CMPS 3130/6130 Computational Geometry – Spring 17

2/23/17

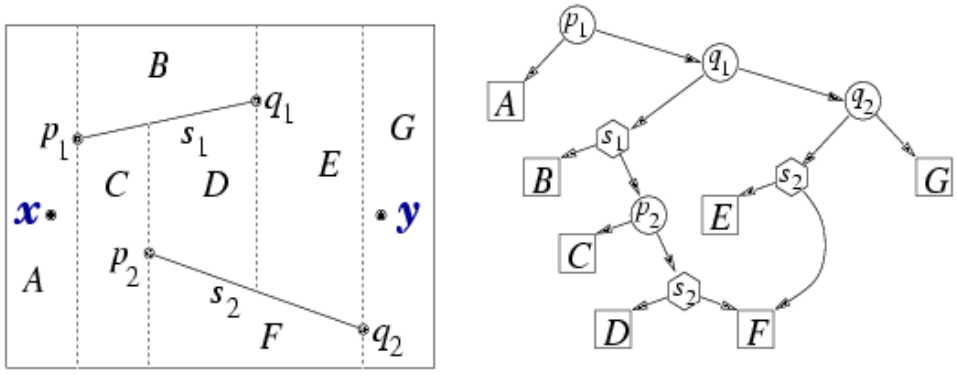
4. Homework

Due **Tuesday 3/7/17** before class.

1. **Star Triangulation (10 points)**
   A star-shaped polygon is a polygon P for which there exists a point c in the interior such that every point on the boundary of P is visible from c (i.e., the line segment between c and the boundary point is not intersected by any other boundary edge).

   In order to construct Kirkpatrick's point location data structure we had to repeatedly triangulate starshaped polygons that resulted from deleting vertices. These polygons were constant size, so the runtime was not a problem. But now assume that we have a starshaped polygon with n vertices. Show that such a polygon can be triangulated in linear time.

2. **Trapezoidal Map (10 points)**
   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 DAG. Describe the resulting trapezoidal map and DAG after segment $\overline{xy}$ has been added.



3. **Sweepline Trapezoidal Map (10 points)**
   Design a *deterministic* (i.e., non-randomized) sweepline algorithm with running time $O(n \log n)$ to construct a trapezoidal map of n non-crossing line segments. You do not have to compute the associated DAG for point location, just the trapezoidal map. Describe the algorithm and analyze its runtime.