Lab Assignment 3

CS 428 – Introduction to Graph Algorithms

Spring 2019

The following problem was written by Marc Vinyals and given at the KTH Challenge 2014.

Problem

Fatima commutes from KTH to home by subway every day. Today Robert decided to surprise Fatima by baking cookies and bringing them to an intermediate station. Fatima does not always take the same route home, because she loves to admire the artwork inside different stations in Stockholm. However, she always optimizes her travel by taking the shortest route. Can you tell Robert which station he should go to in order to surely intercept Fatima?

You are given a graph and two vertices s and t. Implement a linear time algorithm that finds all the vertices u such that all shortest paths from s to t pass through u.

Hint: Use the interval of two vertices and distance layers.

Implementation

You are given a file *Lab3.java* and a file *Graph.java* (which you can download from canvas). The file *Lab3.java* contains a class `Lab3` with the three function `problem`. Implement your solutions in that function. **Do not make any changes outside of these two functions (e. g. by adding helper functions); such changes will be undone.** Do not output anything to the terminal. The class `Graph` in the file *Graph.java* contains the functions `bfs` and `dfs`. Feel free to use these functions.

The program already implemented in the file *Lab3.java* reads in a file *testsLab3.txt*. This file contains a small number of test cases to check if your implementation computes correct answers. Feel free to add additional test cases. When your submission is graded, it will be tested with a file containing a larger number of cases. Note that the purpose of the tests is for you to avoid major mistakes. **Passing all given tests *does not* imply that your algorithm is correct, especially that is has the expected runtime.**

The file is structured as follows. The first line states how many test cases follow. Before every test case, there is an empty line. Each test case first contains a graph as simplified edge list. Then, one line with the start and end vertex follow. The last line of a test case contains the expected output.

Submission

For your submission, upload the file *Lab3.java* with your implement to canvas.

This is an individual assignment. Therefore, a submission is required from each student.

Deadline: Sunday, April 14, 11:59 p.m.