CS133 Computational Geometry, Winter 2009

Assignment 1

Due: Thursday March 12, 2009

1. For the first problem, you will implement an algorithm that triangulates a monotone range polygon (monotone along the y-axis).
   a. Describe (in pseudocode) an algorithm that checks if a polygon is monotone range in linear time
   b. Describe (in pseudocode) an algorithm that triangulates a monotone range polygon in linear time
   c. Prove the running time of your algorithm.
   d. Implement code that, assuming that the input polygon is monotone range, triangulates the polygon in linear time.

      The output should be:

      i. The list of n-2 triangles
      ii. A visual representation of the original polygon and the diagonals used in the triangulation.

2. In the second part, you will implement an incremental algorithm for computing convex hull.
      i. The algorithm should add one point at a time to the convex hull of the current set of points.
      ii. The algorithm should first check if the new point is inside the convex hull. If not, it should add it to the convex hull.
      iii. After every insertion, you should give a graphical description of the current hull.

   a. What is the worst case running time of your algorithm? Give an example.
   b. What is the best case running time of you algorithm? Give an example.
   c. Compare experimentally the running time of your algorithm for the following cases:
      i. The points are given in sorted (by x-coordinate) order.
      ii. The points are uniformly distributed and given in random order.

NOTE: Assume that the points are in general position and don't forget to visualize the algorithms using OpenGL or similar graphic library.