Sample Questions

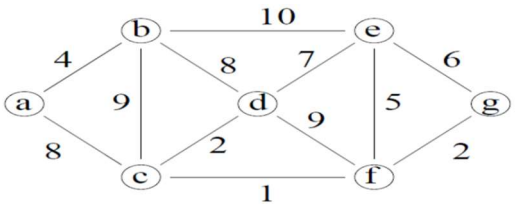
Module 1

1. Briefly describe space complexity/time complexity.
2. Explain the term algorithm. What do you understand by the term 'space complexity' and 'time complexity' in the context of an algorithm?
3. Compare and contrast Big oh, Omega and Theta/ Point out the asymptotic notations with example.
4. Describe the methods for solving recurrence equations.
5. Solve T (n) = 2T (n/2) + cn, where n= 2^k using substitution method.
6. Write down the control abstraction of Divide and Conquer technique. Explain.
7. Sort the following sequence of keys using quick sort algorithm.

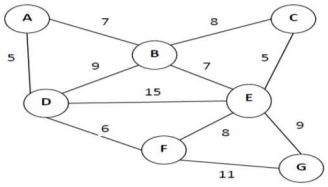
   A= [2,3,18,17,5,1]
8. Consider the following array with eleven numbers A[1:11]={310,285,179,654,349,420,851,263,440,520,367}. Sort these numbers using Merge sort. Write down the merge sort algorithm and also compute its time complexity.
9. Write an algorithm to find maximum and minimum elements from a set of elements.
10. Briefly explain Strassen's matrix multiplication with an example.

Module 2

1. State Principle of optimality and polynomial breakup.
2. Formulate Knapsack problem and write down the algorithm.
3. Write down the algorithm for job sequencing problem.
4. Compare and contrast Greedy method and Dynamic programming.
5. Define feasible solution and optimal solution.
6. Find an optimal solution to the knapsack instance n=3, m=20, (p1,p2,p3) =(25,24,15) and (w1,w2,w3)=(18,15,10)
7. Find a sequence of jobs that will be completed within the deadline with maximum profit. Let n= 5, (p1,p2,p3,p4,p5)=(60,100,20,40,20) and (d1,d2,d3,d4)=(2,1,3,2,1)
8. How would you explain Prim's Algorithm using the following graph.



9. Sketch minimum spanning tree from the following graph using Kruskal's Algorithm. Describe.



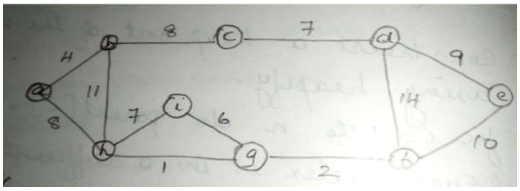
10. Elaborate Greedy method and its control abstraction.
11. Demonstrate Dynamic Programming and relate it with other algorithm design strategies.
12. Construct All pairs shortest path using Dynamic programming.
13. Solve the following distance matrix for the Travelling salesperson problem using dynamic programming.

$$C = \begin{pmatrix} 0 & 2 & 9 & 10 \\ 1 & 0 & 6 & 4 \\ 15 & 7 & 0 & 8 \\ 6 & 3 & 12 & 0 \end{pmatrix}$$

What is knapsack problem? Solve the following knapsack problem using greedy method

N=5 M= 9

14. (P1, P2, P3, P4, P5)=(10,10,15,12,4)(W1,W2,W3,W4,W5)=(2,4,7,4,1)
15. What is minimum cost spanning tree. Solve the following graph using prim's algorithm and describe.



Module 3

1. Explain backtracking method and its control abstraction.
2. Let W[1:6]= (5,10,12,13,15,18) and M=30. Find all possible subsets of w which sum to M. Draw the portion of the state space tree which is generated.
3. Briefly describe 8 puzzle problem.
4. Explain N queens problem.
5. What do you mean by Bounding.
6. Draw the state space tree for 8 queens problem.
7. Define the following terms
    a. State space tree
    b. E node
    c. Dead node
    d. Live node
8. How does branch and bound algorithm work. Explain.
9. How does backtracking differs from Branch and Bound.

Module 4

1. Briefly describe P, NP, NP hard and NP complete.
2. Show the comparison based tree for sorting and searching.
3. Describe lower bound theory.
4. Describe clique problem.
5. Explain vertex cover problem.
6. With an example describe Ford Fulkerson's method.
7. State max flow min cut theorem.
8. Write notes on Maximum Bipartite matching.

Module 5

1. Define Approximation ratio
2. State Baye's theorem.
3. Explain vertex cover problem using the method of approximation algorithm.
4. Explain Probabilistic Identity Testing (PIT) and Schwartz Zippel Lemma.
5. Define conditional probability.
6. Briefly describe performance ratio.

7. Compare and contrast linear programming with approximation algorithms.
8. Describe randomized algorithms and explain the strategy of randomized quick sort.
9. Explain vertex cover problem using the method of approximation algorithm.