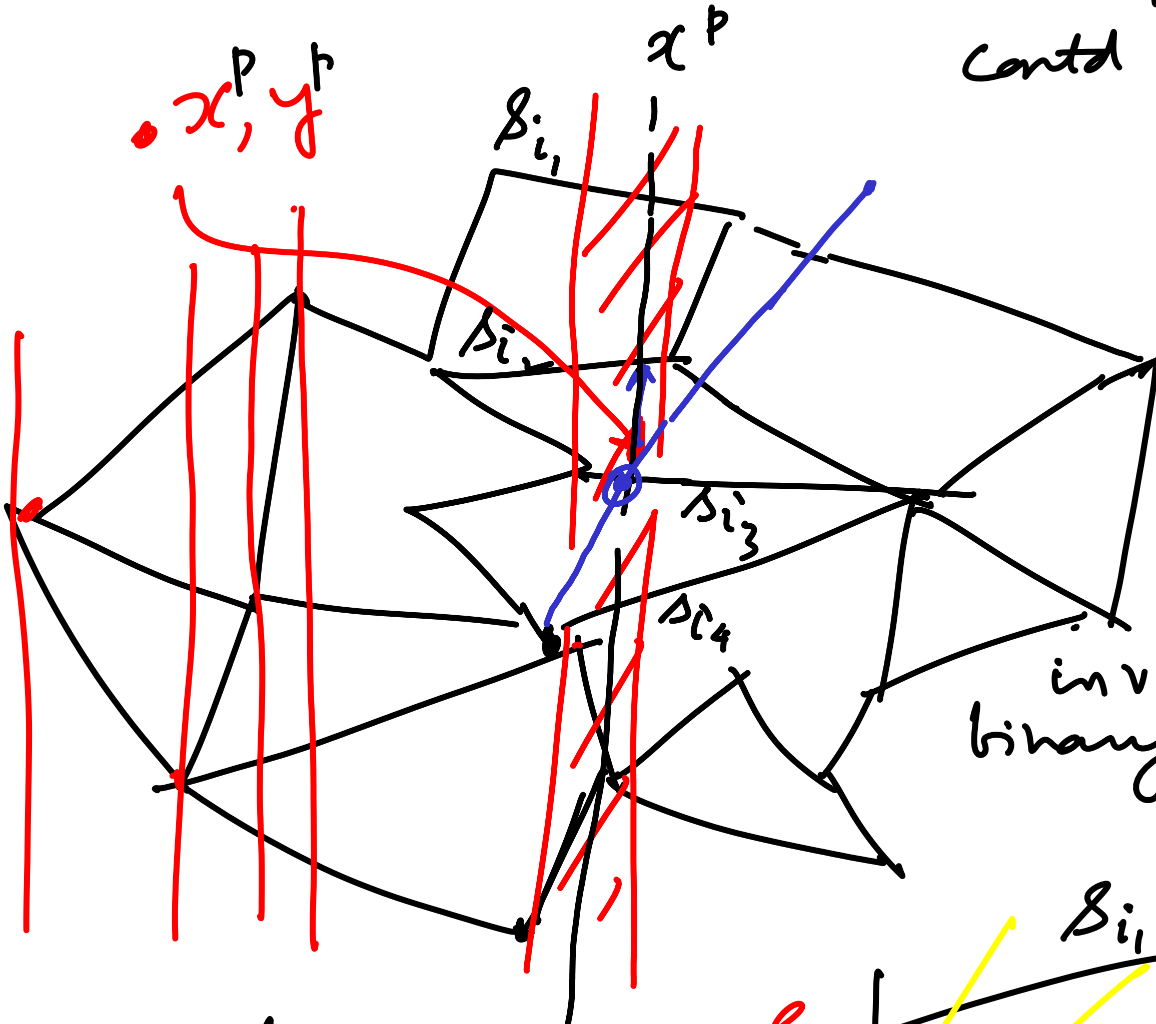
CSL 356 Lecture 29

Point location in planar partition contd

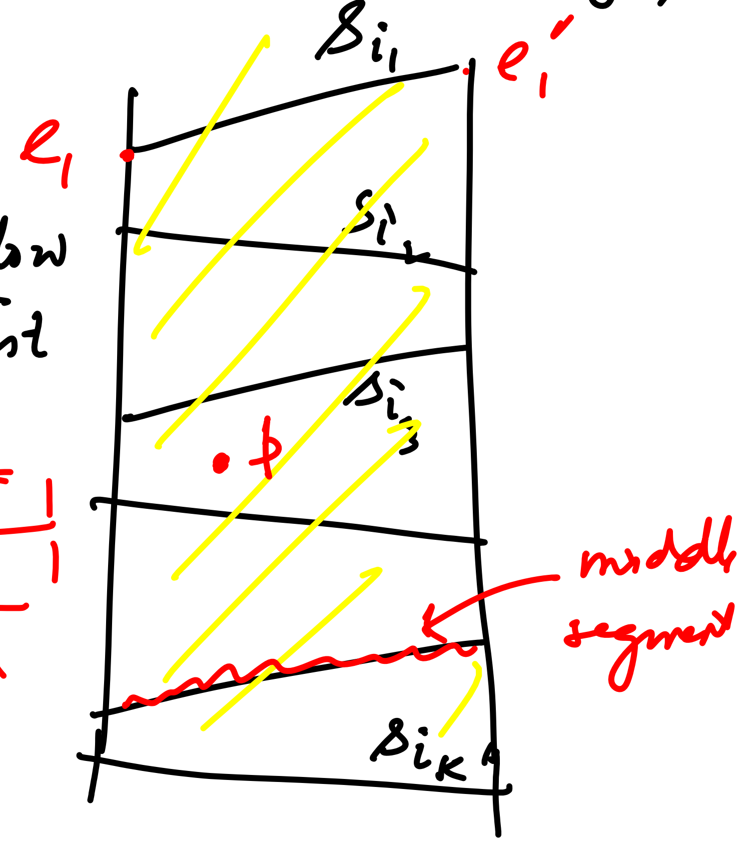


point locatn involves 2 binary searches $O(\log n)$ time

second binary search is based on above/below test in $O(1)$ per test

s_{i_1}	s_{i_2}	s_{i_3}	. . .	s_{i_k}
e_1	e_2			
e_1'	e_2'			

