# CSCI5010 Exercise List 10

Problem 1 (Segment-Segment Intersection). Let S be a set of non-intersecting segments in $\mathbb{R}^2$. Given a vertical segment $q = x \times [y_1, y_2]$, a query reports all the segments in S intersecting q (e.g., in the figure below, the query reports two segments). Preprocess S into a data structure of $O(n)$ space such that a query can be answered in $O((k+1)\log n)$ time, where k is the number of segments reported.
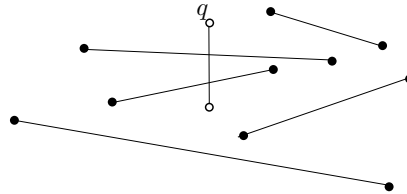
Problem 2 (Segment-Segment Intersection). Consider the previous problem again. Let s, s' be two segments in S. We say that s' is *vertically adjacent* to s if we can shoot a vertical ray either upward or downward from an endpoint of s', such that s is the first segment in S hit by the ray. The *vertical visibility* of s is defined as the number of segments in S (other than s) vertically adjacent to s. For example, the vertical visibility of s_1 is 3, while that of s_2 is 1.

Let λ be the maximum vertical visibility of all segments in S. Preprocess S into a data structure of $O(n)$ space such that a query can be answered in $O(\log n + k \log \lambda)$ time, where k is the number of segments reported.