

**Due Date: December 4, 2008**

**Problem 1:** [10pts] Let  $S$  be a set of  $n$  segments in  $\mathbb{R}^2$ . Describe a randomized algorithm to count the number of intersection points in  $S$  whose expected running time is  $O(n^{4/3} \log n)$ .

**Problem 2:** [10pts] Show that a set  $S$  of  $n$  segments in  $\mathbb{R}^2$  can be preprocessed in  $O(n^2 \log n)$  time into a data structure of size  $O(n^2)$  so that all  $k$  segments of  $S$  intersecting a query line can be reported in  $O(\log n + k)$  time.

**Problem 3:** [10pts] Let  $H$  be a set of  $n$  halfspace in  $\mathbb{R}^4$ , and let  $P$  be a set of  $n$  points in  $\mathbb{R}^4$ . Describe a randomized algorithm with  $O(n^{4/3} \log n)$  expected running time to determine which points of  $L$  lie inside the convex polyhedron  $\bigcap H$ .

**Extra credit:** Describe an  $O(n^{4/3} \text{polylog}(n))$  algorithm to describe which of the halfplanes in  $H$  appear on the boundary of  $\bigcap H$ .