The following problems are due in 2 weeks (Feb 23rd) before class.

1. Let $S$ be a set of triangles in the plane. The boundaries of the triangles are disjoint, but it is possible that a triangle lies completely inside another triangle. Let $P$ be a set of $n$ points in the plane. Give an $O(n \log n)$ algorithm that reports each point in $P$ lying outside all triangles.

2. Let $S$ be a set of $n$ disjoint line segments in the plane, and let $p$ be a point not on any of the line segments of $S$. We wish to determine all line segments of $S$ that $p$ can see. That is, all line segments of $S$ that contain some point $q$ so that the open segment $pq$ does not intersect any line segment of $S$. Give an $O(n \log n)$ algorithm for this problem that uses a rotating half line with its endpoint at $p$.

3. Let $S$ be a set of $n$ segments in the plane. A line $\ell$ that intersects all segments of $S$ is called a traversal or stabber of $S$. Give an $O(n^2)$ algorithm to decide if a stabber for $S$ exists. Hint: Use duality.

4. 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 to an edge to $\cap H$. Prove that for any redundant half-plane $h \in H$ there are two half-planes $h', h'' \in H$ such that $h' \cap h'' \subset h$. Give an $O(n \log n)$ algorithm to compute all redundant half-planes.

5. A simple polygon $P$ is 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.