

Paper Code: COE-208

Title of the subject: Algorithm Design and Analysis

Time: 3:00 Hours

Max. Marks: 50

Note: Answer 5 questions. Write pseudo code for all algorithms asked.
Assume suitable missing data, if any.

Q1. (a) Solve following recurrences:

i. $T(n) = 3T(n/4) + n \log n$

ii. $T(n) = 2^n T(n/2) + n^n$

iii. $T(n) = 64T(n/8) + n^2 \log n$

(b) Solve following 0/1 Knapsack problem using Dynamic Programming algorithm:

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

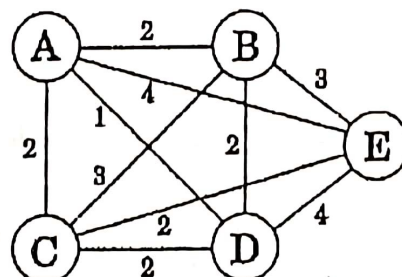
(6+4=10)

Q2 (a) Describe efficient data structure for representation of collection of disjoint sets. Write Union() and Find() algorithm and their amortized cost.

(b). Compute LCS for following set of sequences: $X = \text{"AGGTAB"}$ and $Y = \text{"GXTXAYB"}$ using dynamic programming algorithm. Show mathematical formulation of the given problem using dynamic programming.

(5+5=10)

Q3. A traveler needs to visit all the cities from a list, where distances between all the cities are known and each city should be visited just once. What is the shortest possible route that he visits each city exactly once and returns to the origin city? Apply branch and bound paradigm to solve TSP for graph given below.

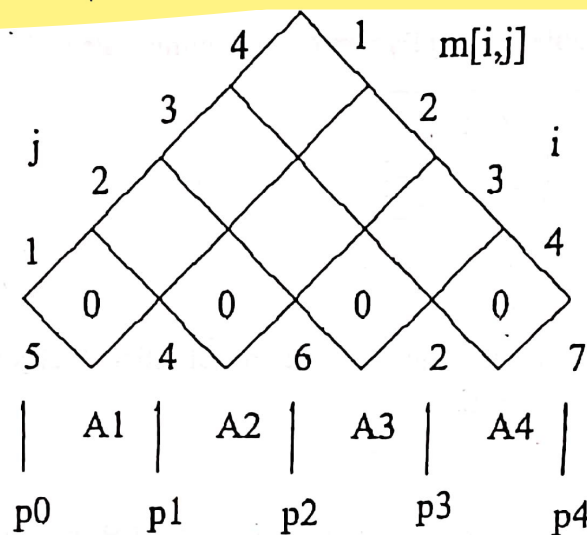


Q4. (a) What is a backtracking? Give the explicit and implicit constraints in 8 queen's problem

(b) What is a Hamiltonian Cycle? Explain how to find Hamiltonian path and cycle using backtracking algorithm. (5+5=10)

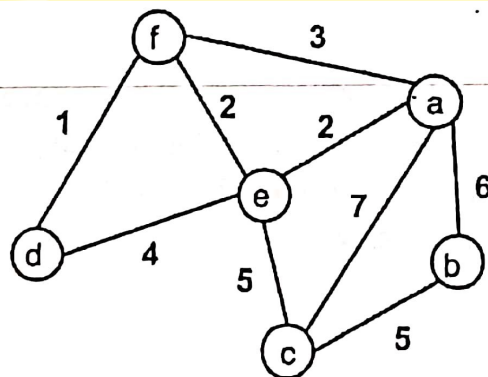
Q5. (a) What is a Spanning tree? Explain Prim's Minimum cost spanning tree algorithm with suitable example.

(b) Given a chain of four matrices A_1 , A_2 , A_3 , and A_4 , with dimensions (15×4) , (4×6) , (6×12) , and (12×5) respectively. Fill the following table in bottom-up fashion and give solution to the problem:



(5+5=10)

Q6. (a) Apply Kruskal's algorithm to find MST for given graph:

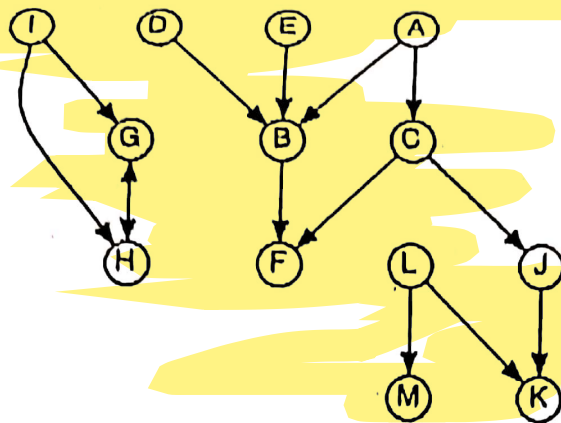


(b) What are types of edges you encounter when you run DFS on a directed graph.

(5+5=10)

Q7. (a) Write algorithm for solving fractional Knapsack problem.

(b) Apply DFS on given graph starting from vertex A and draw DFS Tree.



(4+6=10)

Q.8. (a) Solve the following subset problem using backtracking. $S=\{3,5,6,7\}$, $d=15$.

(b) Consider following unsorted array $A[]=\{24, 12, 8, 17, 11, 76, 32, 54, 9, 23, 44\}$. Convert this array into a MAXHEAP. Also write MakeHeap() algorithm to convert this array into a Max Heap. Apply algorithm on given array and show the output in tree and array form. Now apply remaining part of heap sort algorithm and show array/tree content after every round (deleteMax).

(4+6=10)