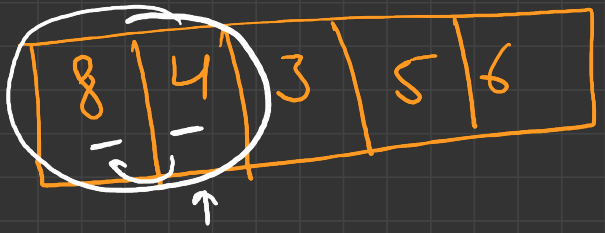
INSERTION SORT



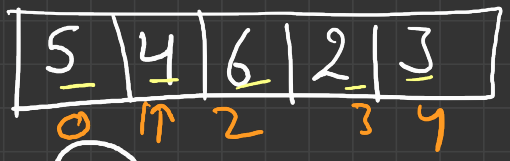
$R_1 \rightarrow$ 4 8 3 5 6

$R_2 \rightarrow$ 4 3 8 5 6

3 4 8 5 6

$R_3 \rightarrow$ 3 4 5 8 6

$R_4 \rightarrow$ 3 4 5 6 8



$n = 5$

Round - 4 : $n-1$

$R_1 \rightarrow$ 4 5 | 6 2 3 (1 - 0)

$R_2 \rightarrow$ 4 5 6 | 2 3 (2 - 0)

$R_3 \rightarrow$ 4 5 2 6 3

4 2 5 6 3

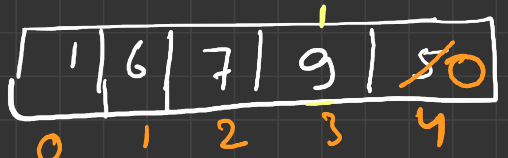
2 4 5 6 | 3 (3 - 0)

$R_4 \rightarrow$ 2 4 5 3 6

2 4 3 5 6

2 3 4 5 6

(4 - 0)




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

j = ~~4~~ ~~3~~ ~~2~~ ~~1~~ 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 (i=1 ; i<n ; i++) {
    for (j=i ; j>0 ; j--) {
        if (arr[j] < arr[j-1])
            swap (arr[j], arr[j-1])
        else
            break
    }
}
```

Space Complexity

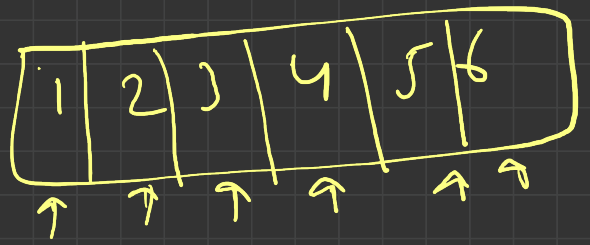
$O(1)$

Time Complexity

$i=1$	$i=2$	...	$i=n-1$
$j=1$ to 1	$j=2$ to 1	...	$j=n-1$ to 1
1 time	2 time	...	$n-1$

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

Best case



$1 + 1 + 1 + \cdots n$

$O(n)$, $\Omega(n)$

Avg - $\frac{\text{Sum of all case}}{\text{Total case}}$ $\quad n - 1 + n + n + 1 -$

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

$= \theta(n^2)$