

# COP 4531 Algorithms Spring 2007

## Assignment 4

**Due: 19 Apr 2007**

**Problem:** In this assignment, you will implement programs to find the minimum spanning tree in two different ways.

**Sorting methods:** You should create programs that will find the minimum spanning tree of a connected graph using the following algorithms.

1. Prim's algorithm.
2. Kruskal's algorithm.

**Running the program:** Your program will be run as follows:

`<executable-name> <input-file-name> <output-file-name>`

**Input and output files:** The input and output files will have the following format.

Input	Output
$n$ $v_1 s_{11} w_{11} s_{12} w_{12} \dots s_{1k_1} w_{1k_1}$ $\cdot$ $\cdot$ $v_n s_{n1} w_{n1} s_{n2} w_{n2} \dots s_{nk_n} w_{nk_n}$	$n$ $v_1 r_{11} r_{12} \dots r_{1l_1}$ $\cdot$ $\cdot$ $v_n r_{n1} r_{n2} \dots r_{nl_n}$

Here,  $n$  is the number of vertices,  $v_i$  are strings containing the names of vertices,  $s_{ij}$  is a string giving the name of the  $j$ th neighbor of vertex  $i$  in the original graph,  $w_{ij}$  is a float number giving the weight of the corresponding edge,  $k_i$  is the degree of vertex  $v_i$  in the original graph,  $r_{ij}$  is a string giving the name of the  $j$ th neighbor of vertex  $i$  in the minimum spanning tree found, and  $l_i$  is its degree in this tree.

Sample input file	Sample output file
4 ab cd 4.2 e 1.0 f 1.0 cd ab 4.2 e 3.2 e ab 1.0 cd 3.2 f 2.3 f ab 1.0 e 2.3	4 ab e f cd e e ab f ab

**Files:** You should create a directory called COP4531/hw4 on `linprog`. This directory should contain the following files, implementing the algorithm indicated by the file name.

1. *prim.c*
2. *kruskal.c*
3. *Makefile*: The makefile for this assignment. Typing `make` should create two executables: *prim* and *kruskal*, corresponding to each of the above algorithms.

**Sample application:** Please run your code on a graph that arises from some real world application, using real world data, and report the results you get, in one or two pages. Your report you should mention the application you considered, identify what the vertices, edges, and edge weights represent (for example, vertices are cities, edges are roads between cities, and weights are driving distances), give the size of the data in terms of the number of edges and number of vertices, cite the source of your data, and summarize your findings.

**Turning in your assignment:** The code is due by midnight of the due date. Turn in instructions will be provided later. A hardcopy of the report is due by 5 pm on 20 April 2007.

**Grading:** You will be graded on the following (i) correctness of your codes, (ii) performance of your codes, and (iii) the quality of your report.