CMPS 3120 Computational Geometry – Spring 13

2/21/13

3. Homework

Due **3/14/13** before class

1. **DCEL (6 points)**

   Which of the following equalities are always true? Justify your answers.

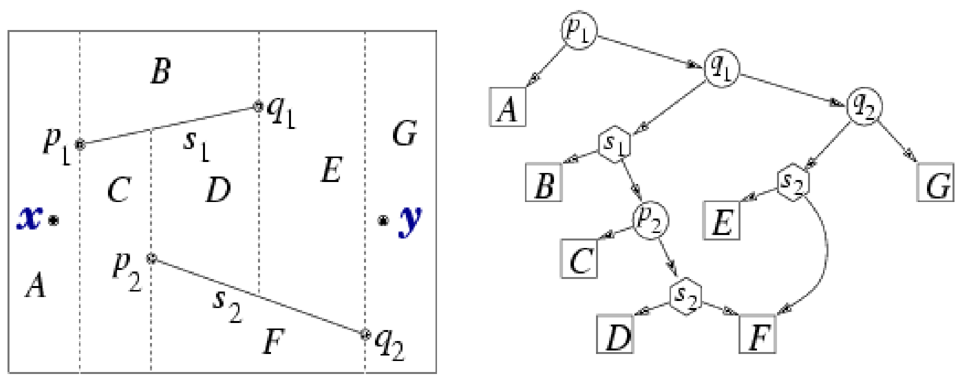
   (a) $Twin(Twin(\vec{e})) = \vec{e}$

   (b) $Next(Prev(\vec{e})) = \vec{e}$

   (c) $Twin(Prev(Twin(\vec{e}))) = Next(\vec{e})$

   (d) $IncidentFace(\vec{e}) = IncidentFace(Next(\vec{e}))$

2. **Trapezoidal Map (6 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 search structure. Describe how the search structure is modified if the next segment to be added is $\overline{xy}$.



3. **Simple Polygon (6 points)**
   Let P be a simple polygon with n vertices in the plane with a given trapezoidal map. Give an algorithm that computes a triangulation of P from the trapezoidal map in $O(n)$ time.

   (Hint: Use the linear-time triangulation algorithm that we have covered in class.)

4. **Hausdorff Distance (6 points)**
   Let A and B be two point sets in the plane with m and n vertices, respectively. The *directed Hausdorff distance* $h(A, B)$ is defined as $h(A, B) = \max_{a \in A} \min_{b \in B} d(a, b)$, where $d(.,.)$ is the Euclidean distance. The *(undirected) Hausdorff distance* $H(A, B)$ is defined as $H(A, B) = \max\{h(A, B), h(B, A)\}$. Show that the undirected Hausdorff distance can be computed in $O((n + m)\log(n + m))$ time.