Q 4)

Merge Sort -

```
#include<iostream>
using namespace std;

template<class temp>
class MergeSort
{
   public :
      temp *arr;
      int n;

      MergeSort(int size)
      {
         arr = new temp[size];
         n = size;
      }

      void mergeSort(int l, int r)
      {
         if(l<r)
         {
            int m = l + (r-l)/2;
            mergeSort(l, m);
            mergeSort(m+1, r);
            mergeArray(l, m, r);
         }
      }

      void mergeArray(int l, int m, int r)
      {
         temp temparr[r-l+1];
         int i=l, j=m+1, k=0;
         while(i<=m && j<=r)
         {
            if(arr[i]<arr[j])
            {
               temparr[k++] = arr[i++];
            }
            else
            {
               temparr[k++] = arr[j++];
            }
         }
         while(i<=m)
         {
            temparr[k++] = arr[i++];
         }
         while(j<=r)
         {
            temparr[k++] = arr[j++];
         }
         k = l;
         i=0;
         while(k<=r)
         {
```

```
            arr[k++] = temparr[i];
            i++;
        }
    }

    void printArray()
    {
        cout<<"The array is : ";
        for(int i=0;i<n;i++)
        {
            cout<<arr[i]<<"\t";
        }
        cout<<endl;
    }
};

int main()
{
    int n, i;
    cout<<"Enter the number of elements to be entered : ";
    cin>>n;

    MergeSort<int> ob(n);

    cout<<"Enter the elements : "<<endl;
    for(i=0;i<n;i++)
    {
        cin>>ob.arr[i];
    }

    ob.mergeSort(0, n-1);
    ob.printArray();
}
```

```
Aadhityas-MacBook-Air:Sorting aadhitya$ g++ MergeSort.cpp
Aadhityas-MacBook-Air:Sorting aadhitya$ ./a.out
Enter the number of elements to be entered : 5
Enter the elements :
1
3
2
5
4
The array is : 1        2       3       4       5
Aadhityas-MacBook-Air:Sorting aadhitya$
```

Quick Sort

```
#include<iostream>
#include<stdlib.h>
using namespace std;

template <class temp>
class QuickSort
{
   public :
      temp *arr;
      int num;
      QuickSort(int size)
      {
         arr = new temp[size];
         num = size;
      }

      void printArray()
      {
         int i;
         cout<<"The elements of the array are : ";
         for(int i=0;i<num;i++)
         {
            cout<<arr[i]<<'\t';
         }
         cout<<endl;
      }

      void sortArray(int a, int b)
      {
         if(a>=b-1)
         {
            return;
         }
         else
         {
            int front=a, back=b-1;
            int pivot, t;

            //Choosing the pivot in a random manner.
            pivot = rand() % (b-a) + a;

            while(front<back)
            {
               while(arr[front]<arr[pivot])
               {
                  front++;
               }
               while(arr[back]>arr[pivot])
               {
                  back--;
               }
               if(front==pivot)
               {
                  pivot = back;
               }
               else if(back==pivot)
```

```
                {
                    pivot = front;
                }

                t = arr[front];
                arr[front] = arr[back];
                arr[back] = t;

                if(arr[front]==arr[back])
                {
                    front++;
                }
            }

            sortArray(a, pivot);
            sortArray(pivot+1, b);
        }
    }
};
int main()
{
    int n;
    cout<<"Enter the number of elements of the array : ";
    cin>>n;

    QuickSort<int> ob(n);
    cout<<"Enter the elements of the array : ";
    for(int i=0;i<n;i++)
    {
        cin>>ob.arr[i];
    }

    ob.sortArray(0, n);
    ob.printArray();
}
```

```
Aadhityas-MacBook-Air:Sorting aadhitya$ g++ QuickSort.cpp
Aadhityas-MacBook-Air:Sorting aadhitya$ ./a.out
Enter the number of elements of the array : 5
Enter the elements of the array : 1
3
2
6
5
The elements of the array are : 1       2       3       5       6
Aadhityas-MacBook-Air:Sorting aadhitya$
```

Q3)

Method - 1 :

```
#include<iostream>
using namespace std;
void insert(int *arr1, int *arr2, int n1, int n2)
{
    int i, j, k;
    for(i=0;i<n2;i++)
    {
        for(j=0;j<n1;j++)
        {
            if(arr1[j]>arr2[i])
            {
                break;
            }
        }
        for(k=n1+i;k>j;k--)
        {
            arr1[k] = arr1[k-1];
        }
        arr1[j] = arr2[i];
    }
}

void printArray(int *arr, int n)
{
    cout<<"The array is : ";
    for(int i=0;i<n;i++)
    {
        cout<<arr[i]<<"\t";
    }
    cout<<endl;
}

int main()
{
    int n, k, i;
    cout<<"Enter the number of elements of the sorted array : ";
    cin>>n;
    cout<<"Enter the number of elements to be inserted : ";
    cin>>k;
    int arr1[n+k], arr2[k];
    cout<<"Enter the elements of the sorted array : "<<endl;
    for(i=0;i<n;i++)
    {
        cin>>arr1[i];
    }
    cout<<"Enter the elements to be inserted into the array : "<<endl;
    for(i=0;i<k;i++)
    {
        cin>>arr2[i];
    }
    insert(arr1, arr2, n, k);
    printArray(arr1, (n+k));
}
```

```
Aadhityas-MacBook-Air:DSA-Course aadhitya$ g++ 17Sep2019.cpp
Aadhityas-MacBook-Air:DSA-Course aadhitya$ ./a.out
Enter the number of elements of the sorted array : 5
Enter the number of elements to be inserted : 3
Enter the elements of the sorted array :
22
33
35
44
46
Enter the elements to be inserted into the array :
34
45
12
The array is : 12       22      33      34      35      44      45      46
Aadhityas-MacBook-Air:DSA-Course aadhitya$
```

