CSE 2320-001 Lab Assignment 4

Due May 3, 2012

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. Send your program (as an attachment or the message body) to `adnan.khan@mavs.uta.edu` by 1:45 p.m. on May 3. The `Subject` should be your name as recorded by the University and you should `cc:` yourself to verify that you sent the message correctly.

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.