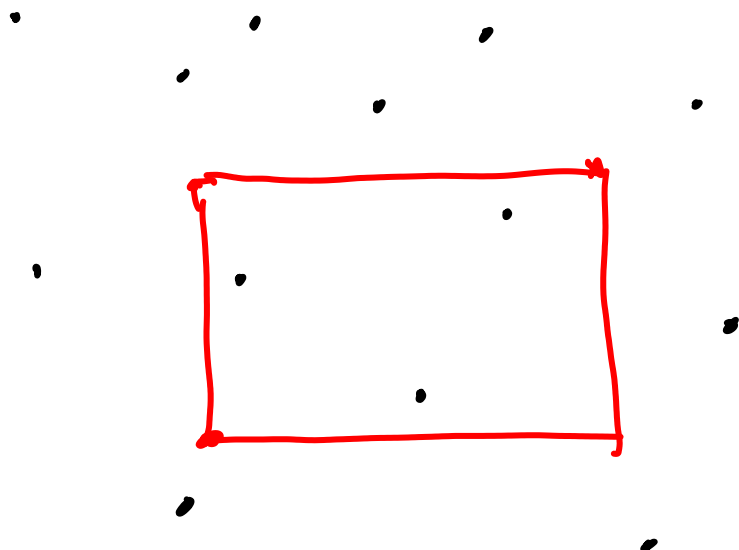


Query problems



Given n
points on the
plane

$$P: (x_i, y_i) \\ 1 \leq i \leq n$$

Build a data structure such that given a query rectangle R , we want to

(i) answer the # points in R : $|P \cap R|$

(ii) Report all the points contained in R
 $P \cap R$

Without any explicit data structure,

Query time : $O(n)$

by testing each
point against R

For query (i), the query complexity should be much smaller than n , preferably $\log n$

For query (ii), we should aim for output-sensitive performance, i.e. proportional to $|P \cap R|$

