Data Structures and Algorithms – (COMP SCI 2C03)
Winter 2021
Tutorial - 7

March 22, 2021

1. How can the number of strongly connected components of a graph change if a new edge is added?

2. Compute the strongly connected components of the digraph G given in Figure 1 using the Kosaraju-Sharir algorithm. In particular, first compute the topological order for G^R. Then run DFS on the topological order obtained from the previous step to compute all the connected components of G.

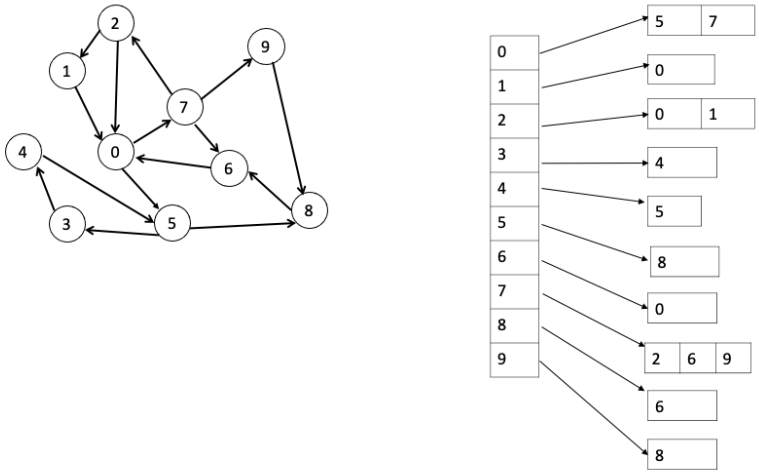

Figure 1: Digraph and its adjacency list for Question 2

3. If we modify the Kosaraju-Sharir algorithm to run the first depth-first search in the digraph G (instead of the reverse digraph G^R) and the second depth-first search in G^R (instead of G), then it will still find the strong components.

4. Compute the MST of the undirected edge-weighted graph shown in the Figure 2 using

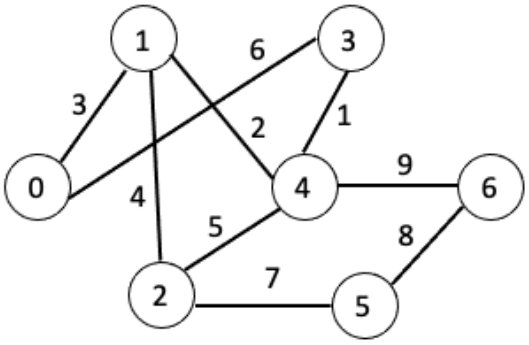

Figure 2: Undirected weighted edge graph

   i. Kruskal's Algorithm

   ii. Prim's Algorithm

5. How would you find a maximum spanning tree of an edge-weighted graph?

6. Consider the assertion that an edge-weighted graph has a unique MST only if its edge weights are distinct. Give a proof or a counterexample.

7. Given an MST for an edge-weighted graph G, suppose that an edge in G that does not disconnect G is deleted. Describe how to find an MST of the new graph in time proportional to E.