CISC-868 WINTER 2015

Please work on these problems and be prepared to share your solutions with classmates in class. Assignments will not be collected for grading. (These problems come from Computational Geometry: Algorithms and Applications, Chapter 4.)

1. Let $H$ be a set of at least three half-planes with a non-empty intersection such that not all bounding lines are parallel. We call a half-plane $h \in H$ redundant if it does not contribute an edge to intersection of the planes of $H$. Prove that for any redundant half-plane $h \in H$ there are two half-planes $h_i, h_j \in H$ such that $h_i \cap h_j \subset h$.

Give an $O(n \log n)$ time algorithm to compute all redundant half-planes.

2. Give an example of a 2-dimensional linear program that is bounded, but where there is no lexicographically smallest solution.

3. A simple polygon $P$ is called star-shaped if it contains a point $q$ such that for any point $p$ in $P$ the line segment $pq$ is contained in $P$. Give an algorithm whose expected running time is linear to decide whether a simple polygon is star-shaped.