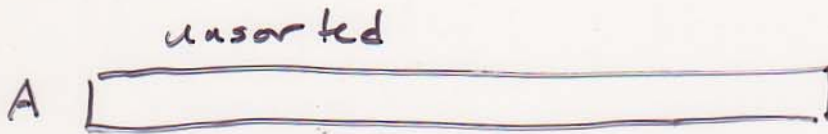


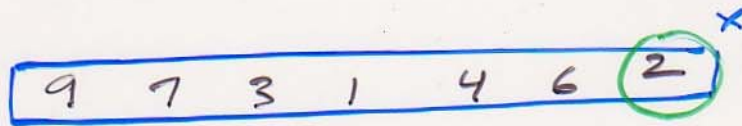
CS 223 Lec 5

SELECTION Problem

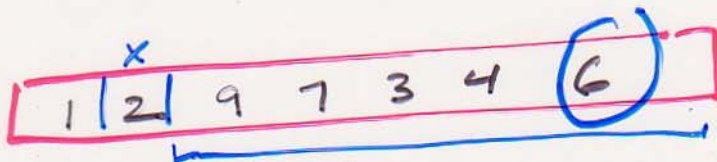


problem: find  
 $i$ th order statistic

Review "quicksort-based  
selection ..."



$i = 3$



$i = 1$

3 4 6 9 7

2

3 4



return 3

### Random-Select

Expected (running time)



$E(x) = \text{avg. value of } x$

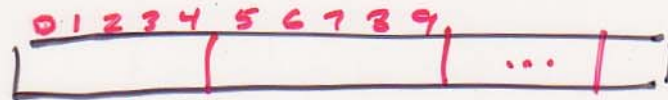
$E(\text{time on size } n) = O(n)$

## Linear Time Selection

Input: unsorted array

Steps      A

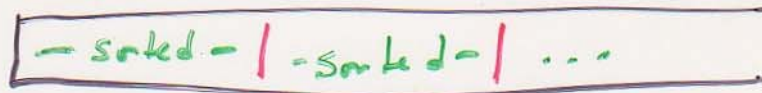
- partition A into groups of 5 elements



$O(n)$   
time

$\lceil n/5 \rceil$  groups

sort each group of 5



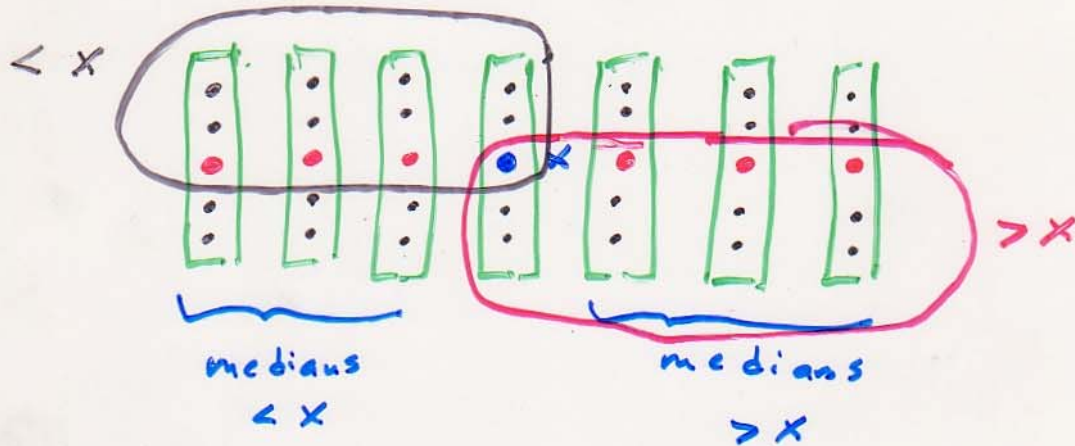
- While sorting each group identify the median value.

gp1	gp2
3	1
6	2
10	8
15	20
35	45

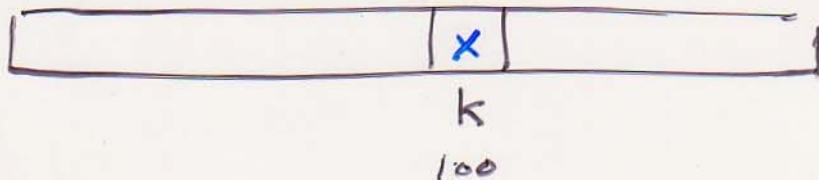
4

... Collect  $\lceil n/5 \rceil$  medians =  $M$

3. Recursively call SELECT to find the median  $x$  of  $M$



4. Partition  $A$  around the pivot value  $x$ . (index of  $x = k$ )



5. If  $i = k$ , return  $x$   
 if  $i < k$ , call SELECT  
     on left side  
 if  $i > k$ , call SELECT  
     on right side

---

Based on picture ..

$$3 \left( \left\lceil \frac{1}{2} \left\lceil \frac{n}{3} \right\rceil \right\rceil - 2 \right) \approx \frac{3n}{10} - 6$$

elements are greater than  
 the pivot  $x$

Similarly,  $\approx \frac{3n}{10} - 6$  are  
 smaller than  $x$ .