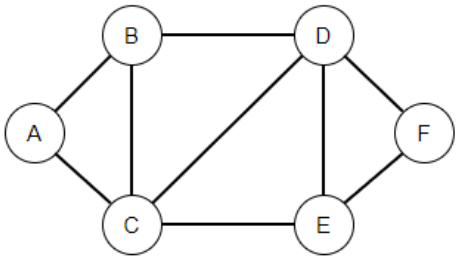
**Introduction to Algorithms (CELEN086)**

***Problem Sheet 9***

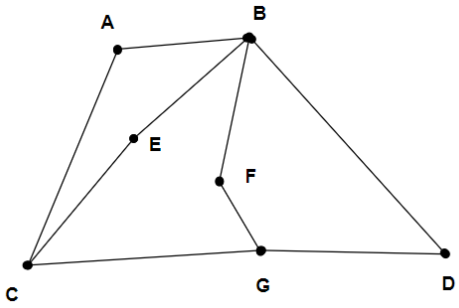
*Topics: Graph Basics; Types of Graphs; Shortest path and Dijkstra's algorithm*

1. Consider the following graph (from ILW Q3):

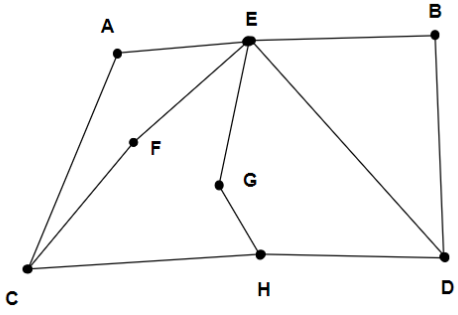



i. How many cycles can you identify in the graph?
ii. Find all paths from Vertex A to Vertex D.
iii. Find the degrees of Vertices C and E.
iv. Is it a connected graph? Is it a complete graph?
v. Is it a weighted graph? Is it a directed graph?
vi. Represent this graph using a 6 × 6 matrix.
vii. Remove edges AC, CE, EF and CD, so no cycle remains. Draw a proper tree structure for the remaining graph with B selected as root node. Is it a binary tree?

2. Consider following two graphs:




Graph i




Graph ii

Determine whether they are bipartite graphs. If yes, redraw the graph in the way that vertices are separated into two sets as shown in Lecture 9 example.

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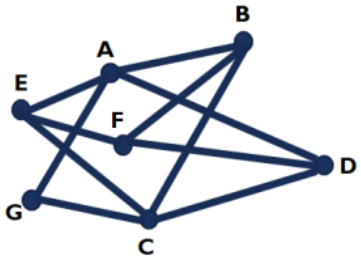
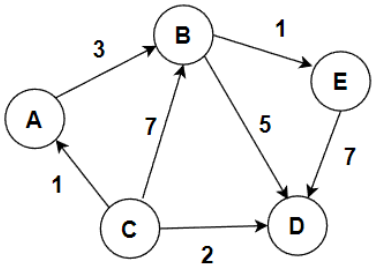
3. By separating the vertices into two sets, show the following graph is bipartite.




4. Draw a complete graph with 8 vertices. Use the formula to check the number of edges you have drawn. What is the degree of each vertex?

5. Apply Dijkstra's algorithm to the following weighted and directed graph, to find the shortest paths between Vertex C to all other vertices. Also, state the minimum cost of each path.




6. Apply Dijkstra's algorithm to solve question on the weighted and undirected graph (from ILW Q4): Suppose the weights describe distances between places. You are living at place A and would like to figure out shortest paths and distances from A to all the other places.