Assignment 8

CIS 2168 (Section 001)

Fall 2023

Instructor: Shuvra Chakraborty

Total points: 100

Objectives

In this assignment, you will work with Depth First Search(DFS), topological sort, and single source shortest path algorithm.

Problem description

You are a software engineer working for a transportation company that operates a fleet of vehicles. The company has various hubs across the country, and they want to optimize the routes taken by their vehicles to minimize travel time. To achieve this, they have decided to implement a Single Source Shortest Path (SSSP) algorithm. Your task is to implement and analyze the performance of Dijkstra's algorithm, a widely used SSSP algorithm, in the context of optimizing routes for the transportation company.

Tasks 1 (40 points)

Create a Java class to represent a weighted directed graph using an adjacency matrix. Each vertex in the graph represents a hub, and each directed edge represents a road connecting two hubs. The weight of an edge represents the travel time between two hubs.

```
class WeightedGraph {
    private int[][] adjacencyMatrix;
    private int numVertices;
    // Implement the constructor and other necessary methods
```

}

Implement Dijkstra's algorithm to find the shortest paths from a given source hub to all other hubs in the network. Ensure that your implementation is efficient and correctly handles the optimizing routes for the transportation company.

Task 2 (40 points)

Generate the topological sorting for the transportation graph. If there is a cycle in the graph, detect it. [Hint: you can find cycle detection technique in the class lecture]

Task 2 (10 points)

Analyze the complexity of your solution algorithms. [Hint: you can find complexity analysis in the class lecture]

Submission Instruction

The assignment should be submitted through the available link on course Canvas shell. The assignment rubric is as follows:

1. Source code and demonstration [90 points]:

Provide the source code in zip file. Each file should have proper comments (e.g., explanations for methods, class and so on). It will be graded based on accuracy (e.g., program execution), clarity of the necessary comments, and short demonstration as instructed by TA or instructor.

2. Status.txt [10 points]:

In this text file, you need to report:

- The status of your program (completed or not; partial credit will be given even if the program is not completed).
- The design of your program (what and how the objectives have been accomplished).
- Support and advice (if any) you get from TA and/or your classmates.
- Comments and suggestions to improve this assignment.
- If you have completed the extra credit part [if any], mention it explicitly.

- If you are doing late submission, you should mention the number of days you are late since the due date. According to our policy, for N days of late submission, you get a deduction of Nx3 points per day even if your submission completes all the requirements. That said, if you are late for 5 days, your maximum point can be up to 85 out of 100.

Please have the source codes and status files zipped into a single file DSAssign8-LastnameFirstname.zip and upload the file on Canvas.