FACULTY OF ENGINEERING

Code No. E-5899/N/AICTE

B.E. (CSE) VI Semester (AICTE) (Main) (New) Examination, September / October 2023

Subject: Design & Analysis of Algorithms

Time: 3 Hours

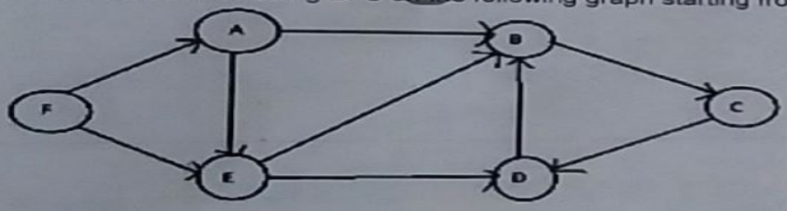
Max. Marks: 70

Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each questions carries 14 Marks.
(ii) Answer to each question must be written at one place only and in the same order as they occur in the question paper.
(iii) Missing data, if any, may be suitably assumed.

1 a) Derive the recurrence relation of the following algorithm is

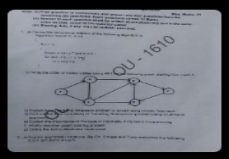
```
Algorithm foo(int m, int n)
{
    if(n > 1)
    {
        foo(m,n-1) + 2 * foo(m,n/3)
        for (int i = 0; i < n; i++)
            m = m/2 + n;
    }
```

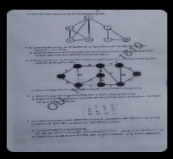

b) Write the order of nodes visited using BFS on the following graph starting from node A



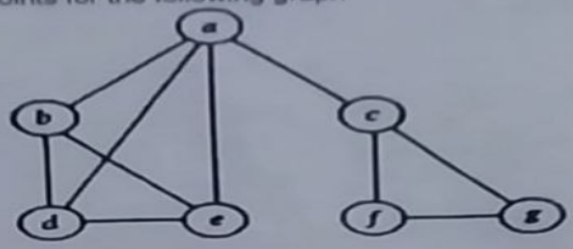
c) Explain how Fractional Knapsack problem is solved using Greedy Approach.
d) Find out the time complexity of Travelling Salesperson problem using brute force approach.
e) Explain the importance of Principle of Optimality in Dynamic Programming.
f) Briefly describe graph coloring problem.
g) Define the terms clique and Node cover.

2. a) Explain asymptotic notations, Big Oh, Omega and Theta and prove the following $f(n) = 3n^2+5n+2$ is $O(n^2)$.



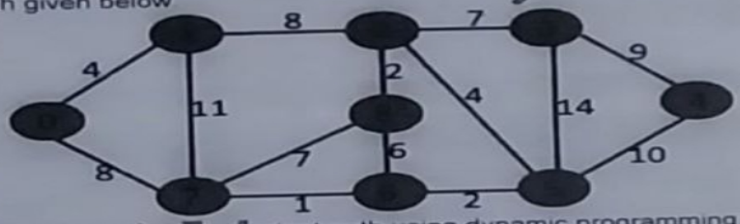


b) Find the articulation points for the following graph



3. a) Demonstrate sorting the following list using quicksort with 1st element as pivot {5,2,3,10,11,6,1,12,4}
   b) Write the algorithm for finding maximum and minimum of an array using divide and conquer approach and write the recurrence relation.

4. a) What is minimum spanning tree. Explain Kruskal's algorithm and trace it step by step using the graph given below



   b) Write the algorithm for all pairs shortest path using dynamic programming.

5. a) Write the algorithm for solving NQueens problem using Backtracking.
   b) Explain travelling salesperson problem and solve the problem for the given cost matrix using LC Branch & Bound.

$$\begin{bmatrix} \infty & 10 & 15 & 20 \\ 10 & \infty & 35 & 25 \\ 15 & 35 & \infty & 30 \\ 20 & 25 & 30 & \infty \end{bmatrix}$$

6. a) Explain nondeterministic algorithms and write nondeterministic algorithm for sorting.
   b) Define NP Hard, NP Complete and Satisfiability problem.

7. a) Construct OBST for the following
   (a1, a2, a3, a4)=(10,15,20,25) (p1,p2,p3,p4)=(2,3,2,1) (q0,q1,q2,q3,q4)=(2,2,1,1,2)
   b) Explain how single source shortest path problem is solved using Greedy approach.