Assignment no. 4

due: June 11th, 2012

Exercise 4.1 Let P be a set of n points in the plane. Give an $O(n \log n)$ time algorithm to find for each point p in P another point in P that is closest to p.

Exercise 4.2 Give an algorithm to compute the *medial axis* of a convex polygon, and analyze its running time.

Exercise 4.3 Let L be a set of lines in the plane. Give an $O(n \log n)$ time algorithm to compute an axis-parallel rectangle that contains all the vertices of the arrangement $\mathcal{A}(L)$ in its interior.

Exercise 4.4 Let S be a set of n segments in the plane. A line ℓ that intersects all segments of S is called a *transversal* or *stabber* for S.
(a) Give an $O(n^2)$ algorithm to decide if a stabber exists for S.
(b) Now assume that all segments in S are vertical. Give a linear time algorithm to decide if a stabber for S exists.
(CGAA Ex. 8.16)

Exercise 4.5 The degree of a point in a triangulation is the number of edges incident to the point. Give an example of a set of n points in the plane such that in any triangulation of the set there is always a point whose degree is $n - 1$.

Exercise 4.6 Prove that any two triangulations of a planar point set can be transformed into each other by edge flips.

Exercise 4.7 (optional) A *Euclidean minimum spanning tree* (EMST) of a set P of planar points is a tree of minimum total edge length connecting all the points.
(a) Prove that the set of edges of a Delaunay triangulation of P contains an EMST of P.
(b) Give an $O(n \log n)$ time algorithm to compute an EMST for P.