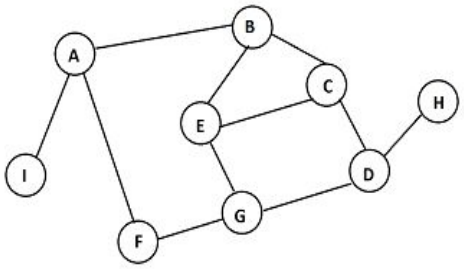
CSE 221: Algorithms
Worksheet 4
Graphs(BFS and DFS)

Name: ID:

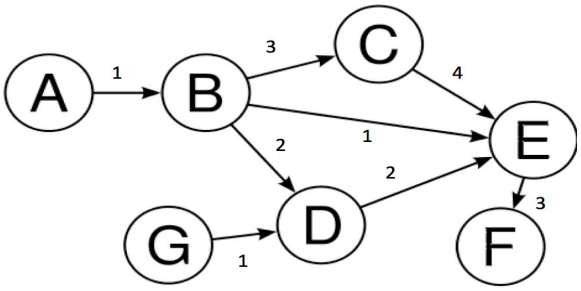
Question 1:

Simulate the BFS algorithm on the following graphs. Show all steps (graph and queue) clearly. Start at A. Print the order of discovered/visited/gray nodes and finished/processed/black nodes.

a) Graph 1:



b) Graph 2

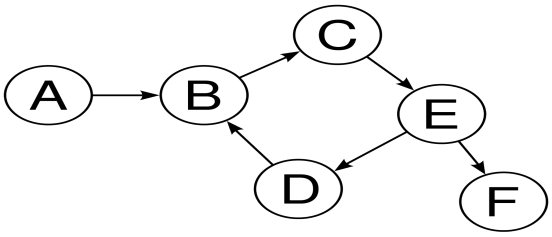


c) Can you find shortest path from source vertex to any other vertex using BFS? Explain for both weighted and unweighted graphs.
d) State the time complexity of BFS algorithm.
e) Explain how you can traverse all nodes of a graph using BFS algorithm if the graph is not connected

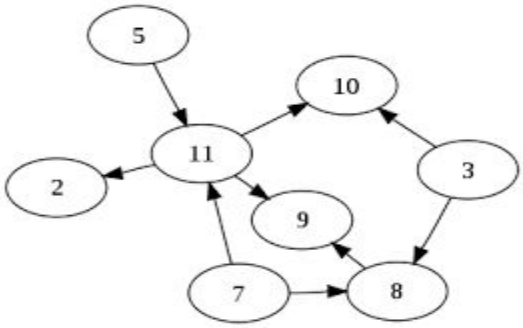
Question 2:

Simulate the DFS algorithm on the following graphs. Show all steps (discover time, finish time and coloring) clearly. Print the order of discovered/visited/gray nodes and finished/processed/black nodes.

a) Graph 1: Start at A. Mark the tree edges, forward edges, back edges and cross edges in the graph.

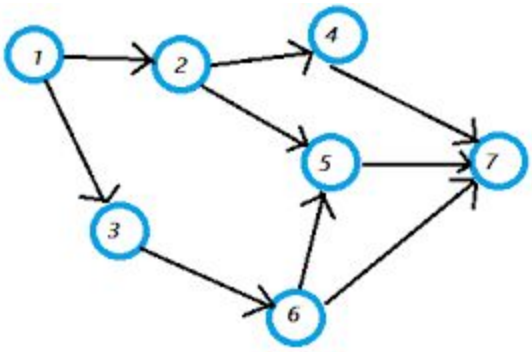


b) Graph 2: Start at 11. Mark the tree edges, forward edges, back edges and cross edges in the graph.

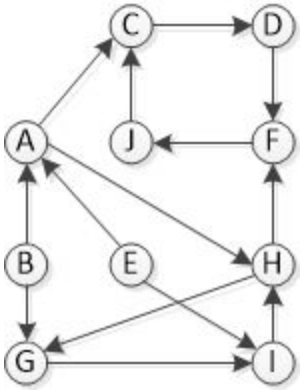


c) Can you find shortest path from source vertex to any other vertex using DFS?
d) Which of the graphs in a or b is a DAG? Explain why.
e) State the time complexity of DFS algorithm.
f) Explain how you can traverse all nodes of a graph using DFS algorithm if the graph is not connected

Question 3: Simulate Topological sort on the graph below. Show each step clearly. Show the sorted order.



Question 4: Find the strongly connected components in the following graph. Show each step clearly.



Question 5: Ichigo has to save his friends who are lost in a labyrinth made by the evil “Grand Fisher”. The labyrinth consist of “mystery rooms”(shown as nodes) and “doors”(shown with arrows) to go into another mystery room. A “mystery hub” is a collection of rooms where there is always a path from any room to any other room inside the hub. The only way Ichigo can save his friends is if he can tell Grand Fisher the number of hubs that exist in the labyrinth. Ichigo found the hidden map of the labyrinth shown below, but the hubs are not marked in it. Apply a suitable algorithm to mark the hubs and help Ichigo save his friends!