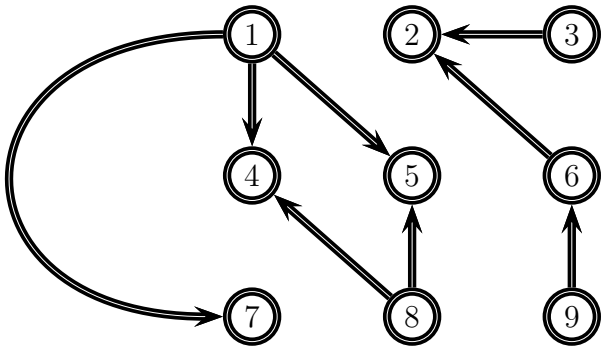
Sample Questions for CS 401 Midterm I

Problem Consider the graph below:

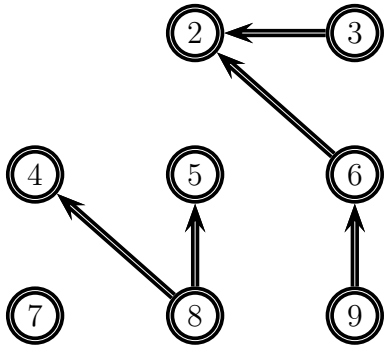


Show all intermediate steps of the algorithm to find a valid topological ordering of the above graph (the algorithm was discussed in class). For each step, provide the following information:

- The node with no edges directed to it (no incoming edges) that is selected for removal.
- The remaining graph after this node deleted.

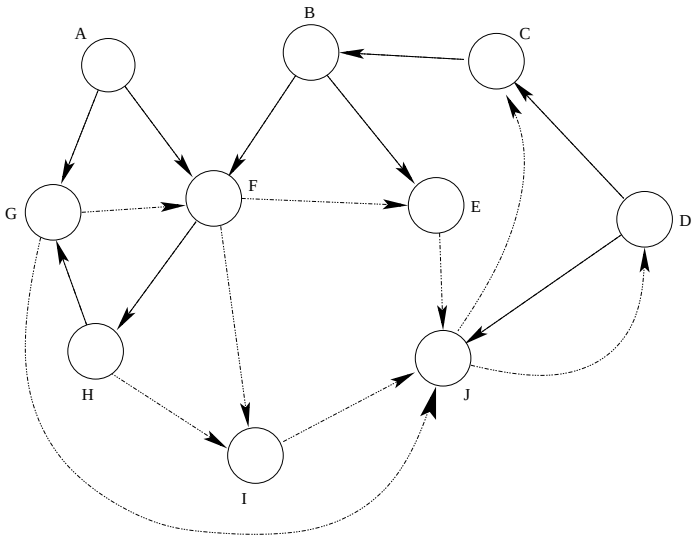
For example, for the first step:

- The node selected for removal is node 1.
- After removal, the remaining graph looks as follows:



Problem

Is the following directed graph strongly connected? Justify your answer.



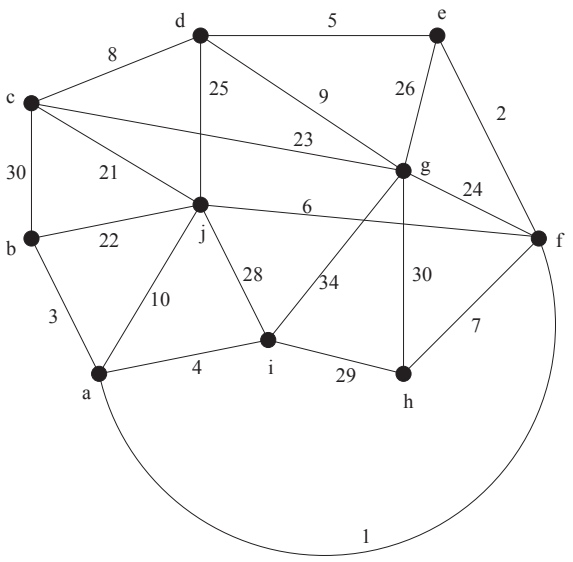


Figure 1: Graph G

Problem Let $G = (V, E)$ be the graph as shown in Figure 1 with $V = \{a, b, c, d, e, f, g, h, i, j\}$.

(a) Simulate Prim's algorithm to find a minimum spanning tree of G. You only need to show the connected components you are building at the end of **each** step of the algorithm. What is the total weight of your tree?

(b) Simulate Kruskal's algorithm to find a minimum spanning tree of G. You only need to show the connected components you are building at the end of **each** step of the algorithm. What is the total weight of your tree?