Bubble Sort (Comparison Based Sorting)

⟹ [20, 20, 50, 30, 90, 8, 15] $n = 7$

	0	1	2	3	4	5	6	
Approach	20	20	20	70	5	90	90	70 > 50
	i	50	30			15		70 < 90
		d						
Pass 1	20	50	30	70	8	15	90	(n-1)
		30	50	5	20	70		
					15			
Pass 2	20	30	50	8	15	70	90	(n-2)
			5	50	50			
				15				
Pass 3	20	30	8	15	50	70	90	(n-3)
		5	30	30				
			15					
Pass 4	20	8	15	30	50	70	90	
	5	20	20					
		15						
Pass 5	5	15	20	30	50	70	90	
Pass 6	5	15	20	30	50	70	90	(1)

Points to Note :-

1) $n = 7 \longrightarrow$ Pass 6

$n \longrightarrow (n-1)$ Passes

2) # comparisons $\longrightarrow (n-1) + (n-2) + (n-3) + \cdots + 3 + 2 + 1$

$= \frac{(n-1)(n-1+1)}{2} = \frac{n(n-1)}{2}$

Sum of n natural numbers

↳ $\frac{n(n+1)}{2}$

$\Rightarrow O(n^2)$

3) Swaps
- Best case → 0
- Worst case → $\frac{n(n-1)}{2}$ ↳ $O(n^2)$

Bubble Sort → comparisons + swaps

↓↓ → $O(n^2) + O(n^2)$

Implementation → $O(n^2)$

↓↓

Loops

↳ $O(n^2)$

Space complexity → $O(1)$ ⇒ constant