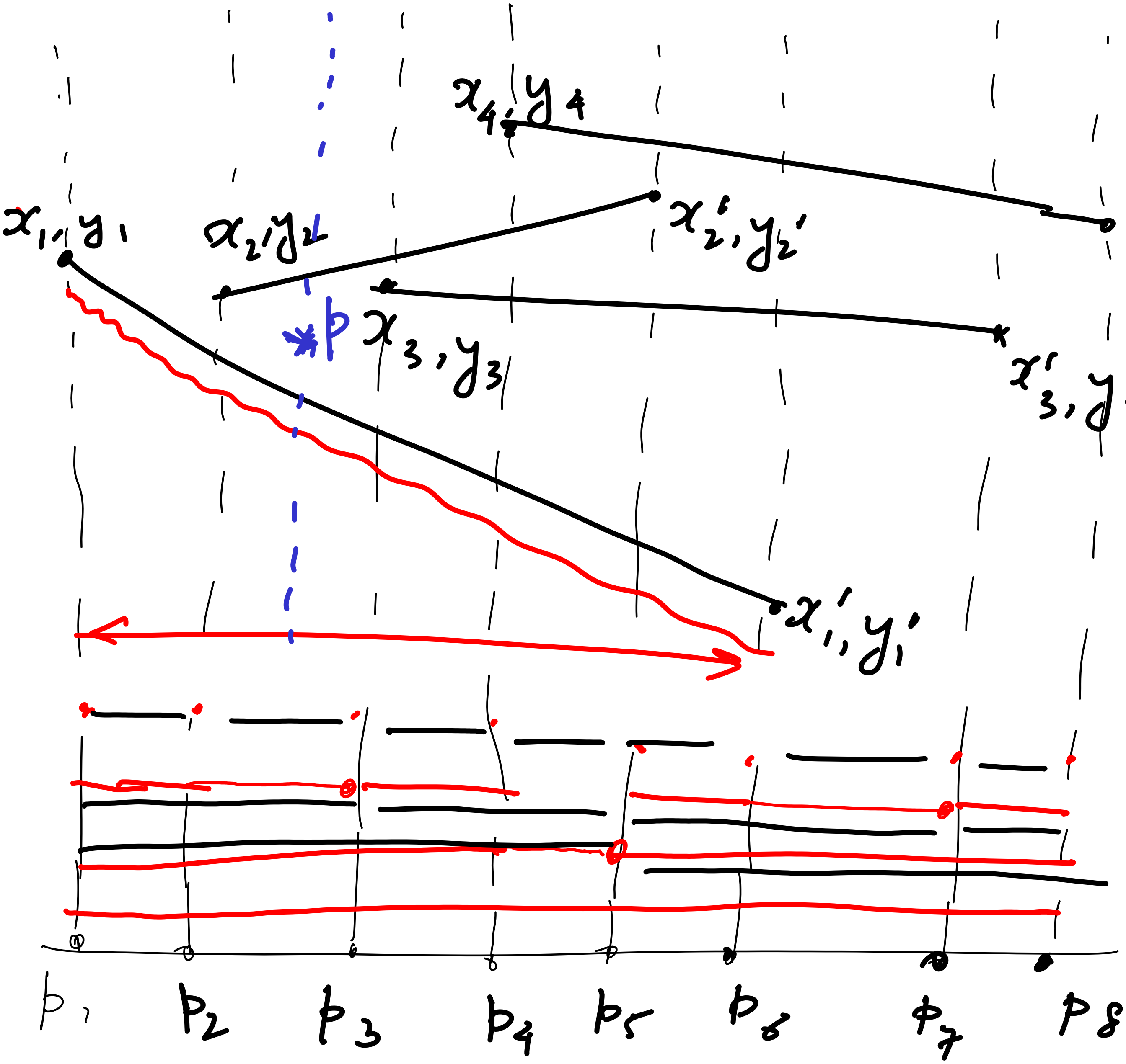
above
below

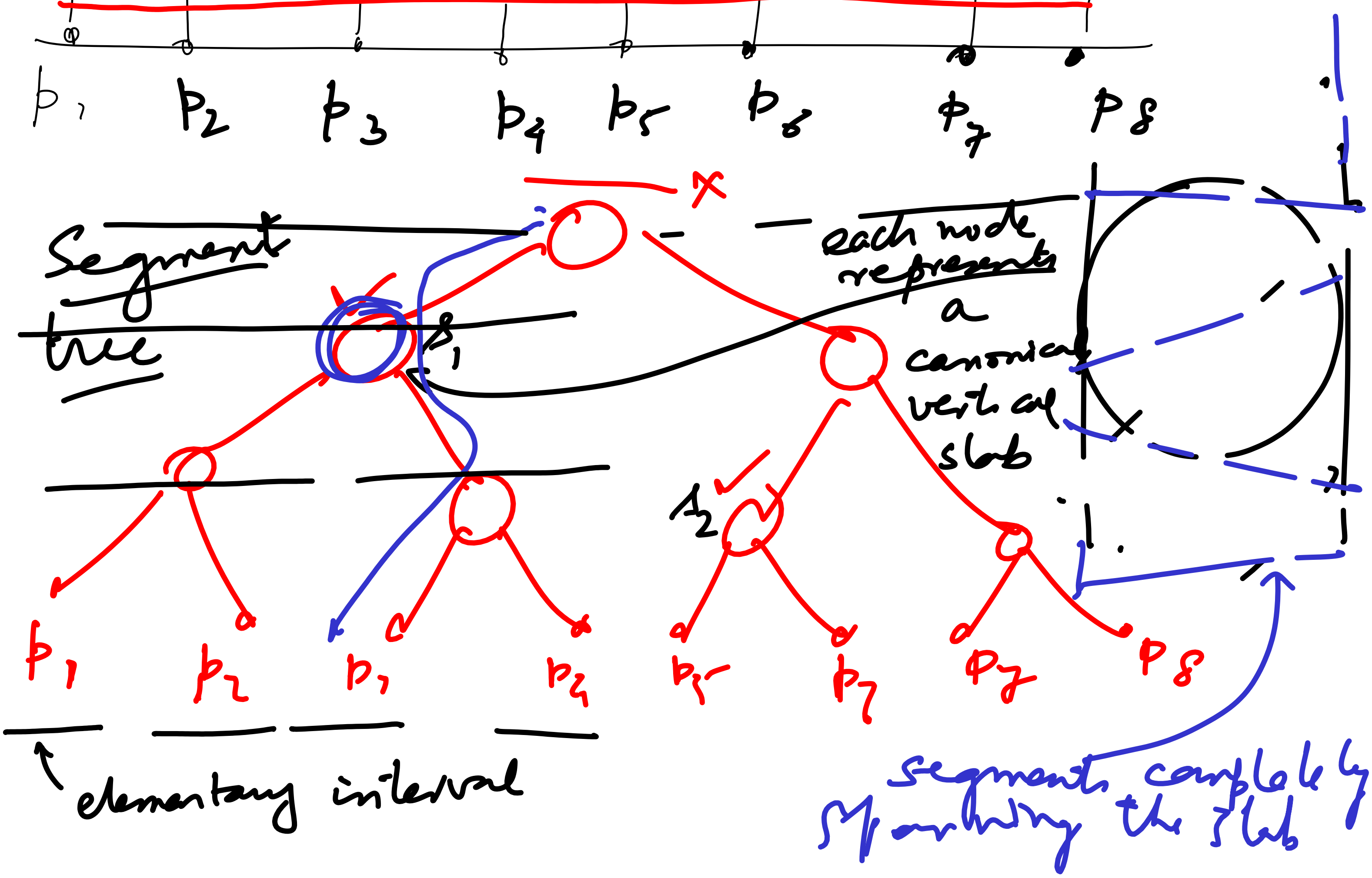


Space is related to the search data structures in $2n+1$ vertical slabs