One dimensional analogue

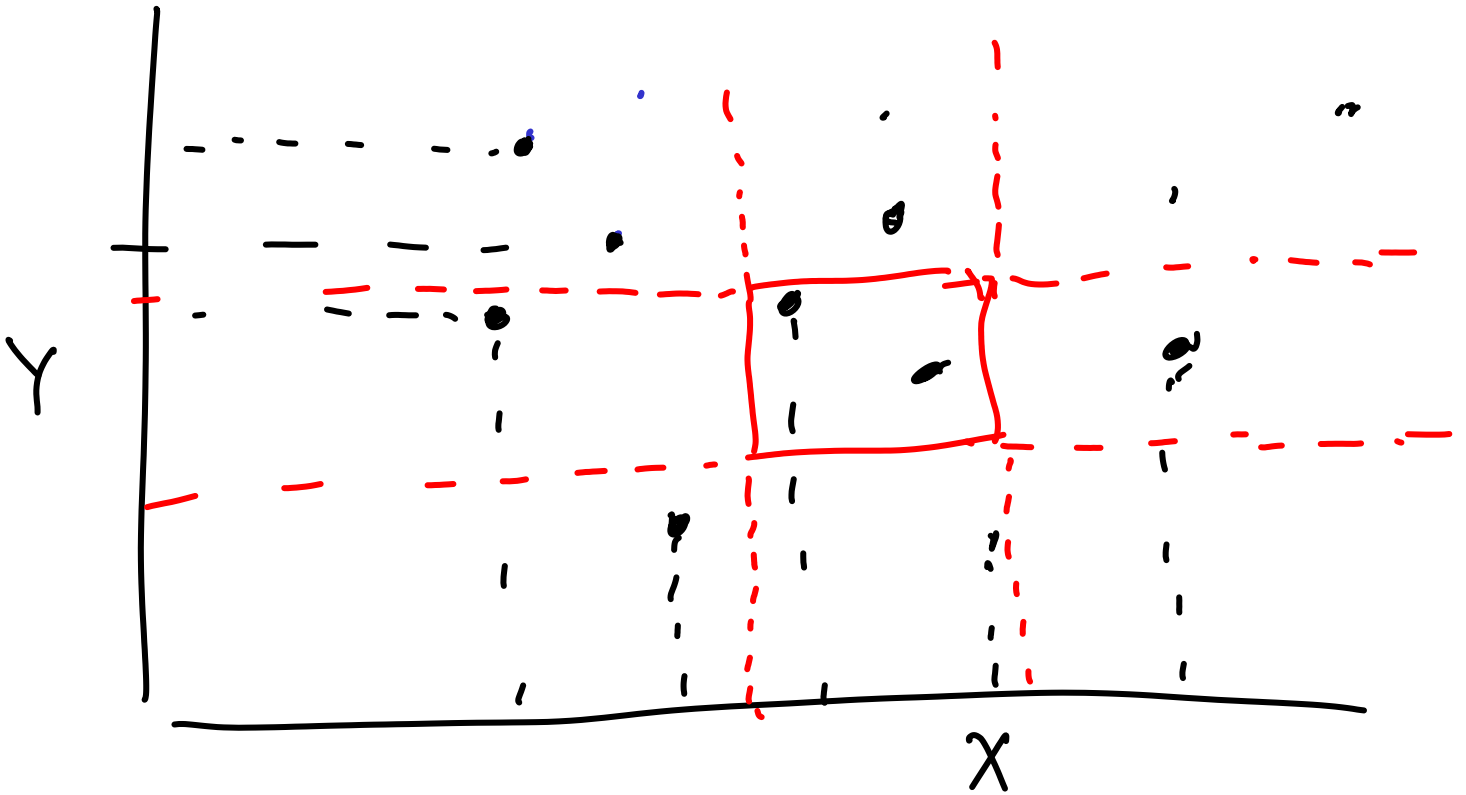
• • • • [• • • •] • • • •

Sort the points : Preprocessing time $O(n \log n)$
given an interval $[l, r]$ we can do a binary search on l and r to locate their position in the sorted set of points, say i and j $j > i$

