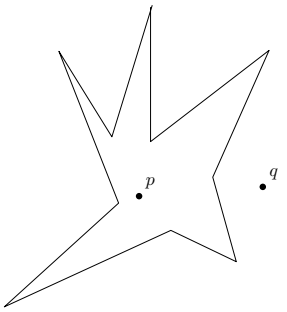
Exercise List 9

Problem 1. Let G be polygon of n vertices, which have been given in clockwise order. Given a point p in $\mathbb{R}^2$, describe an $O(n)$ time algorithm to decide whether p falls inside or outside G.

Problem 2. Recall that a polygon G is *star-shaped* if there is a point p inside the polygon that is visible to all the vertices of the polygon. Suppose that you are given the n vertices of G in clockwise order, such a point p (visible to all vertices), and an arbitrary point q in $\mathbb{R}^2$. An example is shown in the figure below. Give an algorithm to decide whether q is inside or outside G in $O(\log n)$ time.



Problem 3. Given a polygonal subdivision of $\mathbb{R}^2$, explain how to build a structure to answer queries of the following form: given a query segment q, find all the faces of the subdivision that have a non-empty intersection with q. For example, in the figure below, q intersects with 3 faces. Your structure needs to consume $O(n)$ space in expectation, where n is the number of faces in the subdivision. It must answer any query in $O(k \log n)$ time in expectation, where k is the number of faces reported.