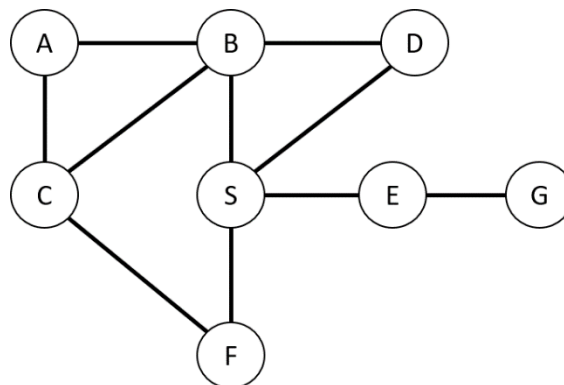


CP312 Algorithm Design and Analysis I**Winter 2024****Assignment 4***Instructor: Dariush Ebrahimi**Due Date: 31-Mar-2024*

Instructions: You must submit your solutions as a single PDF file to MyLS. Make your solutions as detailed as possible by clearly stating every step in your answers. The assignment must be done individually. Any **COPYING** of solutions from external sources will result in a **ZERO** grade.

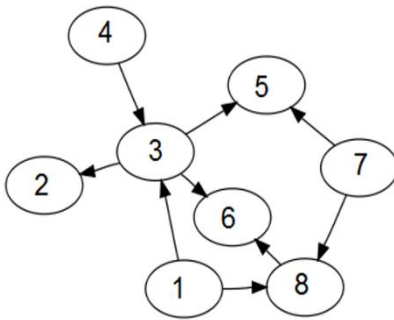
Problems

1. **Traversal and MST.** You are given the following undirected unweighted graph:



- (a) (7 points) Assuming that you start at node *S*, indicate the order in which nodes will be visited when breadth-first search (BFS) is applied. Insert simultaneous nodes into the queue using alphabetical order.
- (b) (7 points) Assuming that you start at node *S*, indicate the order in which nodes will be visited when depth-first search (DFS) is applied.
- (c) (7 points) Show that a minimum spanning tree is NOT unique (i.e., there can be more than one minimum spanning tree) when the weight of edges in the graph is equal.

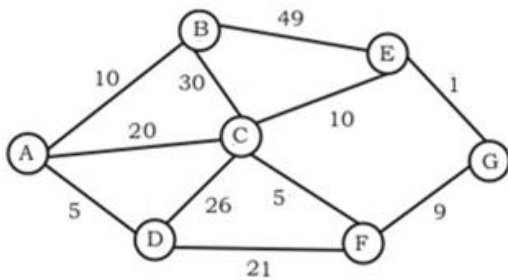
2. **Traversal.** Consider the graph and table below.



Node	Discovery time	Finish time
1		
2		
3		
4		
5		
6		
7		
8		

- (a) (8 points) Perform a DFS on the graph alongside starting from node 1. When there are two or more outgoing edges, pick the edge to the vertex with a smaller ID first. Show discovery (visit) and finish (complete) times in the table above.
- (b) (6 points) Perform a BFS on the graph above if possible. Otherwise, explain why it is not possible.

3. **MST.** Consider the graph shown below.



- (a) (10 points) Run Prim's algorithm starting at node A. Show all the steps.
- (b) (5 points) Show all the steps using Kruskal's algorithm.