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Paper Code : ES-CS401/PCC-CS 404/PCC-CS404/PCC-CSD 402/PCCCS404 Design & Analysis of Algorithms

UPID : 004416

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) What is the appropriate data structure for Prim's Minimum Spanning Tree algorithm?

(ii) What is represented by the asymptotic notation O(1) ?

(iii) Time complexity for recurrence relation T(n)=2 T(n/2) + n is _____.

(iv) The notation Ω(n) is the formal way to express the _____ bound of an algorithm's running time.

(v) Fractional knapsack problem is solved most efficiently by which algorithm design technique ?

(vi) What is the appropriate data structure for Depth First Search algorithm?

(vii) Which algorithm is used to solve a maximum flow problem?

(viii) How many solutions are there for 8 queens problem on 8*8 board?

(ix) Time complexity of Heap sort with n items is _____.

(x) The 0-1 Knapsack problem can be solved using Greedy algorithm -state True or False.

(xi) Which algorithm is used to solve the single source shortest path problem in a graph with negative edge weights?

(xii) Given items as {value,weight} pairs {{40,20},{30,10},{20,5}}. The capacity of knapsack is 20. Find the maximum value output assuming items to be divisible.

Group-B (Short Answer Type Question)

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

2. What are the differences between Dijkstra's algorithm and Bellman-Ford algorithm? Compare their time complexities. [5]

3. Analyze the time complexity of quick sort algorithm for best case and worst case using recurrence relations. [5]

4. Write the Floyd-Warshal Algorithm for all-pairs shortest path problem. What will be the time complexity? [5]

5. For the given set of 5 items and the knapsack capacity of 10 kg, find the maximum profit. You are allowed to take fractional amount of any item. [5]
   Weights, Wi = {3, 3, 2, 5, 1}
   Profits, Pi = {10, 15, 10, 12, 8}

6. Write short note on Randomized algorithms. [5]

Group-C (Long Answer Type Question)

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

7. (a) Find the minimum number of multiplications required for the following matrix chain multiplication using Dynamic programming: A (10 x 20) * B (20 x 50) * C (50 x 1) * D (1 x 100) [7]

   (b) Write the algorithm for single source shortest path (-ve edge weights allowed) [5]

   (c) Discuss the advantages and drawbacks of Dynamic Programming. [3]

8. (a) What are the features of any Algorithm? [3]

   (b) Discuss the different Asymptotic notations and their importance. . [5]

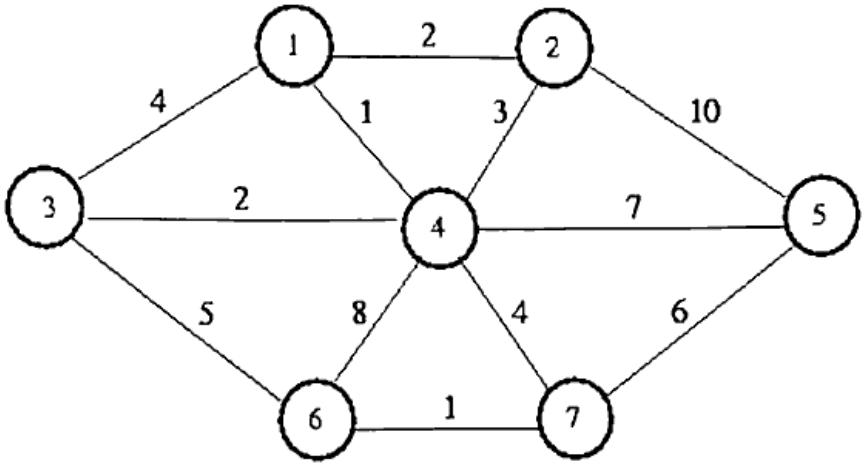
   (c) Write the recurrence relation for computing the time complexity of "Towers of Hanoi" problem. Also solve the recurrence relation to get the time complexity. [7]

9. (a) Write the greedy algorithm for job sequencing with deadline. [4]

   (b) Using greedy method ,find an optimal solution to the problem of job sequencing with deadline where n=4, (p1,p2,p3,p4)=(100,10,5,27) and (d1,d2,d3,d4)=(2,1,2,1). [5]

   (c) Define spanning tree. [2]

   (d) Using Prim's algorithm generate the MST from the following graph [4]



10. (a) Write and explain the classes P, NP, NP-hard and NP-complete. [7]
    (b) What is reducibility? [3]
    (c) "If any NP-complete problem can be solved in polynomial time then P=NP " explain. [5]
11. (a) What is a Flow Network? What are the constraints of flow in a network? [5]
    (b) What is an augmenting path in a flow network? Explain residual capacity - how it is calculated. [5]
    (c) Write the Ford-Fulkerson Algorithm for finding maximum flow. [5]

*** END OF PAPER ***