CS 266 Homework 6

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Problem 7.7

Do the breakpoints of the beach line always move downwards when the sweep line moves downwards? Prove this or give a counterexample.

Problem 7.11

Let P be a set of n points in the plane. Give an O(nlogn) time algorithm to find for each point p in P another point in P that is closest to it.

Compute the Voronoi Diagram and for the cell of p, calculate the nearest edge and whichever cell that corresponds to is the closest point.

Problem 9.11

A Euclidean minimum spanning tree (EMST) of a set P of points in the plane is a tree of minimum total edge length connecting all the points. EMSTs are interesting in applications where we want to connect sites in a planar environment by communication lines (local area networks), roads, railroads, or the like.

Part a

Prove that the set of edges of a Delaunay triangulation of P contains an EMST for P.

Make the Euclidean tree.
Apply Kruskal's to get an MST.
Because the Delaunay Triangulation gets all the sets of points which are closest together, all the edges for them will be included.

Part b

Use this result to give an O(nlogn) algorithm to compute an EMST for P.
Compute the Delaunay Triangulation.
Apply Kruskal's algorithm to the graph derived from the triangulation to get the EMST

Problem 9.17

The weight of a triangulation is the sum of the lengths of all edges of the triangulation. A minimum weight triangulation is a triangulation whose weight is minimal. Disprove the conjecture that the Delaunay triangulation is a minimum weight triangulation.