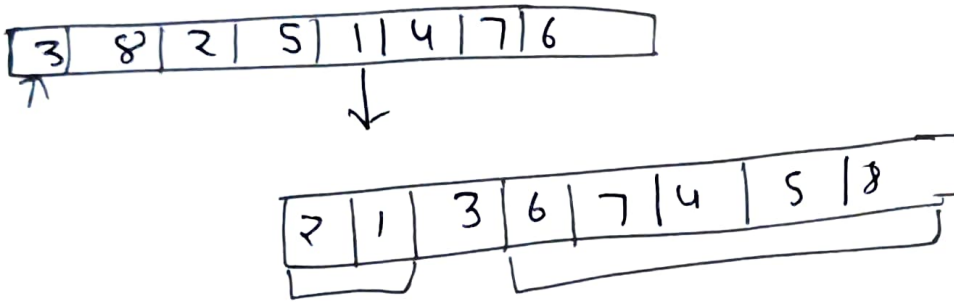


Linear Time selection ①



RandomizedSelect (RSelect)

Input: array A of " $n \geq 1$ " distinct numbers.
and an integer " $i \in \{1, 2, \dots, n\}$ "

Output: The i th order statistic of A .

if $n = 1$ then
return $A[1]$

Choose pivot element p uniformly at random
from A , partition A around p

$J = p$'s position in partitioned array

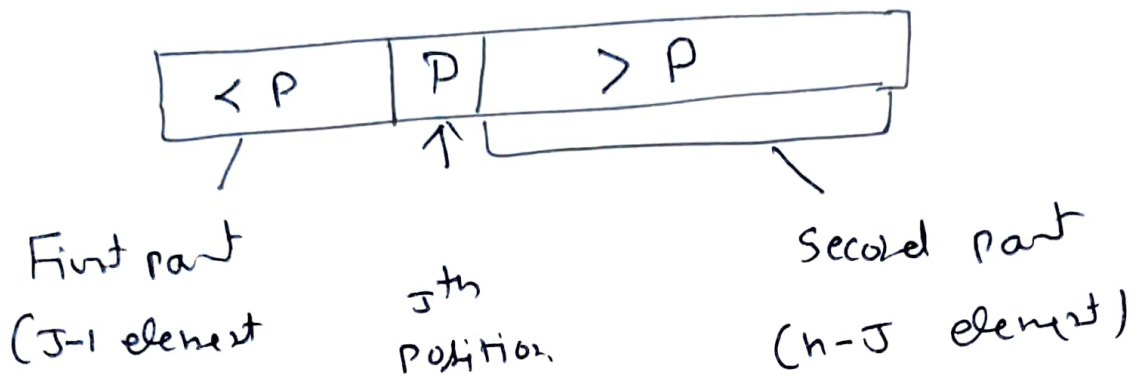
if $J = i$ then
return p

else if $J > i$ then

return RSelect (first part of A , i)

else
return RSelect (second part of A , $i - J$)

(2)



→ Suppose we are looking for s^{th} order statistic in an input array of 10 elements. After partitioning the array, the pivot element ends up in the third position. On which side of the pivot element should we recurse, and what order statistic should we look for

The 2nd order, on the right side of pivot

$$T(n) \leq T\left(\frac{n}{2}\right) + O(n)$$

Since pivot = median

Partition

③

$$T(n) = a T(n/2) + f(n)$$

$$a \geq 1, \quad b > 1$$

solution is

$$T(n) = n^{\log_b a} [U(n)]$$

$U(n)$ depends on $h(n)$

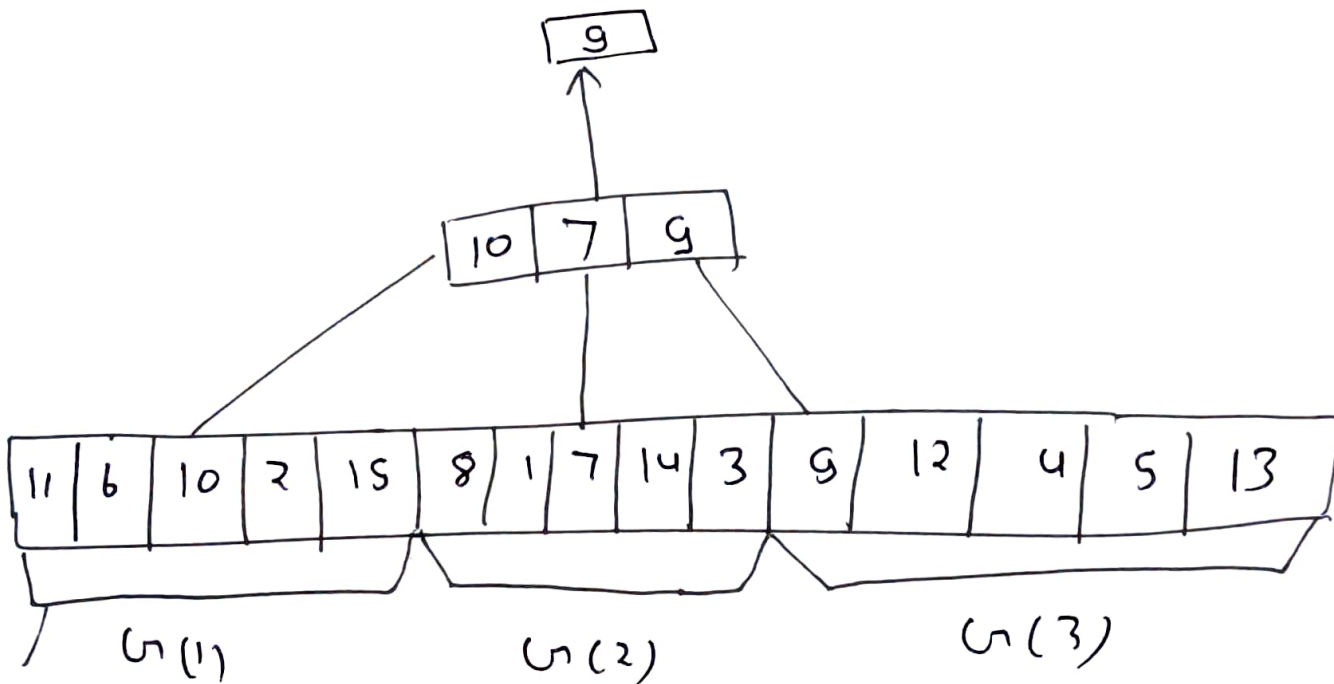
$$h(n) = \frac{f(n)}{n^{\log_b a}}$$

if $h(n)$	$U(n)$
$n^\alpha, \alpha > 0$	$O(n^\alpha)$
$n^\alpha, \alpha \leq 0$	$O(1)$
$(\log n)^i, i \geq 0$	$\frac{(\log_2 n)^{i+1}}{i+1}$

④

Deterministic select Algorithm

~~Median of~~ Median of Medians



Sort each group using any algo.

⑤

Dselect.

Input:- Array A of $n \geq 1$

Integer $i \in \{1, 3, \dots, n\}$

Output! The i th order statistic of A

if $n=1$ then

return $A[1]$

for $h:=1$ to $n/5$ do

$C[h] :=$ middle element from the h th
group of 5

$p := \text{Dselect}(C, n/5)$

partition A around p

$J := p$'s position in partitioned array

if $J=i$ then

return p

else if $J > i$ then

return $\text{Dselect}(\text{first part of } A, i)$

else

return $\text{Dselect}(\text{second part of } A, i - J)$