Mahindra University Hyderabad

École Centrale School of Engineering

Minor – II

Program: B.Tech. **Branch: Computation & Mathematics** **Year: Second** **Semester: Fall**

Subject: Graph Algorithms (MA 2105)

Date: 08/11/2023 **Start Time: 02: 00 PM**

Time Duration: 1. 5 Hours **Max. Marks: 20**

Instructions:

1) **Start each answer on a new page and number your answers clearly. Answer all parts of the same question together and in sequence.**
2) **Explanation of every step is highly desirable.**

Q 01: Select the correct choice for the following questions with a proper explanation. The right choice without valid justification will not be considered. [01 × 05]

A) Consider a complete graph G with four vertices. The graph G has ___ spanning trees.

a) 15 b) 8 c) 16 d) 13

B) Let G be an undirected connected graph with distinct edge weight. Let W be the edge with maximum weight, and E be the edge with minimum weight. Which of the following statements is false?

a) If W is in a minimum spanning tree, then its removal must disconnect G

b) No minimum spanning tree contains W

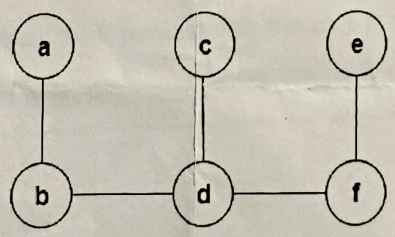
c) Every minimum spanning tree of G must contain at least one edge with edge weight E

d) G has a unique minimum spanning tree

C) For which of the following graphs an Euler circuit is never possible if the number of vertices is greater than 2?

a) K_n b) C_n c) W_n d) Q_n

D) How many Hamiltonian paths does the following graph have?



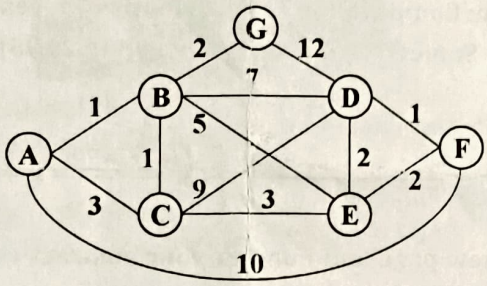
a) 1 b) 2 c) 0 d) 3

E) Let G be a simple undirected planar graph on ten vertices with 15 edges. If G is a connected graph, then the number of bounded faces in any embedding of G on the plane is equal to

a) 3 b) 4 c) 5 d) 6

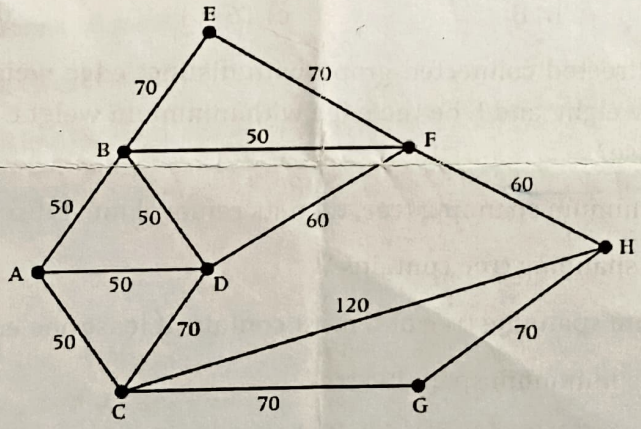
Q 02: Each of the following questions consists of five marks. It is essential to provide an explanation of each step. [05 × 03]

A) Consider the following undirected, weighted graph:



Step through Dijkstra's algorithm to calculate the single-source shortest paths from A to every other vertex. Finally, indicate the lowest–cost path from node A to node F.

B) What is the Chinese postman problem? Solve the Chinese postman problem for the following graph consisting of 13 streets, and the postman has to start at A. What will be the optimal route and length of the Chinese postman problem?



C) The graph G has six vertices with degrees 2, 2, 3, 4, 4, and 5. How many edges does G have? Could G be planar? If so, how many faces would it have? If not, explain.