

Sorting

Arranging numbers in the particular order.

① Bubble Sort

Suppose

[4, 1, 5, 2, 3]

$n=5, n-1=4$ iterations

$(n-1)$ iterations

↓
adjacent numbers
comparison

↓
Push the largest
Number to last
by swapping

1 i=1	2 i=2	3 i=3	4 i=4
4 1 5 2 3	1 4 2 3 5	1 2 3 4 5	1 2 3 4 5
1 4 5 2 3	1 4 2 3 5	1 2 3 4 5	1 2 3 4 5
1 4 5 2 3	1 2 4 3 5	1 2 (3 4 5)	1 (2 3 4 5)
1 4 2 5 3	1 2 3 (4 5)		
1 4 2 3 (5)			

(Descending)
(Ascending)

Pseudocode

```
for (i = 0, i < n-1; i++) {  
    for (j = 0; j < n-i-1; j++) {  
        if (A[j] > A[j+1]) {  
            swap(A[j], A[j+1]);  
        }  
    }  
}
```

T.C

$O(n^2)$

Corner case

If already sorted array given

bool isSwap = false;

If swapping is done

isSwap = true

Then

if (!isSwap)

"array is sorted"

② Selection Sort

Suppose

[4, 1, 5, 2, 3]

[sorted | unsorted]

$n-1$ iteration $\rightarrow (n-1)$ Smallest

0 1 2 3 4

4 ① 5 2 3 \rightarrow 1 4 5 ② 3 \rightarrow 1 2 5 4 ③ \rightarrow 1 2 3 4 5 \rightarrow

US

S

US

S

US

S

US

1 2 3 4 5
S

Pseudocode

```
for (i = 0; i < n-1; i++) {
    int smallestIndex = i
    for (j = i+1; j < n; j++) {
        if (arr[j] < arr[smallestIndex]) {
            smallestIndex = j
        }
    }
    swap(arr[i], arr[smallestIndex])
}
```

$T.C$
 $O(n^2)$

< (Ascending)
> (Descending)

i j=i+1
[4 ① 5, 2, 3]

Smallest Index

Inner loop
if (arr[j] < arr[smallestIndex])
smallestIndex = j

outer loop for Sorted part
Swap(arr[i], arr[smallestIndex])

3) Insertion Sort

Suppose:

$[4, 1, 5, 2, 3]$
 $i=1$

$\begin{array}{cccccc} 1 & 4 & 5 & 2 & 3 & \text{curr}=1 \\ \hline s & & & \text{US} & & \\ \downarrow & & & & & \\ \text{prev} & & & & & \end{array}$

$i=2$
 $\begin{array}{cccccc} 1 & 4 & 5 & 2 & 3 & \text{curr}=5 \\ \hline s & & & \text{US} & & \\ \downarrow & & & & & \\ \text{prev} & & & & & \end{array}$

$\begin{array}{cccccc} 1 & 2 & 4 & 5 & 3 & \text{curr}=2 \\ \hline \downarrow s & & & \text{US} & & \\ \text{prev} & & & & & \end{array}$

$\begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & \text{curr}=3 \\ \hline s & & & \text{US} & & \end{array}$

$\begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 \\ \hline s & & & & \end{array}$

Pseudocode

for ($i=0; i < n; i++$) {
 $\text{curr} = i$;

$\text{prev} = i - 1$;

 for (while ($\text{prev} \geq 0$ & $A[\text{prev}] > \text{curr}$)
 $A[\text{prev}+1] = A[\text{prev}]$
 $\text{prev}--$; $i \leftarrow i-1$)

(Ascending) $>$
(Descending) $<$

$A[\text{prev}+1] = \text{curr}$

$\begin{array}{cccccc} & \text{prev} & \text{curr} & i \\ \hline & \uparrow & \uparrow & \\ & 4 & 1 & 5 & 2 & 3 \\ & & \downarrow & & & \\ & & \text{prev}+1 = \text{curr} & & & \end{array}$