WEEK-1

Q1

```
#include <bits/stdc++.h>
using namespace std;
void lsearch(int arr[], int size, int key){
    int c = 0;
    for (int i = 0; i < size; i++){
        c++;
        if (arr[i] == key){
            cout << key << " is present\n";
            cout << "comparisions : " << c << endl;
            return;
        }
    }
    cout << key << " is not present\n";
    cout << "comparisions : " << c << endl;
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        cin >> z;
        lsearch(arr, y - 1, z);
    }
    return 0;
}
```

Q2

```
#include <bits/stdc++.h>
using namespace std;
void bsearch(int arr[], int size, int key){
    int c = 0;
    int l, h;
    l = 0, h = size - 1;
    while (l <= h){
        c++;
        int mid = (l + h) / 2;
        if (arr[mid] == key){
            cout << key << " is present\n";
            cout << "no of comparision : " << c << endl;
            return;
        }
        else if (arr[mid] > key)
```

```
            h = mid - 1;
        else
            l = mid + 1;
    }
    cout << key << " is not present\n";
    cout << "no of comparision : " << c << endl;
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        cin >> z;
        bsearch(arr, y - 1, z);
    }
    return 0;
}
```

Q3

```
#include <bits/stdc++.h>
using namespace std;
void jsearch(int arr[], int size, int key){
    int c = 0;
    int i = 0;
    int j = sqrt(size);
    while (arr[j] < key && i < size){
        c++;
        i = j;
        j += sqrt(size);
        if (j > size - 1)
            j = size - 1;
    }
    for (int k = i; k <= j; k++){
        c++;
        if (arr[k] == key){
            cout << key << " is present\n";
            cout << "no of comparision : " << c << endl;
            return;
        }
    }
    cout << key << " is not present\n";
    cout << "no of comparision : " << c << endl;
}
int main(){
    int x, y, z;
    cin >> x;
```

```
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        cin >> z;
        jsearch(arr, y - 1, z);
    }
    return 0;
}
```

WEEK-2

Q1

```
#include <bits/stdc++.h>
using namespace std;
int bsearch(int arr[], int size, int key, int fs){
    int l, h;
    int res = -1;
    l = 0, h = size - 1;
    while (l <= h){
        int mid = (l + h) / 2;
        if (arr[mid] == key){
            res = mid;
            if (fs)
                h = mid - 1;
            else
                l = mid + 1;
        }
        else if (arr[mid] > key)
            h = mid - 1;
        else
            l = mid + 1;
    }
    return res;
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        cin >> z;
        int a = bsearch(arr, y - 1, z, 1);
        int b = bsearch(arr, y - 1, z, 0);
        if (a != -1)
            cout << z << "-" << b - a + 1 << endl;
        else
            cout << "key not found\n";
    }
    return 0;
}
```

Q2

```
#include<bits/stdc++.h>
using namespace std;
void sumsearch(int arr[],int size){
```

```
    for(int i=0;i<=size-2;i++){
        for(int j=i+1;j<=size-1;j++){
            int sum=arr[i]+arr[j];
            int k=j+1;
            while(k<=size){
                if(arr[k]==sum){
                    cout<<i+1<<","<<j+1<<","<<k+1<<endl;
                    return;
                }
                else
                    k++;
            }
        }
    }
    cout<<"no sequence found\n";
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        sumsearch(arr, y - 1);
    }
    return 0;
}
```

Q3

```
#include<bits/stdc++.h>
using namespace std;
void pairsrch(int arr[],int size,int diff){
    int x=0;
    for(int i=0;i<size;i++){
        for(int j=i+1;j<=size;j++){
            if(abs(arr[i]-arr[j])==diff)
                x++;
        }
    }
    if(!x){
        cout<<"no such pair exist\n";
        return;
    }
    cout<<x<<endl;
}
int main(){
    int x, y, z;
    cin >> x;
```

```
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        cin>>z;
        pairsrch(arr, y - 1,z);
    }
    return 0;
}
```

WEEK-3

Q1

```
#include<bits/stdc++.h>
using namespace std;
void insertion_sort(int arr[],int size){
    int c=0,s=0;
    for(int i=1;i<size;i++){
        c++;
        int t=arr[i];
        int j=i-1;
        while(j>=0 && t<arr[j]){
            s++;
            arr[j+1]=arr[j];
            j--;
        }
        arr[j+1]=t;
    }
    for(int i=0;i<size;i++)
        cout<<arr[i]<<" ";
    cout<<endl<<"comparisions : "<<c+s<<endl;
    cout<<"shifts : "<<s<<endl;
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        insertion_sort(arr, y);
    }
    return 0;
}
```

