Problem Set 1
TTIC 31100 / CMSC 39000 Computational geometry

October 7, 2010

Problem 1. For two sets of points $X, Y \subset \mathbb{R}^2$, define the ℓ_∞ *distance* between X and Y, denoted by $d(X, Y)$, to be

$$d(X, Y) = \inf_{x \in X, y \in Y} \|x - y\|_\infty,$$

where $\|x - y\|_\infty$ is the usual ℓ_∞ distance between the points x and y. Given a set of n axis-parallel rectangles in the plane, show how to find a pair of rectangles with minimum ℓ_∞ distance, in time $O(n \log n)$.

Problem 2.

(a) Show that the problem of constructing a data structure for Orthogonal Range Searching, can be reduced deterministically to the case where in every dimension, all points have distinct coordinates.

(b) Provide a randomized reduction for (a), by randomly perturbing the input. I.e. for every point in the input, add some appropriately chosen random noise to every coordinate.

Problems from the book. 1.10 (a-d), 5.13(a-b).