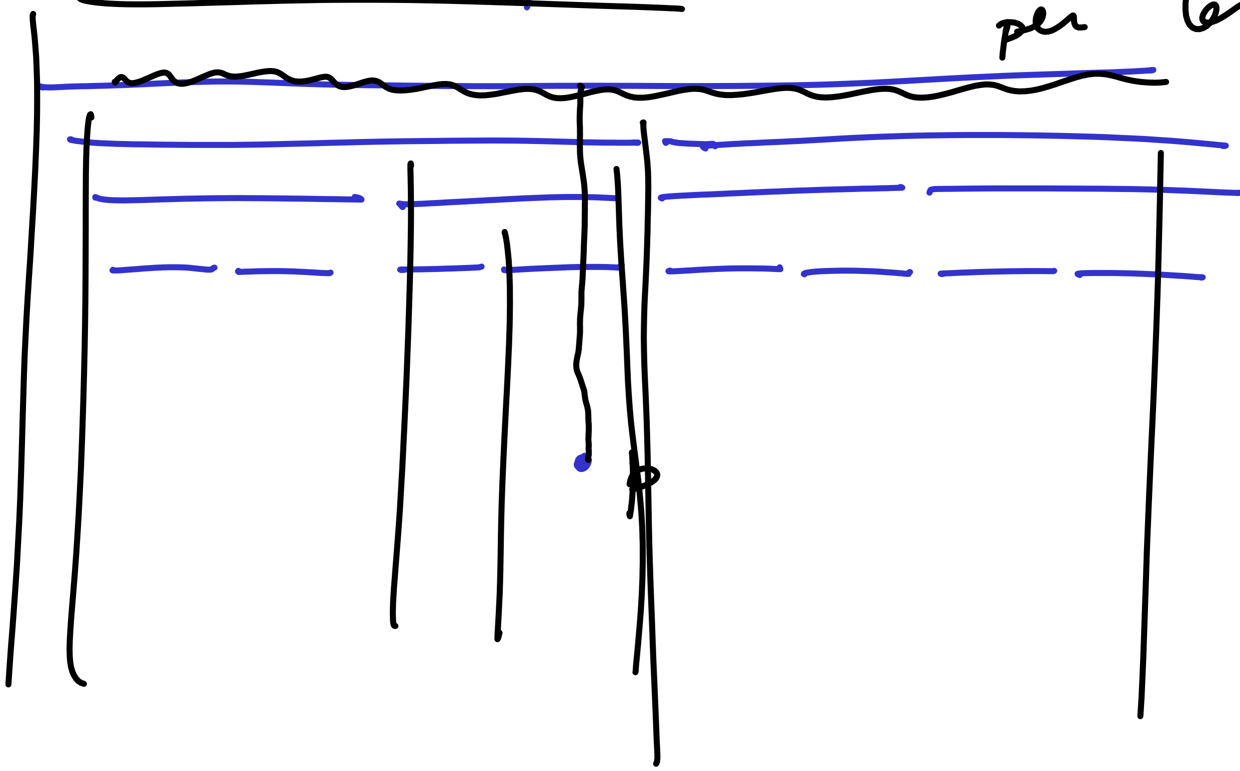
Each such structure could involve $\Omega(n)$ segments $\Rightarrow O(n^2)$ space

for eg. in this kind of line segments, each vertical slab can have about $\frac{n}{2}$ segments


x_4, y_4
x_4', y_4'
x_1, y_1
x_2, y_2
x_2', y_2'
x_3, y_3
x_3', y_3'
x_1', y_1'
p
p_1 p_2 p_3 p_4 p_5 p_6 p_7 p_8


