COT5520 Computational Geometry

Homework Assignment # 3

Due: September 29, 2003

1. Let S be a set of n triangles in the plane. We want to find a set of segments with the following properties:
   a. Each segment connects a point on the boundary of one triangle to a point on the boundary of another triangle.
   b. The interiors of the segments are pairwise disjoint and they are disjoint from the triangles.
   c. Together they connect all triangles to each other, that is, by walking along the segments and the triangle boundaries it must be possible to walk from a triangle to any other triangle.

   Develop a plane sweep algorithm for this problem that runs in time. State the events and the data structures that you use explicitly, and describe the cases that arise and the actions required for each of them. Also state the sweep invariant.

2. Let S be a subdivision of complexity n, and let P be a set of m points. Give a plane sweep algorithm that computes for every point in P in which face of S it is contained. Show that your algorithm runs in $O((n+m)\log(n+m))$ time.

3. Prove or disprove: The dual graph of the triangulation of a monotone polygon is always a chain, that is, any node in this graph has degree at most two.

4. Give the pseudo-code of the algorithm to compute a 3-coloring of a triangulated simple polygon. The algorithm should run in linear time.

5. Show that if a polygon has $O(1)$ turn vertices, then the polygon triangulation algorithm, given in chapter 3 of Berg et al, can be made to run in $O(n)$ time.