CSC 437/537 - Geometric Algorithms

Assignment 3

Due: Friday, October 8th at 11:59pm

Triangulation

1) Implement in Python a plane-sweep algorithm to triangulate an x-monotone polygon. Show the output for two different polygons and measure some times for larger polygons to show that the time complexity of the algorithm is O(n).
2) Give an algorithm that computes in O(n log n) time a diagonal that splits a simple polygon with n vertices into two simple polygons each with at most $\lfloor 2n/3 \rfloor + 2$ vertices. Hint: Use the dual graph of a triangulation.

Halfplane Intersection

1) On n parallel railway tracks, n trains are moving with constant speeds v1, v2, . . . , vn. At time t = 0 the trains are at positions k1,k2,...,kn. Write an O(nlogn) algorithm that identifies all trains which at some point in time are leading. You can make use of the algorithm for computing the intersection of halfplanes. Draw a diagram showing how halfplanes are used to model the problem and how your algorithm works.

Submit your code, your plots, and any screen captures that demonstrate that your programs work. For any proofs, arguments or pseudocode you can use a word processor or free-hand writing and drawing as long as it is clear and readable.