

Sorting

Loop \rightarrow pass

pass 1: $n=5$
 $arr[0] < arr[1]$ 4 5 3 2 1 $\rightarrow j=0$
 $arr[1] > arr[2]$ 4 3 5 2 1 $j=1$
 $arr[2] > arr[3]$ 4 3 2 5 1 $j=2$
 $arr[3] > arr[4]$ 4 3 2 1 5 $j=3$
 unsorted sorted

pass 2: 4 3 2 1 5
 $arr[0] > arr[1]$ 3 4 2 1 5 $\rightarrow j=0$
 $arr[1] > arr[2]$ 3 2 4 1 5 $\rightarrow j=1$

loop 2 = 2

0 to $n-2$

1st loop \rightarrow pass \rightarrow 1 to $n-1$

2nd loop \rightarrow swapping 0 to $n-1-pass$
 $j = 1 + pass + j$

$arr[0] > arr[1] \quad 3 \ 4 \ 2 \ 1 \ 5 \rightarrow j=0$
 $arr[1] > arr[2] \quad 3 \ 2 \ 4 \ 1 \ 5 \rightarrow j=1$
 $arr[2] > arr[3] \quad 3 \ 2 \ 1 \ 4 \ 5 \rightarrow j=2$
 unsorted sorted

pass 3: $3 \ 2 \ 1 \ 4 \ 5$
 $arr[0] > arr[1] \quad 2 \ 3 \ 1 \ 4 \ 5 \rightarrow j=0$
 $arr[1] > arr[2] \quad 2 \ 1 \ 3 \ 4 \ 5 \rightarrow j=1$
 unsorted sorted

pass 4: $2 \ 1 \ 3 \ 4 \ 5$
 $arr[0] > arr[1] \quad 1 \ 2 \ 3 \ 4 \ 5 \rightarrow j=0$
 sorted

j

pass	j	pass + j
1	3	4
2	2	4
3	1	4
4	0	4

$pass + j = n - 1$
 $j = n - 1 - pass$

```

static void bubbleSort(int arr[], int n){
    for(int pass=1; pass<=n-1; pass++){
        for(int j=0; j<=n-1-pass; j++){
            if(arr[j]>arr[j+1]){
                //swapping
                int temp=arr[j];
                arr[j]=arr[j+1];
                arr[j+1]=temp;
            }
        }
    }
}
    
```

$TC = ?? = O(n^2)$
 $SC = ?? = O(1)$
 $n \times n$

pass 1: $2 \ 1 \ 3 \ 4 \ 5$
 $arr[0] > arr[1] \rightarrow 1 \ 2 \ 3 \ 4 \ 5$
 $arr[1] < arr[2] \rightarrow 1 \ 2 \ 3 \ 4 \ 5$
 $1 \ 2 \ 3 \ 4 \ 5$

pass 2: $1 \ 2 \ 3 \ 4 \ 5$
 $arr[0] < arr[1] \rightarrow 1 \ 2 \ 3 \ 4 \ 5$
 $arr[1] < arr[2] \rightarrow 1 \ 2 \ 3 \ 4 \ 5$
 $1 \ 2 \ 3 \ 4 \ 5$

1 2 3 4 5
1 2 3 4 5

1 2 3 4 5

Selection sort - select minimum.

4 5 3 2 1

$i=0$, $j=1 \rightarrow 2 \rightarrow 3 \rightarrow 4$

$\text{min_ind} = 4$

Swapping - $\text{arr}(i=0)$, $\text{arr}(\text{min_ind}=4)$

\Rightarrow 1 5 3 2 4
Sorted unsorted

$i=1$, $j=2 \rightarrow 3 \rightarrow 4$

$\text{min_ind} = 3$

Swap ($\text{arr}(i=1)$, $\text{arr}(\text{min_ind}=3)$)

1 2 3 5 4
Sorted unsorted

$i=2$, $j=3 \rightarrow 4 \rightarrow 5$

$\text{min_ind} = 2$

swap ($\text{arr}(i=2)$, $\text{arr}(\text{min_ind}=2)$)

1 2 3 5 4
sorted unsorted

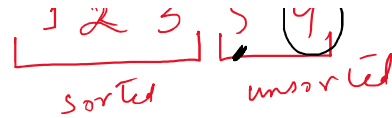
4 5 3 2 1

Loop

$2 \rightarrow$

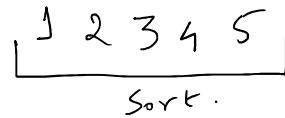
$i = 0$ to $n-2$

$j = i+1$ to $n-1$



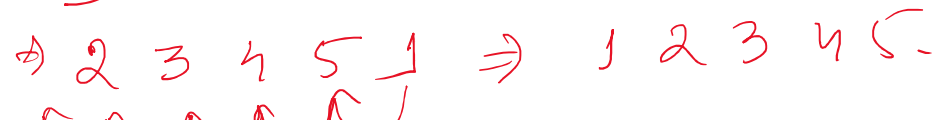
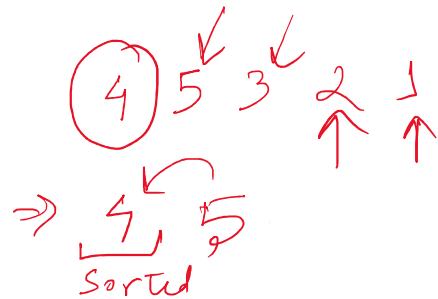
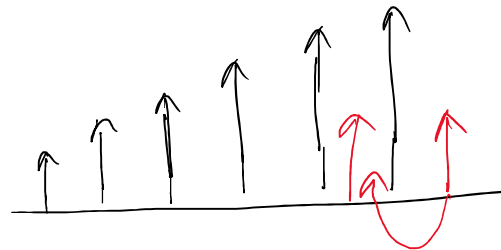
$i=3, j=4 \neq 5$ $\text{min_ind} = 3 \rightarrow 4$

Swap($\text{arr}(i=3), \text{arr}(\text{min_ind}=4)$)



$j = i+1$ to $n-1$
 $\text{min_ind} = i$

Insertion Sort -



2 3 4 5 1 \Rightarrow 1 2 3 4 5 -
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