

1. Homework

Due 9/21/06 before class

Always justify the runtime and the correctness of your algorithms.

1. (1.3) – 10 points

Let E be an unsorted set of n line segments that are the edges of a convex polygon. Describe an $O(n \log n)$ algorithm that computes from E a list containing all vertices of the polygon, sorted in clockwise (or counter-clockwise) order.

2. (1.6) – 15 points

This exercise is about computing the convex hull of objects other than points.

- Let S be a set of n line segments in the plane. Prove that the convex hull of S is exactly the same as the convex hull of the $2n$ endpoints of the segments. *Hint: It is enough to use the definition of the convex hull as the intersection of convex sets.*
- Let \mathcal{P} be a non-convex polygon. Describe an algorithm that computes the convex hull of \mathcal{P} in $O(n)$ time. *Hint: Use a variant of Graham's scan where the vertices are not treated in lexicographic order but in some other order.*

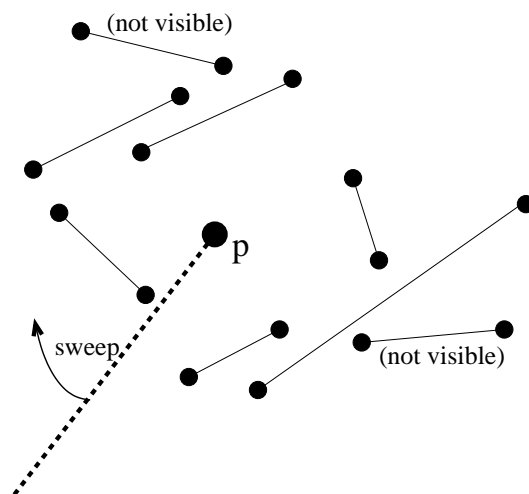
3. – 5 points

Let $a, b, c, d \in \mathbb{R}^2$. Show how to check whether the two line segments ab and cd intersect using a constant number of half-plane tests (or orientation tests).

4. (2.14) – 10 points

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, i.e., 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 $O(n \log n)$ time algorithm for this problem that uses a rotating half-line with its endpoint at p .



5. – 5 points

Give an example of a polygon together with a placement of vertex guards, such that the whole polygon boundary is guarded but not the whole interior.