with $T(1) = 1$.   [7]

11. (a) Define Spanning Tree with suitable example. [3]
    (b) Explain Kruskal's Algorithm using Union and Find approach. [7]
    (c) Analyze the complexity of Kruskal's Algorithm. [5]

*** END OF PAPER ***