Graph Algorithms

Wednesday, November 29, 2017

Introduction

This lab will serve as a warm-up for your last assignment. You will be working with Bailey's `Graph` and `GraphListDirected` classes to implement two graph algorithms. The first algorithm is an edge reversal, i.e., the algorithm takes an input graph and returns a graph which is identical to the input but all of the edges are reversed. You will use this function as part of Assignment 11 to test strong connectivity. The second algorithm is breadth-first search. In Assignment 11, you will be implementing Dijkstra's algorithm which is essentially breadth-first search, replacing the queue with a priority queue.

Getting Started

First, copy the starter code over from the usual locations. Then, read about the `Graph` and `GraphListDirected` classes from the Bailey Structure5 source code link in the Documentation and Handouts.

Edge Reversal

Your edge reversal should run in $O(n + m)$ time (for n nodes and m edges). There are several ways to implement this method; if you get stuck coming up with an algorithm, you can use the hints provided in the comments. Make sure you thoroughly test this method! Feel free to create some test cases and draw them on the whiteboards.

Breadth-First Search

You will be implementing the breadth-first search algorithm, as described in class. In lab, you will only be implementing the "basic" breadth-first search algorithm, i.e., you will explore all vertices reachable from a single vertex without restarting to explore the entire graph. Recall, that the "basic" breadth-first search takes a connected graph and produces a spanning tree represented using an array of parents. The entire solution to this problem is contained in the lecture slides, but you should make sure you understand every line you are typing! You should thoroughly test this method as well, and compare your results with the examples on the white boards.

The Assignment

You may freely use code from this lab while implementing the driving directions assignment. The program should now display the desired behavior.

What to Hand In

Export your Eclipse code as usual and submit your `bin/` and `src/` directories as usual. Don't forget to put both your name and your partner's name (if any) in the `.json` file.