

SORTINGS

3	1	4	2	5
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 \Rightarrow

1	2	3	4	5
---	---	---	---	---

sorting

① Bubble Sort

①

5 ⁴	4 ³	3 ²	2 ¹	5
----------------	----------------	----------------	----------------	---

 \Rightarrow

4	3	2	1	5
---	---	---	---	---

$\uparrow \downarrow$ $\uparrow \downarrow$

Bubble the max in unsorted array to its right position

②

4 ³	3 ²	2 ¹	4	5
----------------	----------------	----------------	---	---

 \Rightarrow

3	2	1	4	5
---	---	---	---	---

unsorted

$j \leq n - i$

③

3 ²	2 ¹	1	3	4	5
----------------	----------------	---	---	---	---

 \Rightarrow

2	1	3	4	5
---	---	---	---	---

$\uparrow \downarrow$

4

2	4	3	4	5
---	---	---	---	---

\Rightarrow

1	2	3	4	5
---	---	---	---	---

j

$$i = 1 - n$$

$n-1$

Time

$$i = 1 \quad j = 0 \quad n-1 \Rightarrow n-1$$

$$i = 2 \quad j = 0 - n-2 \quad n-2$$

$$i = n \quad j = 0 - \phi \quad i$$

$$1 + 2 + 3 + \dots + n-2 + n-1$$

$$\Rightarrow n \times \frac{(n-1)}{2} \Rightarrow \frac{n^2-1}{2}$$

$$\Rightarrow O(n^2)$$

Space

Auxiliary space

$$\Rightarrow O(1)$$

(2) Selection Sort

Step 1:

0	1	2	3	4
5	3	4	5	2

i

$0 - j$

$minidx = \cancel{3}$

$min = \cancel{5}$

⇒ Swap 1 with 5

⇒

1	3	4	5	2
---	---	---	---	---

j

Unsorted

Sorted

Step 2:

0	1	2	3	4
1	3	4	5	2

i

$min = \cancel{2}$

$minidx = \cancel{4}$

⇒

1	2	4	5	3
---	---	---	---	---

Step 3:

0	1	2	3	4
1	2	4	5	3

i

$min = \cancel{3}$

$minidx = \cancel{4}$

⇒

1	2	3	5	4
---	---	---	---	---

Step 4:

0	1	2	3	4
1	2	3	5	4

i

$min = \cancel{4}$

$minidx = \cancel{4}$

⇒

1	2	3	4	5
---	---	---	---	---

Time Complexity

$i = 0 \rightarrow n-1$

	Operations
$i = 0 \left\{ \begin{array}{l} j \Rightarrow 1-n \end{array} \right.$	n
$i = 1 \left\{ \begin{array}{l} j \Rightarrow 2-n \end{array} \right.$	$n-1$
$i = 2 \left\{ \begin{array}{l} j \Rightarrow 3-n \end{array} \right.$	$n-2$
$i = n$	0

$$0 + 1 + 2 + 3 + 4 + \dots + n$$

$$\Rightarrow \frac{n \times (n+1)}{2} \Rightarrow \frac{n^2 + 1}{2}$$

$$\Rightarrow \underline{O(n^2)}$$

Space

Auxiliary space $\Rightarrow O(1)$

Inplace sorting

stable

1	2	1	3	5	4
---	---	---	---	---	---

\Rightarrow

1	1	3	4	5	2
---	---	---	---	---	---

③ Insertion sort

⇒

5	3	4	1	2
---	---	---	---	---

 \Rightarrow

5	3	4	1	2
---	---	---	---	---

①

5	3	4	1	2
---	---	---	---	---

 \Rightarrow

3	5	4	1	2
---	---	---	---	---

②

3	5	4	1	2
---	---	---	---	---

 \Rightarrow

3	4	5	1	2
---	---	---	---	---

③

3	4	5	1	2
---	---	---	---	---

 \Rightarrow

1	3	4	5	2
---	---	---	---	---

④

1	3	4	5	2
---	---	---	---	---

 \Rightarrow

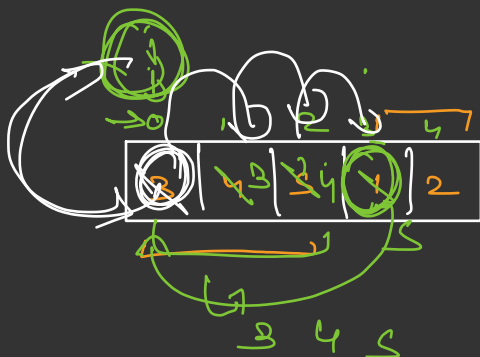
1	2	3	4	5
---	---	---	---	---

Shifting

⇒

3	4	5	1	2
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key = 1



$$\text{cosec}[j+1] = \text{cosec}[j]$$

$$j \rightarrow j'$$