

Week 3

Question 1:

```
#include<iostream>

using namespace std;

void insertion_sort(int A[],int n)
{
    int comparisons=0,shift=0;

    int i, j, x;
    for (i = 1; i < n; i++)
    {
        j = i - 1;
        x = A[i];
        while (j > -1 && A[j] > x)
        {
            comparisons++;
            A[j + 1] = A[j];
            j--;
            shift++;
        }

        A[j + 1] = x;
        shift++;
    }

    cout<<"sorted array: "<<endl;
    for (int i=0;i<n;i++)
        cout<<A[i]<<" ";

    cout<<endl;

    cout<<"Comparisons: "<<comparisons<<endl;
```

```
cout<<"Shift: "<<shift<<endl;
```

```
}
```

```
int main()
```

```
{
```

```
    int t;
```

```
    cin>>t;
```

```
    while (t--)
```

```
    {
```

```
        int n;
```

```
        cin>>n;
```

```
        int arr[n];
```

```
        for (int i=0;i<n;i++)
```

```
            cin>>arr[i];
```

```
        insertion_sort(arr,n);
```

```
    }
```

```
}
```

Output:

enter the number of test cases

3

enter the number of elements

8

enter the elements

-23 65 -31 76 46 89 45 32

sorted array:

-31 -23 32 45 46 65 76 89

Comparisons: 13

Shift: 20

enter the number of elements

10

enter the elements

54 65 34 76 78 97 46 32 51 21

sorted array:

21 32 34 46 51 54 65 76 78 97

Comparisons: 28

Shift: 37

enter the number of elements

15

enter the elements

63 42 223 645 652 31 324 22 553 -12 54 65 86 46 325

sorted array:

-12 22 31 42 46 54 63 65 86 223 324 325 553 645 652

Comparisons: 54

Shift: 68

Process returned 0 (0x0) execution time : 91.906 s

Press any key to continue.

Question 2:

```
#include<iostream>
```

```
using namespace std;
```

```
void swap(int *x, int *y)
```

```
{
```

```
    int temp = *x;
```

```
    *x = *y;
```

```
    *y = temp;
```

```
}
```

```
void Selection_sort(int arr[],int n)
```

```
{
```

```
    int comp=0,swaps=0;
```

```
    int i,j,pos=0,min=0;
```

```
    for (i=0;i<n-1;i++)
```

```
    {
```

```
        min=arr[i];
```

```
        pos=i;
```

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

```
        {
```

```
            comp++;
```

```
            if (min>arr[j])
```

```
            {
```

```
                min=arr[j];
```

```
                pos=j;
```

```
            }
```

```
        }
```

```

        if (pos!=i)
        {
            swap(&arr[pos],&arr[i]);
        }

        swaps++;
    }

    cout<<"sorted array is: "<<endl;
    for (int i=0;i<n;i++)
        cout<<arr[i]<<" ";

    cout<<endl;

    cout<<"Comparisons:"<<comp<<endl;
    cout<<"Swaps:"<<swaps<<endl;

}

int main()
{
    int t;

    cout<<"enter the number of test cases"<<endl;

    cin>>t;

    while (t--)
    {
        int n;

        cout<<"enter the number of elements"<<endl;

        cin>>n;

        int arr[n];

        cout<<"enter the array elements"<<endl;

        for (int i=0;i<n;i++)
            cin>>arr[i];

        Selection_sort(arr,n);
    }
}

```

Output:

enter the number of test cases

3

enter the number of elements

8

enter the array elements

-13 65 -21 76 46 89 45 12

sorted array is:

-21 -13 12 45 46 65 76 89

Comparisons:28

Swaps:7

enter the number of elements

10

enter the array elements

54 65 34 76 78 97 46 32 51 21

sorted array is:

21 32 34 46 51 54 65 76 78 97

Comparisons:45

Swaps:9

enter the number of elements

15

enter the array elements

63 42 223 645 652 31 324 22 553 12 54 65 86 46 325

sorted array is:

12 22 31 42 46 54 63 65 86 223 324 325 553 645 652

Comparisons:105

Swaps:14

Process returned 0 (0x0) execution time : 80.715 s

Press any key to continue.

Question 3:

```
#include<iostream>

using namespace std;

void merge(int arr[],int l,int mid,int h)
{
    int count=0;
    int i=l,j=mid+1;
    int temp[h-l+1];
    int k=0;

    while (i<=mid && j<=h)
    {
        if (arr[i]<arr[j])
            temp[k++]=arr[i++];
        else
        {
            temp[k++]=arr[j++];
            count+=mid-i+1;
        }
    }

    for (;i<=mid;)
        temp[k++]=arr[i++];

    for (;j<=h;)
        temp[k++]=arr[j++];

    for (int f=0;f<k;f++)
        arr[f+l]=temp[f];
}
```

```
void merge_sort(int arr[],int l,int h)
```

```
{
```

```
    if (l<h)
```

```
    {
```

```
        int mid=l+(h-l)/2;
```

```
        merge_sort(arr,l,mid);
```

```
        merge_sort(arr,mid+1,h);
```

```
        merge(arr,l,mid,h);
```

```
    }
```

```
}
```

```
int main()
```

```
{
```

```
    int t;
```

```
    cout<<"enter the number of test cases"<<endl;
```

```
    cin>>t;
```

```
    while (t--)
```

```
    {
```

```
        int n;
```

```
        cout<<"enter the number of elements"<<endl;
```

```
        cin>>n;
```

```
        int arr[n];
```

```
        cout<<"enter the array elements"<<endl;
```

```
        for (int i=0;i<n;i++)
```

```
            cin>>arr[i];
```

```
        merge_sort(arr,0,n-1);
```

```
        int flag=0;
```

```
        for (int i=0;i<n-1;i++)
```

```
        {
```



```
    if (arr[i]==arr[i+1])
    {
        cout<<"YES"<<endl;

        flag=1;

        break;
    }
}

if (flag==0)
    cout<<"NO"<<endl;

}

}
```

Output:

enter the number of test cases

3

enter the number of elements

5

enter the array elements

28 52 83 14 75

NO

enter the number of elements

10

enter the array elements

75 65 1 65 2 6 86 2 75 8

YES

enter the number of elements

15

enter the array elements

75 35 86 57 98 23 73 1 64 8 11 90 61 19 20

NO

Process returned 0 (0x0) execution time : 62.287 s

Press any key to continue.