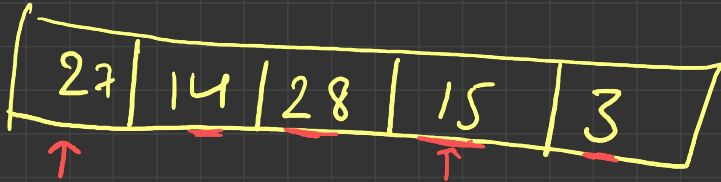


Bubble Sort



$\begin{array}{r} 14 \\ \hline \uparrow \end{array}$
 $\begin{array}{r} 27 \\ \hline \uparrow \end{array}$
 $\begin{array}{r} 15 \\ \hline \end{array}$
 $\begin{array}{r} 3 \\ \hline \end{array}$
 $\begin{array}{r} 28 \\ \hline \end{array}$

14 15 3 27 28

14 3 15 27 28

3 14 15 27 28

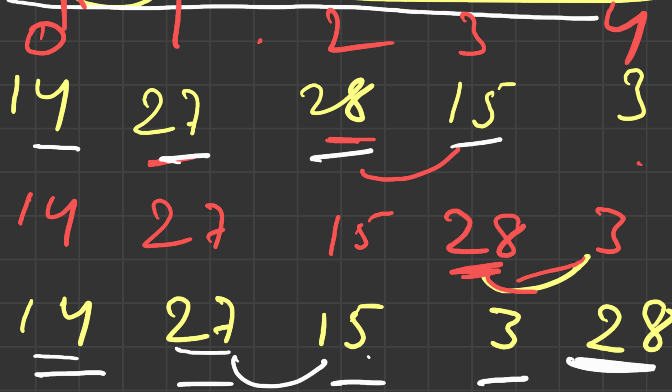
Field

arr =

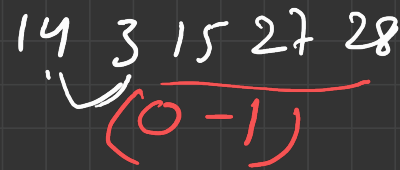


R1

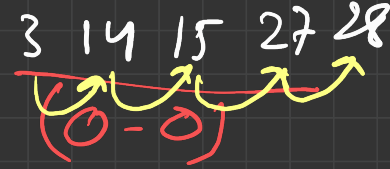
(0-3)



R3



R4

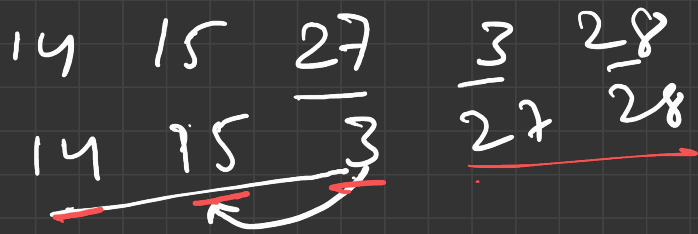


n = 5

Round = n - 1
= 4

R2

(0-2)



Q.

18	11	20	5	8	7	18
----	----	----	---	---	---	----

n

$j = \cancel{0} + 2$
 $\quad \quad \quad \cancel{3} 4$

for ($j=0$; $j < \cancel{5}^{n-1}$; $j++$) {

if ($arr[j]$ > $arr[j+1]$)

swap ($arr[j]$; $arr[j+1]$)

```

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

```

Space -
Auxiliary
 $O(1)$

Time

$i = 0$
 $= 0 \ 6 \ 0$
↓

Exec $\rightarrow n-1$

$$\begin{aligned}
 & n-2 \\
 & n-1 + n-2 + \dots + 1 = \frac{n \times (n-1)}{2}
 \end{aligned}$$

~~$\frac{n^2 - n}{2}$~~ worst $\rightarrow O(n^2)$

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

```
for (i = 3; i > 0; i++) {  
    Bool swapped = 0;  
    for (j = 0; j < i; j++) {  
        if (arr[j] > arr[j+1])  
            swap(arr[j], arr[j+1])  
        swapped = 1;  
    }  
    if (swapped == 0)  
        break;  
}
```

Avg $\rightarrow O(n^2)$
 $\Theta(n^2)$

