Chapter 9 Medians and Order-Statistics

Given a list of n elements,
the i^{th} order statistic is the
i^{th} smallest element in the list.

So the 1^{st} order statistic is the minimum
The n^{th} order statistic is the maximum

The median is the $\lfloor \frac{(n+1)}{2} \rfloor^{th}$ order statistic

Consider the following problem:

Given a list A of n numbers and an integer i such that $1 \le i \le n$ find the i^{th} order statistic of A.

e.g. $A =$

17	21	3	19	51	11	26	42

$i = 5$

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$i = 5$

the i^{th} order static is $\underline{\underline{21}}$

$\quad\;\; \shortparallel$
$\quad\;\; 5^{th}$

__Note__: there are 4 smaller elements than 21 in A.

Observe that if we sort A as follows:

1	2	3	4	5	6	7	8
3	11	17	19	21	26	42	51

then it is easy to find the 5^{th} order statistic.
In fact we can easily find any i^{th} order statistic.

But sorting is $O(n \log n)$,
so we seek algorithms that
are $O(n)$.

9.1. Finding Min and Max.

Minimum(A)
min = A[1]
for i = 2 to n
    if min > A[i]
        min = A[i]
return min.

Note: ↑ requires n-1 comparisons

Finding Max is similar and also requires $n-1$ comparisons.

However, we can simultaneously find Min and Max with $3\lfloor \frac{n}{2} \rfloor$ comparisons.

- Please read through this on page 214 -