a b a b a

$$\frac{N(N+1)}{2} \approx N^2$$

Total: $O(N^3)$

$O(N)$

x y x a b a b a z a b z

$1 \backsim N$

$N/2$
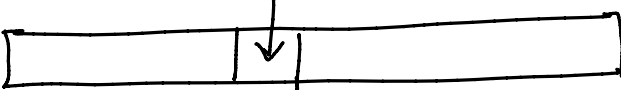
Length = $3 \backsim 7$

— o —

Sorting *) QuickSort
         *) MergeSort

QuickSort $\longrightarrow$ comparison - based $\rightarrow O(N \log N)$

Quick Partition: elem $< P \leqslant$ elem

How "QP" works?

a_1

| 5 | -2 | -11 |

(10)

a_2

| 150 | 80 | 20 | 40 | 50 | 100 |

i

arr[j] > pivot $\rightarrow$ DO NOTHING

pivot = 10

arr[i] $\leqslant$ pivot $\rightarrow$

i
j
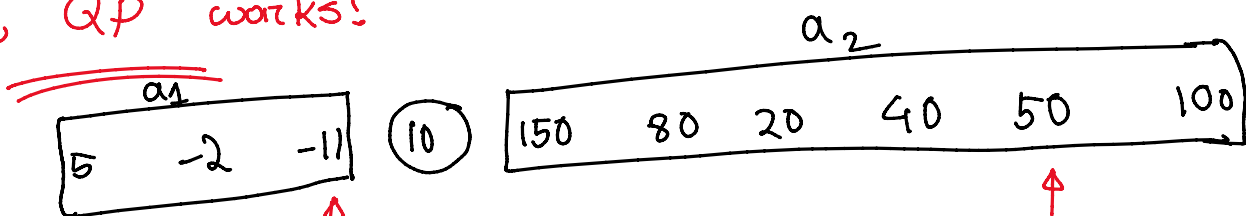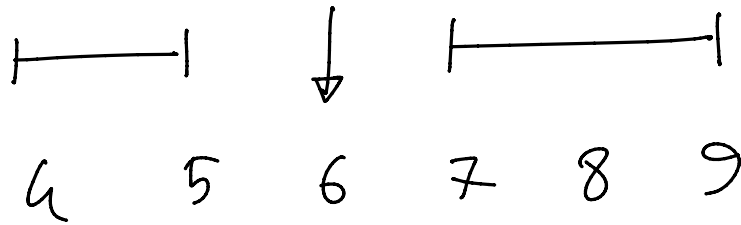
4 5 6 7 8 9

$$\left(\frac{1}{10}\right)^{100}$$

10^{100}

0 1 2 3 4 5 6 7 8 9

$[L, R]$ $[5, 9]$ 5, 6, 7, 8, 9

$L = 5$

0, 1, 2, 3, 4

$-\circ-$

⊛ Merge Sort

		10	15	20	40	50	100

-11	5	10	15	20	40	50	100

1st day →
10	5	-11	50	20	40	15	100
0	1	2	3	4	5	6	7
							4

2nd day
-11	5	10	50	15	20	40	100

3rd day
5	10	-11	50	20	40	15	100

4th day
10	5	-11	50	20	40	15	100
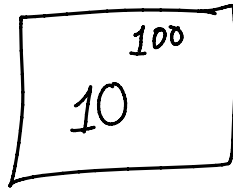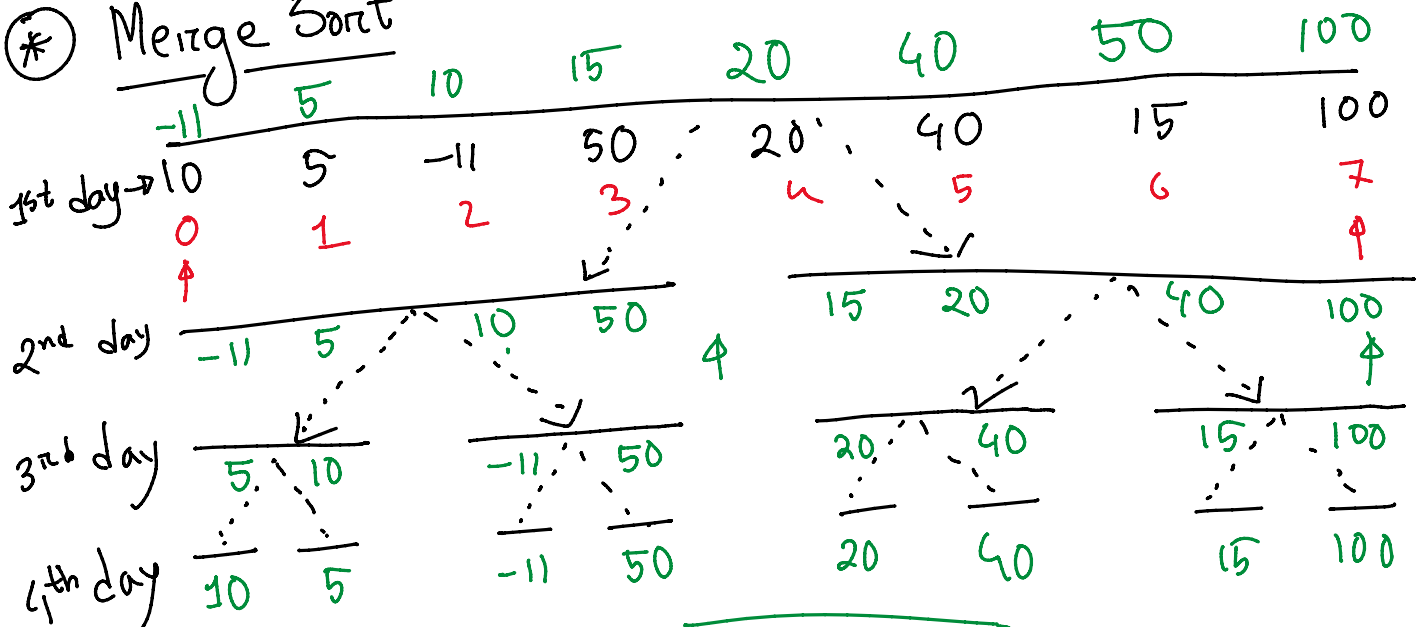
4th day $\frac{.}{10}$ $\frac{.}{5}$ $\overline{-11}$ 50   20   40   15   100

$$\boxed{N \times \log N}$$

— o —

Application

QuickSort ———→ Quick Partition $\boxed{O(N)}$

[51, 100]
  24th   index = 50   ⑦⑤

  ⑩⑩ ——→ ~~index = 50   75~~

                                                    74th $N + \frac{N}{2} + \frac{N}{4} + \frac{N}{8}$
   ↓ $+ \frac{N}{16} + \cdots + \frac{N}{N}$
  5 8 2 9 0 3 4 7 6 1 $= N(1 + \frac{1}{2} + \frac{1}{4} + \cdots + \frac{1}{N})$

                                                                  $= N(2)$

MergeSort ———→ Inversion Count   O(2N)

                 $i < j$ 4   3   2   1
$\frac{4 \times 3}{2} = 6$ $arr[i] > arr[j]$ —   —
                                          ↳3   3   2   2   1
                                          ↳2   3   1
                                          ↳1