

**Problem Set 3**

*Due: Thursday, March 11, 2021*

**Problem 3.1 [Thinking Outside The Box].** The orthogonal range query data structure described in Lecture 4 supports the following operation:

*inside*( $\mathbf{p}, \mathbf{q}$ ): return all  $k$  points *inside* the bounding box spanned by points  $\mathbf{p}$  and  $\mathbf{q}$ .

Implement the following operation using  $O(d)$  calls to *inside*():

*outside*( $\mathbf{p}, \mathbf{q}$ ): return all  $k$  points *outside* the bounding box spanned by points  $\mathbf{p}$  and  $\mathbf{q}$ .

Other than the black-box calls to *inside*(), the running time of your algorithm should be  $O(d + k)$ .

You will receive partial credit if you use  $O(c^d)$  calls to *inside*() for some constant  $c$ .

You can assume that all coordinates, including those of queries, are distinct.