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SELECTION SORT

- What if, I select the minimum element and put it at right position
- For i th iteration, pick smallest element from i to $(n-1)$ index and swap it with i th element

алл

5	4	3	2	1
---	---	---	---	---

After sorting array in ascending

1	2	3	4	5
---	---	---	---	---

DRY RUN

MinIndex = 0
Starting me First element ko smallest मान lo

Diagram illustrating the first pass of bubble sort. The array is $[5, 4, 3, 2, 1]$ with indices 0 to 4 . A red arrow points to index 0 with the label $i=0$. A green arrow points from index 0 to index 4 with the label $j=i+1$ and "swap". The array is shown again below, indicating the swap of elements at indices 0 and 4 .

$N=5$

1st Iteration

4 com

▶ **Step 01:** find smallest element's index from $[0, N-1]$

$$i = 0 \quad j = 4 \quad \text{minIndex} = j = 4$$

▶ **Step 02:** swap the *ith* and *minIndex* position's value

swap(arr[i], arr[minIndex])

YE APNI
Right position
par hai

→ 1 4 3 2 5

swap

2nd Iteration

1	4	3	2	5
0	1	2	3	4

3 com

Step 01: find smallest element's index from $[0, N-1]$

$$i = 1 \quad j = 3 \quad \minIndex = j = 3$$

Step 02: swap the i th and \minIndex position's value

swap($arr[i]$, $arr[\minIndex]$)
4 2

YE DONO APNI
Right position
par hai

→ 1 2 3 4 5

3rd Iteration

1	2	3	4	5
0	1	2	3	4

2 com

Step 01: find smallest element's index from $[0, N-1]$

$$i = 2 \quad j = 2 \quad \minIndex = j = 2$$

Step 02: swap the i th and \minIndex position's value

swap($arr[i]$, $arr[\minIndex]$)
3 3

1 2 3 4 5

4th Iteration

1	2	3	4	5
0	1	2	3	4

1 com

Step 01: find smallest element's index from $[0, N-1]$

$$i = 3 \quad j = 3 \quad \minIndex = j = 3$$

▶ Step 02: swap the i th and $minIndex$ position's value

$swap(arr[i], arr[minIndex])$

1 2 3 4 5

Sorted Array

1	2	3	4	5
0	1	2	3	4

$i \in [0, N-1)$
Iteration

$j \in [i+1, N)$
Comparison

Outer
Loop

Ist

4

IInd

3

IIIrd

2

IVth

1

Inn
Loop

GENERALIZE

$N=5$

Iteration

Comparison

1 $\rightarrow (N-1)$

2 $\rightarrow (N-2)$

0

0

0

0

$(N-2) \rightarrow (N-1-2) = 2$

$(N-1) \rightarrow (N-1-1) = 1$

$$T.C. \Rightarrow O\left(\frac{N^2}{2} - \frac{N}{2}\right) \Rightarrow O(N^2)$$

$$S.C. \Rightarrow O(1)$$

```
// SORTINGS 02: SELECTION SORT
#include<iostream>
#include<vector>
using namespace std;

// SELECTION SORT Function
void selectionSort(vector<int> &arr){
    int N = arr.size();

    for(int i=0; i < N-1; i++){

        // Lets assume ki 1st index par jo value hai wo hi smallest hai
        int minIndex = i;

        // ▶Step 01: find smallest element's index from [0,N-1]
        for(int j= i+1; j<N; j++){

            if(arr[j] < arr[minIndex]){
                minIndex = j;
            }
        }

        // ▶Step 02: swap the ith and minIndex position's value
        swap(arr[i], arr[minIndex]);
    }
}
```

```

        minIndex = j;
    }
}
// ▶Step 02: swap the ith and minIndex position's value
swap(arr[i], arr[minIndex]);
}

}

int main(){
    vector<int> arr{5,4,3,1,2};

    selectionSort(arr);
    for(auto value: arr){
        cout<<value<<" ";
    }
    return 0;
}

/*
INPUT: {5,4,3,1,2}
OUTPUT: {1,2,3,4,5}
TIME COMPLEXITY: O(N^2)
SPACE COMPLEXITY: O(1)
*/

```

$T.C. = O(N) * O(N)$
 $= O(N * N)$
 $= O(N^2)$
 $S.C. = O(1)$