

INSERTION SORT



8	4	3	5	6
-	-	-	-	-

$R_1 \rightarrow$



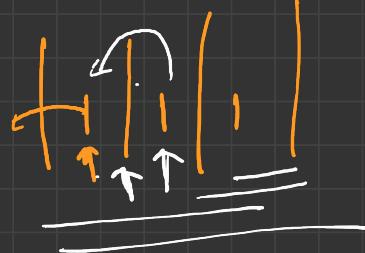
$R_2 \rightarrow$



$R_3 \rightarrow$



$R_4 \rightarrow$



5	4	6	2	3
0	↑ 2	3	7	

$$n = 5$$

Round - 4

$$\begin{array}{l} R_1 \rightarrow \\ \hline \end{array} \quad \begin{array}{ccccc} 4 & 5 & | & 6 & 2 & 3 & (1-0) \\ \hline \end{array} \quad = n-1$$

$$\begin{array}{l} R_2 \rightarrow \\ \hline \end{array} \quad \begin{array}{ccccc} 4 & 5 & 6 & | & 2 & 3 & (2-0) \\ \hline \end{array}$$

$$\begin{array}{l} R_3 \rightarrow \\ \hline \end{array} \quad \begin{array}{ccccc} 4 & 5 & 2 & 6 & 3 \\ 4 & 2 & 5 & 6 & 3 \\ \hline \end{array}$$

$$\begin{array}{ccccc} 2 & 4 & 5 & 6 & 3 & (3-0) \\ \hline \end{array}$$

$$\begin{array}{l} R_4 \rightarrow \\ \hline \end{array} \quad \begin{array}{ccccc} 2 & 4 & 5 & 3 & 6 \\ 2 & 4 & 3 & 5 & 6 \\ 2 & 3 & 4 & 5 & 6 \\ \hline \end{array}$$

1	6	7	9	80
0	1	2	3	4

j=4 82 + 0

1 6 7 9 0

1 6 7 0 9

1 6 0 7 9

1 0 6 7 9

X [0 1 6 7 9]

```
{
    for( j=4 ; j > 0 ; j-- ) {
        if ( arr[j] < arr[j-1] )
            swap ( arr[j] , arr[j-1] )
        else
            break
    }
}
```

```
for (i=1 ; i<=n ; i++) {
```

Space Complexity

$O(1)$

```
    for (j=i ; j>0 ; j--) {
```

```
        if (arr[j] < arr[j-1])
```

```
            swap (arr[j], arr[j-1])
```

else

break

i = 1

j = 1 to 1

1 time

i = 2

j = 2 to 1

2 time

Time Complexity

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

$$= \frac{n^2 - n}{2}$$

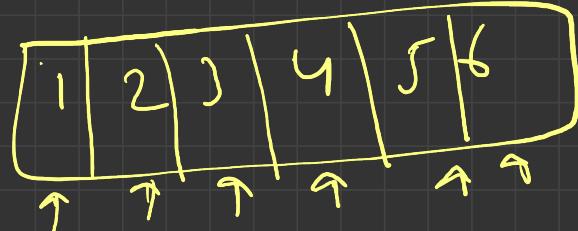
$= O(n^2)$

n-1

i = n-1

j = n-1 to 1

Best case



$$1 + 1 + 1 + \dots - n$$

$\Theta(n)$, $\Omega(n)$

Avg -
$$\frac{\text{Sum of all case}}{\text{Total case}} = \frac{n - 1 + n + n + 1}{2} = \frac{n(n+1)}{2} = \Theta(n^2)$$

