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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 $\Omega(n)$ 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]

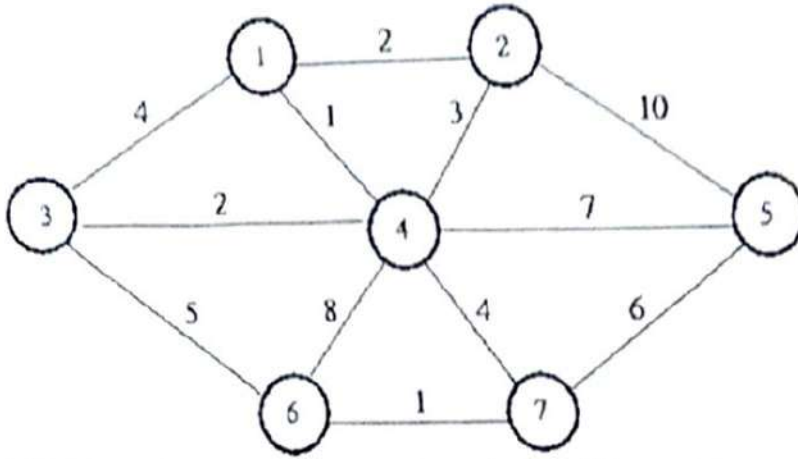
2. What are the differences between Dijkstra's algorithm and Bellman-Ford algorithm? Compare their time complexities. [5]
3. Analyze the time complexity of quick sort algorithm for best case and worst case using recurrence relations. [5]
4. Write the Floyd-Warshal Algorithm for all-pairs shortest path 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, $W_i = \{3, 3, 2, 5, 1\}$
Profits, $P_i = \{10, 15, 10, 12, 8\}$
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: $A (10 \times 20) * B (20 \times 50) * C (50 \times 1) * D (1 \times 100)$ [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 $n=4$, $(p_1,p_2,p_3,p_4)=(100,10,5,27)$ and $(d_1,d_2,d_3,d_4)=(2,1,2,1)$. [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 ***