1. a. Let $P_1$ and $P_2$ be two disjoint convex polygons with $n$ vertices in total. Describe an $O(n)$ algorithm that computes the convex hull of $P_1 \cup P_2$.

b. Develop an $O(n \log n)$ algorithm for computing the convex hull of a set of $n$ points in the plane that is based on the algorithm of the previous part.

2. Let $l_1, \ldots, l_n$ be $n$ given lines in the plane, no two parallel and no three meeting at a common point. Let $S$ be the set of their $n(n - 1)/2$ intersection points. Give an algorithm for calculating the convex hull of $S$ in time $O(n \log n)$ (in particular, you cannot afford to calculate the entire set $S$.) Prove your claims.

3. Let $S_1$ be a set of $n$ disjoint horizontal segments, and let $S_2$ be a set of $n$ disjoint vertical segments. Describe an $O(n \log n)$-time algorithm for counting the number of intersections in $S_1 \cup S_2$.

4. Draw a polygon $P$ and place guards in it, such that the guards cover the boundary of $P$, but there exists a point in the interior of $P$ that is not seen by any of the guards.

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