CSE 2320-002 Lab Assignment 4

Due December 4, 2014

Goals:

- 1. Understanding of Warshall's algorithm.
- 2. Understanding of strongly connected components.

Requirements:

- 1. Write a program, based on Warshall's algorithm with successors, to find a *leader* for each strongly connected component of a directed graph. The leader of a strongly connected component is the *smallest* numbered vertex appearing in that SCC. The input will be formatted as follows:
 - a. The first line will contain an integer V giving the number of vertices. V will not exceed 50.
 - b. Tail and head for each edge, one edge per line. The tail and head will be in the range 0 ...
 V 1.
 - c. A line with -1 -1.
- 2. Your program's output for each vertex *i* will be either 1) the fact that vertex *i* is a leader or 2) a path from vertex *i* to its leader and a path from the leader to vertex *i*. Your program must also output the intermediate matrices from your Warshall-based technique.
- 3. Submit your program source file on Blackboard by 10:45 am on December 4. One of the comment lines should include the compilation command used on OMEGA.

Getting Started:

- 1. Review Warshall's algorithm with successors. Also, consider the usual transitivity diagram and how it relates to this problem.
- 2. Test files are available on the course web page. Other cases may be used when your submissions are checked.
- 3. Since SCCs treat the graph as being reflexive (e.g. self-loops), each diagonal entry A[i][i] is initialized to i. If there is an edge from i to j (i!=j), then A[i][j] is initialized to min(i,j). If there is no edge from i to j, then A[i][j] is initialized to -1 (or some other value depending on your code).
- 4. Based on this initialization, Warshall's algorithm may be modified to terminate with the leader for the SCC of vertex i stored at A[i][i].
- 5. Your code must execute in $O(V^3)$ time.
- 6. Static allocation (i.e. no mallocs) is allowed.
- 7. You may modify http://ranger.uta.edu/~weems/NOTES2320/warshall.c to do this assignment.