ECON381 Fall 2024

Homework Assignment 4

Take some time to inspect the following graph.

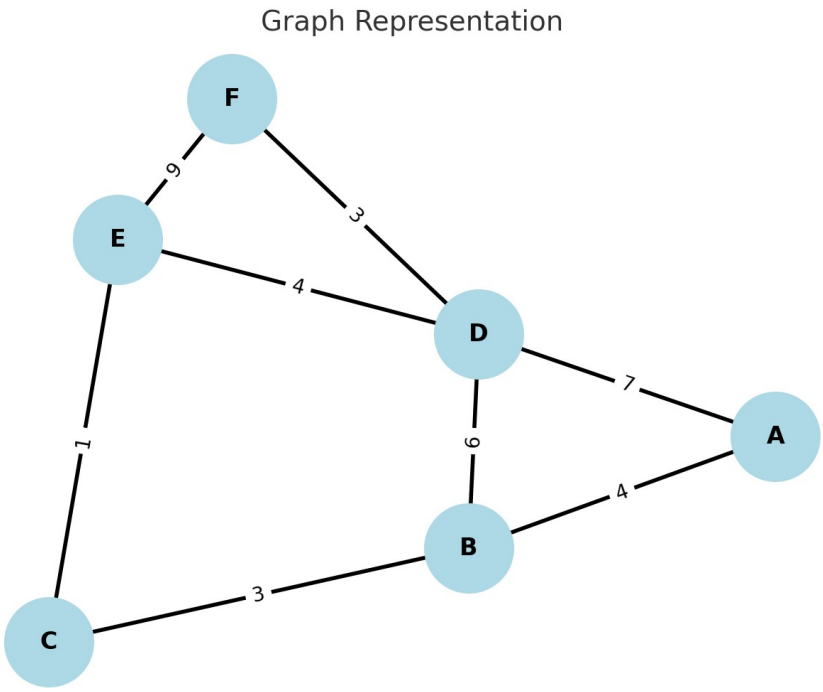

Figure 1: Reference Graph

Questions.

1. Explain what a minimum spanning tree (MST) is and then create an MST for the above graph. You can use Kruskal's algorithm or any similar algorithm. Show all your steps. This may take some space.
2. We need to know if the MST you created is unique or not. Do some research on the conditions for uniqueness of a generated MST. Is the above graph suitable for guaranteed uniqueness?
3. Calculate the shortest paths from node A to all other nodes using Dijkstra's algorithm. Show all your steps. This may take some space.
4. Explain what a critical edge in a graph is. Then try to find critical edges in this graph. Show detailed steps for a single edge removal. If you can not find any critical edge, explain why.
5. Explain what an articulation point in a graph is. Then try to find articulation points in this graph. Show detailed steps for a single vertex removal. If you can not find any articulation point, explain why.
6. Suppose you want to go from A to E, the path you are given is A-B-C-E (based on Dijkstra's algorithm). You are at B and learn that C is now unavailable. Given that you know there are no critical edges or articulation points beforehand, can you be sure that there is now another path towards E without any calculations?
7. Do some research on the concept of graph robustness, and explain it using critical edges and articulation points.

Submit your homework as a PDF upload via Github.