Q2

```
#include<bits/stdc++.h>
using namespace std;
void swap(int *a,int *b){
    int temp=*a;
    *a=*b;
    *b=temp;
}
void selection_sort(int arr[],int size){
    int c=0,s=0;
    for(int i=0;i<size-1;i++){
        int min=i;
```

```
        for(int j=i+1;j<size;j++){
            c++;
            if(arr[j]<arr[min])
                min=j;
        }
        s++;
        swap(&arr[min],&arr[i]);
    }
    for(int i=0;i<size;i++)
        cout<<arr[i]<<" ";
    cout<<endl<<"comparisions : "<<c<<endl;
    cout<<"swaps : "<<s<<endl;
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        selection_sort(arr, y);
    }
    return 0;
}
```

Q3

```
#include<bits/stdc++.h>
using namespace std;
void merge(int arr[],int l,int m,int h){
    int flag=0;
    int i=l,j=m+1,k=l;
    int b[h+1];
    while(i<=m && j<=h){
        if(arr[i]>=arr[j]){
            b[k]=arr[j];
            j++;
            flag=arr[i]==arr[j]?1:0;
        }
        else{
            b[k]=arr[i];
            i++;
        }
        k++;
    }
    while(i<=m){
        b[k]=arr[i];
        k++;i++;
    }
```

```
    while(j<=h){
        b[k]=arr[j];
        k++;j++;
    }
    for(int p=l;p<=h;p++)
        arr[p]=b[p];
}
void mergesort(int arr[],int l,int h){
    if(l<h){
        int mid=(l+h)/2;
        mergesort(arr,l,mid);
        mergesort(arr,mid+1,h);
        merge(arr,l,mid,h);
    }
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        mergesort(arr,0, y-1);
        int flag=0;
        for(int i=1;i<y;i++){
            if(arr[i-1]==arr[i])
                flag++;
        }
        flag>0?cout<<"YES\n":cout<<"NO\n";
    }
    return 0;
}
```

WEEK-4

Q1

```
#include<bits/stdc++.h>
using namespace std;
int c=0;
void merge(int arr[],int l,int m,int h){
    int i=l,j=m+1,k=l;
    int b[h+1];
    while(i<=m && j<=h){
        if(arr[i]<=arr[j])
            b[k++]=arr[i++];
        else
            b[k++]=arr[j++];
        c++;
    }
    while(i<=m)
        b[k++]=arr[i++];
    while(j<=h)
        b[k++]=arr[j++];
    for(int i=l;i<=h;i++)
        arr[i]=b[i];
}
void mergesort(int arr[],int l,int h){
    if(l<h){
        int mid=(l+h)/2;
        mergesort(arr,l,mid);
        mergesort(arr,mid+1,h);
        merge(arr,l,mid,h);
    }
}
int count_inv(int arr[],int y){
    int inv=0;
    for(int i=0;i<y-1;i++){
            for(int j=i+1;j<y;j++){
                if(arr[i]>arr[j])
                    inv++;
            }
        }
    return inv;
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
```

```
        int inv=count_inv(arr,y);
        mergesort(arr,0,y-1);
        cout<<"INVERSIONS : "<<inv<<endl;
        cout<<"COMPARISIONS : "<<c<<endl;
        c=0;
    }
    return 0;
}
```

Q2

```
#include<bits/stdc++.h>
using namespace std;
int s=0;
void swap(int *a,int *b){
    int t=*a;
    *a=*b;
    *b=t;
    s++;
}
int c=0;
int partition(int arr[],int l,int h){
    int pivot=arr[h];
    int i=l-1;
    for(int j=l;j<h;j++){
        c++;
        if(arr[j]<pivot){
            i++;
            swap(&arr[j],&arr[i]);
        }
    }
    swap(&arr[i+1],&arr[h]);
    return i+1;
}
void quick_sort(int arr[],int l,int h){
    if(l<h){
        int p=partition(arr,l,h);
        quick_sort(arr,l,p-1);
        quick_sort(arr,p+1,h);
    }
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++)
            cin >> arr[i];
        quick_sort(arr, 0,y-1);
```

```
        for (int i = 0; i < y; i++)
            cout<<arr[i]<<" ";
        cout<<"\nCOMPARISION : "<<c<<endl;
        cout<<"SWAPS : "<<s<<endl;
        s=0;
        c=0;
    }
    return 0;
}
```