Segment tree
each node represents a canonical vertical slab
s_1
s_2
p_1 p_2 p_3 p_4 p_5 p_6 p_7 p_8
elementary interval
segments completely spanning the slab

For point location, we need to do binary searches in vertical slabs that span the point $\rightarrow$ exactly one per level



Total time for $\log n$ binary searches (within the segments spanning the vertical slab)

Report the closest segment (distance of p to the segment) among the $\log n$ ray shooting queries

The space corresponds to the total sizes of the segments stored in the vertical slabs

Suppose $S(v)$ denotes the # of segments in vertical slab v

$$\sum_{v \in \text{all nodes}} S(v) \leq \sum_{s \in \text{Segments}} N(s)$$

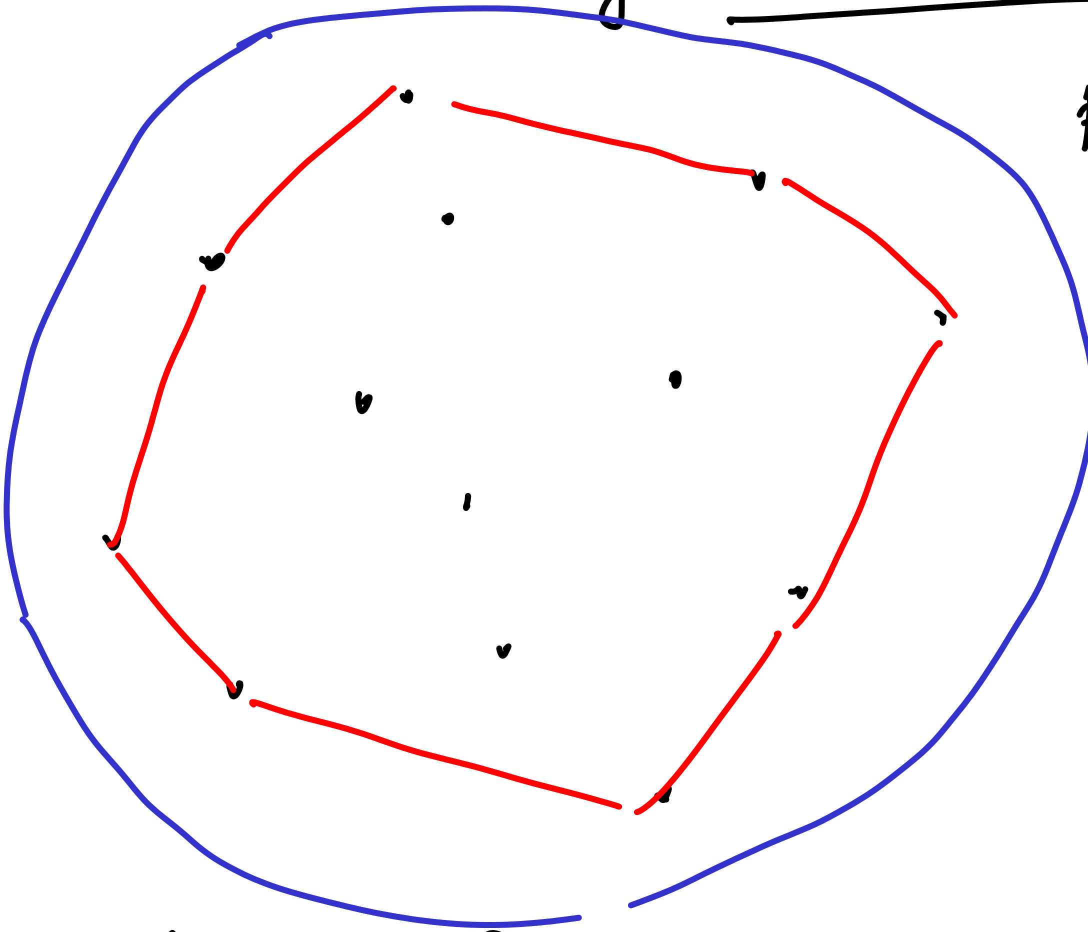
# of subsegments of s

$$\leq 2 n \log n$$

Ideally we would like
$O(\log n)$ search time
$O(n)$ space

Storing "similar lists" is done by "persistent data structures"

Constructing Convex hulls



point set
P

Convex hull of P, CH(P) is the smallest convex set containing P