CSE 5311 Lab Assignment 2

Due July 20, 2005

Goals:

1. Review of minimum spanning tree concepts.

2. Understanding of union-find trees.

3. Understanding of directed MSTs and their relationship to ordinary MSTs.

Requirements:

1. Write (and test) a C or C++ program that produces a directed minimum spanning tree based on the attached excerpt from E. Lawler, *Combinatorial Optimization: Networks and Matroids*, (Holt, Rinehart, Winston), 1976 (reprinted as a paperback in 2001 by Dover). Your program must compile and execute on OMEGA. There should be a comment near the beginning of your code that indicates how to compile on OMEGA. Be sure that your program follows the requirements under "Getting Started".

   The first line of the input file will give the number of vertices and the number of edges. These will not exceed 100 and 10,000, respectively. Vertices will be numbered consecutively, starting with 0. Each of the remaining lines will contain a triple representing the tail, head, and weight for an edge. Weights will be between -100,000 and 100,000.

2. Email your code (as attachments) to `ghosh@cse.uta.edu` before 3:45 pm on July 20, 2005. The subject should include your name as recorded by the University.

Getting Started:

1. The example in the paper (Figures 8.13-8.15) is useful in understanding the concepts. It is also useful to solve Problem 14.1. Note that the paper discusses directed *maximum* spanning trees, but your code is to produce a directed *minimum* spanned tree with vertex 0 as the root. (This leads to no substantial changes in the approach.)

2. Do not prompt for a file name. Use a shell redirect (<) to access test case files.

3. You should use union-find trees for representing the contracted cycles ("pseudonodes").

4. Your program should trace the following for each phase when $|V| \leq 8$ or a flag (e.g. `#define TRACE`) is set:

   a. The input instance.
   b. Best ("lightest") edge found for each vertex.
   c. Cycles found.
   d. Adjustments to edge weights.

   Otherwise, the output is just the |V| - 1 DMST edges listed as tail, head, weight (one triple per line).