**MCS 3312 Analysis of Algorithms – Fall 2017**

Homework Assignment #3

Problem 1: Computational geometry

Part A:

Write a program to generate a random set of points in 2D. Write your point set out to file using the following file format:

p1:(*x*,*y*)

p2:(*x*,*y*)

p3:(*x*,*y*)

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Part B:

Read in the random set of points from 1A and compute the convex hull of the random set of points.

Part C:

Use the random set of points from 1A to compute a random set of line segments.

Part D:

Expand upon the program from 1C to determine if any of the line segments in 1C intersect. Print to screen the list of random line segments, and the list of intersecting line segments.

Part E:

Based upon the method from 1D, what would be a method for determining if a point lies inside or outside of a polygon?

Problem 2: Graph problems:

Part A:

Write a program to generate a random graph *G*(V, E); where *G* is the graph, *V* is the set of vertices for the graph, and *E* is the set of edges *e*(*u*, *v*); where *u*,*v*∈*E*. Write your random graph out to file using the following format:

*v*1: *n*1, *n*2, *n*3..

*v*1: *n*1, *n*2, *n*3..

*v*1: *n*1, *n*2, *n*3..

⁝

where *vi* is the *i*th vertex in the graph and *nj* is the *j*th neighbor of the *i*th vertex in the graph.

Part B:

Read in the random graph from 2A and compute a solution for the single-source shortest path problem.

Part C:

Read in the random graph from problem 1 and compute a solution for the all-pairs shortest path problem.

Part D:

Read in the random graph from problem 1 and compute a solution for the minimum spanning tree problem.

Part E:

Read in the random graph from problem 1 and compute a solution for the maximum flow problem.