☆ "Bubble Sort" (Complexity)

→ do

    swapped = false.

    for i=1 to Index of last unsorted element -1

        if left Element > right Element.

            swap (left Element, right Element).

            swapped = true

while swapped.

→ <u>Worst case</u> Comparisions   swaps

	Comparisions	Swaps
1	n	n
2	$n-1$	$n-1$
3	$n-2$	$n-2$
⋮	⋮	
	1	

⇒ so $n + n-1 + n-2 + n-3 + \cdots + 1 \Rightarrow \dfrac{n(n+1)}{2}$.

Worst case Time Complexity ⇒ <u>$O(n^2)$</u>

→ Best case :- Where they are arranged in a order.

    so swaps = $O(1)$, Comparision = $O(n)$.

    <u>Best case = $O(n)$.</u>

→ Space Complexity → i, A, Swapped.

                 ⇒ $O(1)$.

2) An array contains four occurrences of 0, five occurrences of 1 and three occurrences of 2, in any order. The array is to be sorted using swap operation (elements that are swapped need to be adjacent).

1) What is the minimum number of swaps needed to sort such an array in the worst case?

2) Given an ordering of element in the above array so that the minimum number of swaps needed to sort the array is maximum.

→ i) 2,2,2,1,1,1,1,1,0,0,0,0. → Worst case (in decreasing order).

i) So Total 12 elements.

$$\underbrace{2, 2, 2, 1, 1, 1, 1, 1, 0, 0, 0, 0}$$
$$9+9+9 \Rightarrow \text{for swaping (2)}.$$

1, 1, 1, 1, 1, 0, 0, 0, 0, 2, 2, 2
$$4+4+4+4+4 = \underline{\underline{20}}$$

So total sorting ⇒ 20+27 ⇒ 47.

2) Consider the following sequence of number
92, 37, 52, 12, 11, 25

Use bubble sort to arrange the sequence in ascending order. Give the sequence at the end of each of the first five passes.

→

1) 37, 52, 12, 11, 25, 92.

2) 37, 12, 11, 25, 52, 92.

3) 12, 11, 25, 37, 52, 92.

4) 11, 12, 25, 37, 52, 92.

5) 11, 12, 25, 37, 52, 92.