CS 6463 Computational Geometry, Fall 10

9/22/10

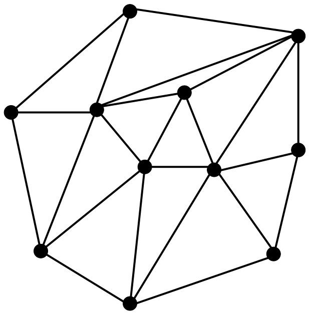
2. Homework

Due **10/6/10** before class

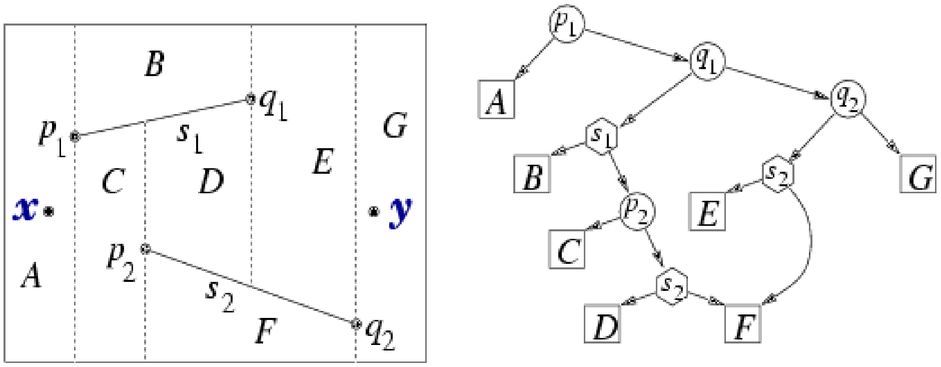
Always justify the runtime and the correctness of your algorithms, and try to make algorithms as efficient as possible.

1. (10 points) Triangulating a Point Set

   A triangulation of a set of points P in the plane is a decomposition of $CH(P)$ into triangles whose vertices are points of P and which contain no point of P in the interior of a triangle or an edge.
   Explain how to adapt the triangulation algorithm that we discussed in class to efficiently triangulate a set of n points.



2. (5 points) Trapezoidal Map Example
   Consider the following instance of the trapezoidal map point location data structure. The left side shows the map, and the right side shows the corresponding search structure. Describe how the search structure is modified if the next segment to be added is $\overline{xy}$.



3. (20 points) Point Location Without Preprocessing
   Consider the following *single shot* problems, where the subdivision and the query point are given at the same time, and no preprocessing is allowed to speed up the query time.

   a) (10 points) Given a planar subdivision $\mathcal{S}$ stored in a doubly-connected edge list with n vertices and edges, and given a query point q. Show that the face of $\mathcal{S}$ containing q can be computed in time $O(n)$.

   b) (10 points) Given a convex polygon $\mathcal{P}$ as an array of its n vertices in sorted order along the boundary. Show that, given a query point q, it can be tested in time $O(\log n)$ whether q lies inside $\mathcal{P}$.