Method - 2 :

```
#include<iostream>
using namespace std;
void printArray(int *arr, int n)
{
    cout<<"The array is : ";
    for(int i=0;i<n;i++)
    {
        cout<<arr[i]<<"\t";
    }
    cout<<endl;
}
void insert(int *arr, int *arr1, int *arr2, int n1, int n2)
{
    int i=0, j=0, k=0;
    while(i<=n1 && j<=n2)
    {
        if(arr1[i]<arr2[j])
        {
            arr[k++] = arr1[i++];
        }
        else
        {
            arr[k++] = arr2[j++];
        }
    }
    k--;
    while(i<=n1)
    {
        arr[k++] = arr1[i++];
    }
    while(j<=n2)
    {
        arr[k++] = arr2[j++];
    }
}
```

```
void sortArray(int *arr, int n)
{
    int i, j, t;
    for(i=0;i<n-1;i++)
    {
        for(j=0;j<n-i-1;j++)
        {
            if(arr[j]>arr[j+1])
            {
                t = arr[j];
                arr[j] = arr[j+1];
                arr[j+1] = t;
            }
        }
    }
}
int main()
{
    int n, k, i;
    cout<<"Enter the number of elements of the sorted array : ";
    cin>>n;
    cout<<"Enter the number of elements to be inserted : ";
    cin>>k;
    int arr1[n+k], arr2[k];
    cout<<"Enter the elements of the sorted array : "<<endl;
    for(i=0;i<n;i++)
    {
        cin>>arr1[i];
    }
    cout<<"Enter the elements to be inserted into the array : "<<endl;
    for(i=0;i<k;i++)
    {
        cin>>arr2[i];
    }
    sortArray(arr2, k);
    int arr[n+k];
    insert(arr, arr1, arr2, n, k);
    printArray(arr, (n+k));
}
```

```
Aadhityas-MacBook-Air:DSA-Course aadhitya$ g++ 17Sep2019.cpp
Aadhityas-MacBook-Air:DSA-Course aadhitya$ ./a.out
Enter the number of elements of the sorted array : 5
Enter the number of elements to be inserted : 4
Enter the elements of the sorted array :
2
4
5
6
8
Enter the elements to be inserted into the array :
1
7
9
3
The array is : 1        2       3       4       5       6       7       8       9
Aadhityas-MacBook-Air:DSA-Course aadhitya$
```

Q1)

```
#include<iostream>
using namespace std;

template<class temp>
class BubbleSort
{
    public :
        temp *arr;
        int n;

        BubbleSort(int size)
        {
            arr = new temp[size];
            n = size;
        }

        void bubbleSort()
        {
            int i, j;
            temp t;
            for(i=0;i<n-1;i++)
            {
                for(j=0;j<n-i-1;j++)
                {
                    if(arr[j]>arr[j+1])
                    {
                        t = arr[j];
                        arr[j] = arr[j+1];
                        arr[j+1] = t;
                    }
                }
            }
        }

        void printArray()
        {
            cout<<"The array is : ";
            for(int i=0;i<n;i++)
            {
                cout<<arr[i]<<"\t";
            }
            cout<<endl;
        }
};

int main()
{
    int n, i;
    string s;
    cout<<"Enter the string : ";
    getline(cin, s);
    n = s.length();

    BubbleSort<char> ob(n);
```

```
    for(i=0;i<n;i++)
    {
        ob.arr[i] = s[i];
    }

    ob.bubbleSort();
    ob.printArray();
}
```

```
Aadhityas-MacBook-Air:DSA-Course aadhitya$ g++ 17Sep2019.cpp
Aadhityas-MacBook-Air:DSA-Course aadhitya$ ./a.out
Enter the string : VIT Chennai Campus
The array is :                C       C       I       T       V       a       a       e       h       i       m       n       n       p       s       u
Aadhityas-MacBook-Air:DSA-Course aadhitya$
```

Q2)

```
#include<iostream>
using namespace std;

template<class temp>
class BubbleSort
{
    public :
        temp *arr;
        int n;

        BubbleSort(int size)
        {
            arr = new temp[size];
            n = size;
        }

        void bubbleSort()
        {
            int i, j;
            temp t;
            for(i=0;i<n-1;i=i+2)
            {
                for(j=0;j<n-i-2;j+=2)
                {
                    if(arr[j]>arr[j+2])
                    {
                        t = arr[j];
                        arr[j] = arr[j+2];
                        arr[j+2] = t;
                    }
                }
            }
        }

        void printArray()
```

```
        {
            cout<<"The array is : ";
            for(int i=0;i<n;i++)
            {
                cout<<arr[i]<<"\t";
            }
            cout<<endl;
        }
};

int main()
{
    int n, i;
    cout<<"Enter the number of elements to be entered : ";
    cin>>n;

    BubbleSort<int> ob(n);

    cout<<"Enter the elements : "<<endl;
    for(i=0;i<n;i++)
    {
        cin>>ob.arr[i];
    }

    ob.bubbleSort();
    ob.printArray();
}
```

```
Aadhityas-MacBook-Air:DSA-Course aadhitya$ g++ 17Sep2019.cpp
Aadhityas-MacBook-Air:DSA-Course aadhitya$ ./a.out
Enter the number of elements to be entered : 6
Enter the elements :
-1
2
-2
-5
4
0
The array is : -2       2       -1      -5      4       0
Aadhityas-MacBook-Air:DSA-Course aadhitya$
```