CS 266 Homework 8

Zachary DeStefano, PhD Student, 15247592

Due Date: June 5, 2014

Problem 11.2

Prove that the worst case running time of algorithm CONVEXHULL is O(n3), and that there are sets of points where a bad choice of the random permutation makes the algorithm actually need (n3) time.

Problem 11.4

In many applications, only a small percentage of the points in a given set P of n points are extreme. In such a case, the convex hull of P has less than n vertices. This can actually make our algorithm CONVEXHULL run faster than (nlogn).

Assume, for instance, that the expected number of extreme points in a random sample of P of size r is $O(r^{\alpha})$, for some constant $\alpha < 1$. (This is true when the set P has been created by picking points uniformly at random in a ball.) Prove that under this condition, the running time of the algorithm is O(n).

Problem 11.8

Describe a randomized incremental algorithm to compute the intersection of half-planes, and analyze its expected running time. Your algorithm should maintain the intersection of the current set of half-planes. To figure out where to insert a new half-plane, maintain a conflict graph between the vertices of the current intersection and the half-planes that are still to be inserted.