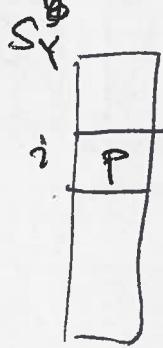


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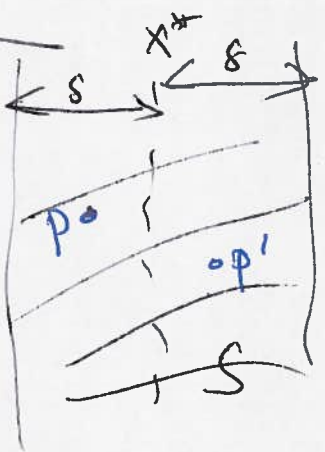
# KICKASS PROPERTY LEMMA

$\forall p \neq p' \in S$  s.t.  $d(p, p') < \delta$   
 if  $S_y[p] = i$   
 $S_y[p'] = j$

$\Rightarrow |i - j| \leq 15 (!)$



$\Downarrow$   
 $p \in Q_A, p' \in R$   
 OR  
 $p \in R, p' \in Q_A$   
 ( $\uparrow$  by defn of  $\delta$ )



Note: Can replace 15 by 9 (Ex.)

I think 7 is also possible.

Note: Can compute  $S_y$  from  $P_y$  in  $O(n)$  time

Q: How does Kickass property lemma  $\Rightarrow O(n)$  time implementation of Closest-in-Box?

A: Closest-in-Box ( $S_y, \delta$ )  $|S_y| = n'$

for  $i = 1 \dots n'-1$

Let  $(p_i, p'_i)$  be closest pair of pts in

$(S_y[i], S_y[i+1]), \dots, S_y[i], S_y[\min(i+15, n'-1)]]$

Let  $(p, p')$  be closest pair of pts  $(p_i, p'_i)$  ( $i = 1 \dots n'-1$ )  
 Output  $(p, p')$  if  $d(p, p') < \delta$ .

$O(n')$   
 $= O(n)$

