CSC 279/479 Computational Geometry - homework 3
due: Oct 9th, 11:59pm ET, submit on Gradescope

PROBLEM 10—duality

PART A) Let pq be a line segment in the plane. For each point x on the segment pq let $\hat{x}$ be the dual line. Consider the union of all $\hat{x}$ (for x on the segment pq). Describe the union (the object is called "double wedge").

PART B) Given a collection of line segments in the plane we want to find a line that intersects as many of the segments as possible. Give an $O(n^2 \log n)$ algorithm for the problem (using part A and sweep paradigm).

PROBLEM 11—monotone?

Recall that a simple polygon P is monotone w.r.t. line ℓ if every line ℓ' perpedicular to ℓ we have that $\ell' \cap P$ is either empty or a line segment (could be a single point). Give an efficient algorithm that determines whether for a given input simple polygon P there exists a line ℓ such that P is monotone w.r.t ℓ.

PROBLEM 12—separating red and blue points by a parabola.

A parabola is a function of the form $ax^2 + bx + c$. We are given n red points an n blue points. We want to find a parabola such that all red points are above and all blue points are below. Give na efficient algorithm for the problem.

PROBLEM 13—minimum are annulus

An annulus is an area between two concentric circles (that is, set of points x such that

$$r \leq \|x - c\|_2 \leq R,$$

where c is the common center and r, R are the radiuses). Given a set of points $p_1, \ldots, p_n$ we want to find minimum area (the area is $\pi(R^2 - r^2)$) annulus that contains all the points. Given a linear program for the problem.