Assignment 2
Trapezoidal decomposition, Delaunay triangulation

Exercise 1. Give an example of a collection of n segments and a bad insertion order for them, such that the incremental construction algorithm of the trapezoidal decomposition produces a graph G with many nodes—asympototically as many as possible.

Exercise 2. We claimed that there exists a constant c such that, for every n and every collection of n segments, the probability that there will be a query point in the plane with query time larger than $c \log n$ is at most $O(1/n)$. Finish the proof of this claim, by applying Chernoff's bound and the union bound.

Exercise 3. Write a computer program that reads as input a collection of n points and outputs its Delaunay triangulation, using the Randomized Incremental Construction (RIC) algorithm presented in class.

The program should read the input from a specified file. The file should contain $2n + 1$ integers, where the first integer is n, and the remaining integers are the coordinates of the points $x_1, y_1, \ldots, x_n, y_n$ in this order. You can assume general position. You can also assume that all the points are contained in the triangle with vertices $(0, 0), (10000, 0), (5000, 8660)$, and that no circumcircle contains any of these points.

The Delaunay triangulation should be internally represented in a way that allows for efficient implementation of the algorithm. Provide a description of the representation you are using.

Exercise 4. Give an example of an n-point set such that, in the RIC Delaunay triangulation algorithm, the lookup of one of the points visits $\Theta(n)$ nodes in expectation.