CSCI5010 Exercise List 5

Problem 1 (Redundant Linear Constraints; question 4.9 from the textbook). Let H be a set of halfplanes with $|H| \geq 3$. Let P be the (perhaps unbounded) polygon that corresponds to the intersection of all the halfplanes in H. We say that a halfplane $h \in H$ is *redundant* if it does not contribute an edge to P.

- Prove: for any redundant $h \in H$, there are two halfplanes $h', h'' \in H$ such that $h' \cap h'' \subset h$.
- Design an algorithm to find all the redundant halfplanes in $O(n \log n)$ time.

Problem 2 (Linear Separation). Let S be a set of n points in $\mathbb{R}^2$. Each point is colored either red or blue. Give an algorithm to find in $O(n)$ expected time whether the red points can be separated from the blue points by a line.

Problem 3 (Output-Sensitive Lower Envelop). Let S be a set of n non-vertical lines in $\mathbb{R}^2$. Report the lower envelop of S in $O(n \log k)$ time, where k is the number of lines contributing to the lower envelop.