Q3

```
#include<bits/stdc++.h>
using namespace std;
int l=0,m=0;
void count_sort(int arr[],int size,int k){
    int b[size];
    int max=arr[0];
    for(int i=0;i<size;i++){
        b[i]=0;
        if(max<arr[i])
            max=arr[i];
    }
    int count[max+1];
    for(int i=0;i<=max;i++)
        count[i]=0;
    for(int i=0;i<size;i++)
        count[arr[i]]++;
    for(int i=0;i<=max;i++){
        if(count[i]!=0){
            m++;
            if(m==k)
                l=i;
        }
    }
}
int main(){
    int x, y, z;
    cin >> x;
    while (x--){
        cin >> y;
        int arr[y];
        for (int i = 0; i < y; i++){
            cin >> arr[i];
        int g,h;
        cin>>g;
        count_sort(arr,y,g);
        if(g<=m)
            cout<<g<<": smallest value : "<<l;
        else
```

```
            cout<<"not present\n";
        m=0;
        l=0;
    }
    return 0;
}
```

WEEK-5

Q1

```
#include <bits/stdc++.h>
#include <string>
using namespace std;
void csort(string s){
    int n = s.length();
    char arr[n];
    int x = 0;
    memset(arr, 0, sizeof(arr));
    for (auto i : s)
        arr[x++] = i;
    int count[26];
    memset(count, 0, sizeof(count));
    for (int i = 0; i < n; i++)
        count[arr[i] - 'a']++;
    char l = 'a';
    int num = 0;
    for (int i = 0; i < 26; i++){
        if (num < count[i]){
            num = count[i];
            l = l + i;
        }
    }
    if (num <= 1)
        cout << "NO DUPLICATE ELEMENTS" << endl;
    else
        cout << l << " : " << num << endl;
}
int main(){
    string s;
    cout << "Enter the string : ";
    cin >> s;
    csort(s);
    return 0;
}
```

Q2

```
#include<bits/stdc++.h>
using namespace std;
void merge(int a[],int l,int m,int h){
    int b[h+1];
    int i,j,k;
    i=l,j=m+1,k=l;
    while(i<=m&&j<=h){
        if(a[i]<=a[j])
            b[k]=a[i++];
```

```
        else
            b[k]=a[j++];
        k++;
    }
    while(i<=m)
        b[k++]=a[i++];
    while(j<=h)
        b[k++]=a[j++];
    for(int i=l;i<=h;i++)
        a[i]=b[i];
}
void find(int a[],int l,int h,int key){
    int x=0;
    while(l<h){
        if(a[l]+a[h]>key)
            h--;
        else if(a[l]+a[h]<key)
            l++;
        else{
            cout<<a[l++]<<","<<a[h--]<<endl;
            x++;
        }
    }
    if(x==0)
        cout<<"no such pair exist";
}
void msort(int a[],int l,int h){
    if(l<h){
        int p=(l+h)/2;
        msort(a,l,p);
        msort(a,p+1,h);
        merge(a,l,p,h);
    }
}
int main(){
    int x;
    cout<<"enter number of elements : ";
    cin>>x;
    int arr[x];
    for(int i=0;i<x;i++)
        cin>>arr[i];
    msort(arr,0,x-1);
    int y;
    cout<<"enter key : ";
    cin>>y;
    find(arr,0,x-1,y);
    return 0;
}
```

Q3

```
#include<bits/stdc++.h>
using namespace std;
void common(int a[],int x,int b[],int y){
    int i=0,j=0;
    int m=0;
    int l=x>y?x:y;
    int c[l];
    while(i<x && j<y){
        if(a[i]==b[j]){
            c[m]=a[i];
            i++;
            j++;
            m++;
        }
        else if(a[i]>b[j])
            j++;
        else
            i++;
    }
    if(m==0)
        cout<<"NO COMMON ELEMENT"<<endl;
    else
        for(int i=0;i<m;i++)
            cout<<c[i]<<" ";
}
using namespace std;
int main(){
    int x;
    cout<<"enter number of elements in arr 1 : ";
    cin>>x;
    int a[x];
    for(int i=0;i<x;i++)
        cin>>a[i];
    int y;
    cout<<"enter number of elements in arr 2 : ";
    cin>>y;
    int b[y];
    for(int i=0;i<y;i++)
        cin>>b[i];
    common(a,x,b,y);
    return 0;
}
```