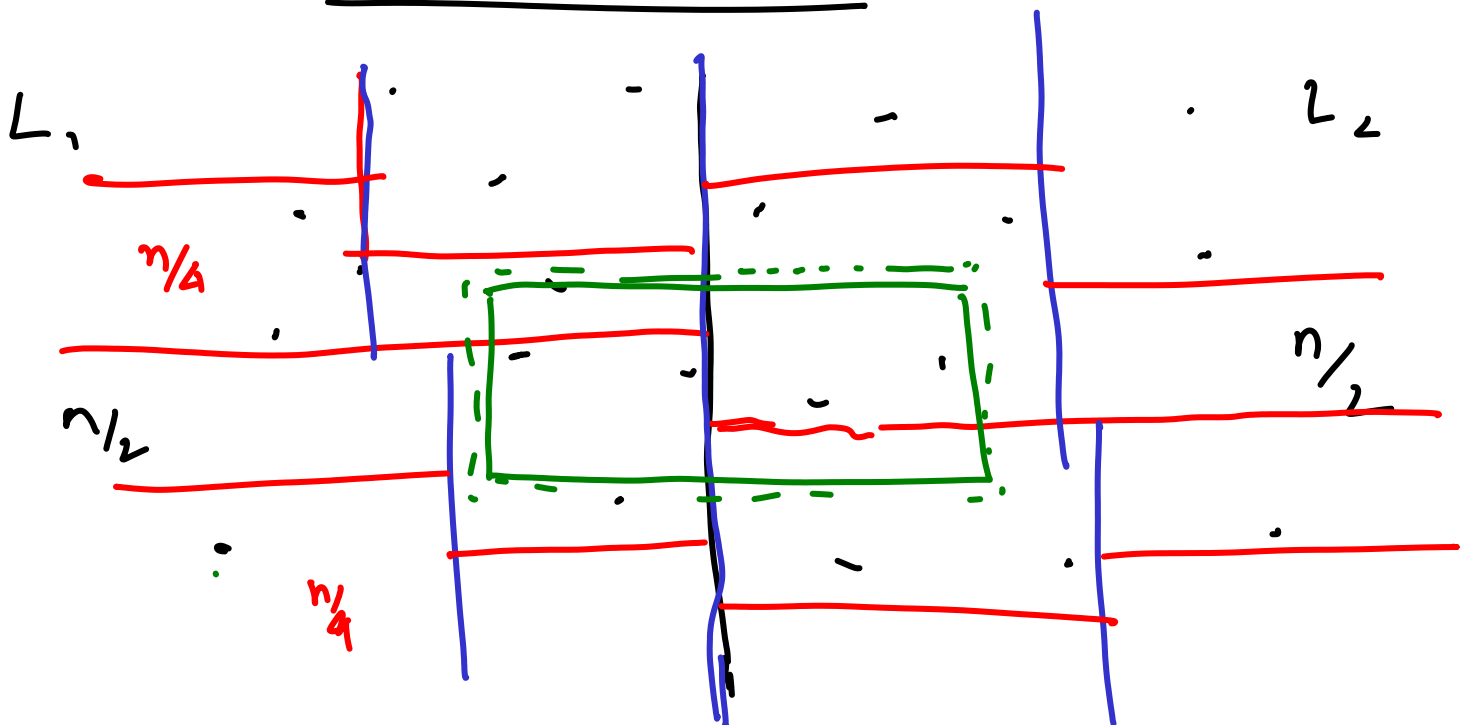
Points in $j-i$ Query Time : $2 \log n$

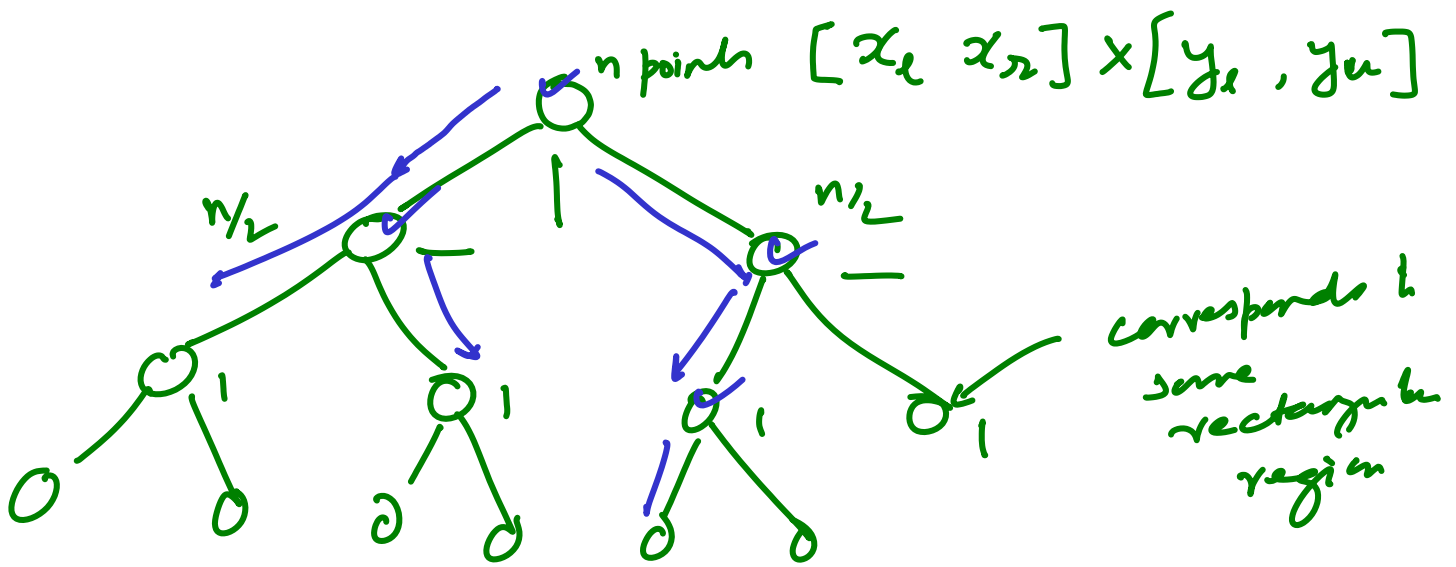
Cost of reporting : $O(\log n + |P \cap R|)$

Can we extend it to 2 dim?



K-d trees





Query time \sim # nodes visited