Lab Manual

Course Title: Design and Analysis of Algorithms

Week 1:

Note: Input, output format for problem I, II and III is same and is given at the end of this exercise.

I I. Given an array of nonnegative integers, design a linear algorithm and implement it using a program to find whether given key element is present in the array or not. Also, find total number of comparisons for each input case. (Time Complexity = O(n), where n is the size of input) **Sample I/O Problem - 1:**

I II. Given an already sorted array of positive integers, design an algorithm and implement it using a program to find whether given key element is present in the array or not. Also, find total number of comparisons for each input case. (Time Complexity = O(nlogn), where n is the size of input).

II III. Given an already sorted array of positive integers, design an algorithm and implement it using a program to find whether a given key element is present in the sorted array or not. For an array arr[n], search at the indexes arr[0], arr[2], arr[4],.....,arr[2_k] and so on. Once the interval (arr[2_k] < key < arr[2_{k+1}]) is found, perform a linear search operation from the index 2_k to find the element key. (Complexity < O(n), where n is the number of elements need to be scanned for searching):

Jump Search

Input format:

The first line contains number of test cases, T.
For each test case, there will be three input lines.
First line contains n (the size of array).
Second line contains n space-separated integers describing array.
Third line contains the key element that need to be searched in the array.

Output format:

The output will have T number of lines.
For each test case, output will be "**Present**" if the key element is found in the array, otherwise "**Not Present**".

Also, for each test case output the number of comparisons required to search the key.
Sample I/O Problem - 2, 3:

Answers:

Q1.

```
#include<iostream>

#define max 100

using namespace  std;

int main()

{

int a[100];

int t,i,key,n,flag,c;

cout<<"enter number of test cases";

cin>>t;

for(int p=0;p<t;p++)

{

flag=0;

c=0;

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

cin>>n;

cout<<"enter the elements";

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

cin>>a[i];

cout<<"enter the element to be searched";
```

```
cin>>key;
for(i=0;i<n;i++)
{
c++;
if(a[i]==key)
{
flag=1;
break;
}
}
if(flag==1)
cout<<"Present ";
else
cout<<"not Present";
cout<<c<<endl;
}
return 0;
}
```

OUTPUT-

enter number of test cases3

enter the number of elements:8

enter the elements34 35 65 31 25 89 64 30

enter the element to be searched89

Present 6

enter the number of elements:5

enter the elements977 354 244 546 355

enter the element to be searched244

Present 3

enter the number of elements:6

enter the elements23 64 13 67 43 56

enter the element to be searched63

not Present6

Q2.

```
#include<iostream>
#define max 100
using namespace  std;
int main()
{
        int a[100];
        int t,i,key,n,flag,c;
        cout<<"enter number of test cases";
        cin>>t;
        for(int p=0;p<t;p++)
        {
        flag=0;
        c=0;
        cout<<"enter the number of elements:";
        cin>>n;
        cout<<"enter the sorted array";
        for(i=0;i<n;i++)
        cin>>a[i];
```

```
cout<<"enter the element to be searched";
cin>>key;
int l=0,u=n-1,mid;
while(l<=u)
{
c++;
mid=(l+u)/2;
if(key==a[mid])
{
flag=1;
break;
}
else if(key<mid)
u=mid-1;
else
l=mid+1;

}

if(flag==1)
cout<<"Present ";
else
cout<<"not Present";
```

```
        cout<<c<<endl;
  }
return 0;      }
```

OUTPUT-

```
enter number of test cases3
enter the number of elements:5
enter the sorted array12 23 36 39 41
enter the element to be searched41
Present 3
enter the number of elements:8
enter the sorted array21 39 40 45 51 54 68 72
enter the element to be searched69
not Present4
enter the number of elements:10
enter the sorted array101 246 438 561 796 896 899 4644 7999 8545
enter the element to be searched7999
Present 3
```

Q3.

```
#include<iostream>
#include<cmath>
#define max 100
using namespace  std;
int main()
{
        int a[100];
        int t,i,key,n,flag,c;
        cout<<"enter number of test cases";
        cin>>t;
        for(int p=0;p<t;p++)
        {
        flag=0;
        c=0;
        cout<<"enter the number of elements:";
        cin>>n;
        cout<<"enter the sorted array";
        for(i=0;i<n;i++)
        cin>>a[i];
```

```
cout<<"enter the element to be searched";
cin>>key;
int pos=0,k=0;
for(i=0;i<n;i=pow(2,k))
{c++;

        if(a[i]>=key)
        {
                flag=1;
                break;
        }
        pos=i;
        k++;
}


if(flag==1)
{
        if(a[i]==key)
cout<<"Present ";
else
{
```

```
            for(int j=pos;j<i;j++)
            {c++;
                if(key==a[j])
                {
                    cout<<"Present";
                    break;
                }
                else
                cout<<"not Present";
            }
        }
        }

        else
        cout<<"not Present";
        cout<<c<<endl;
   }
return 0;
}
```

OUTPUT-

enter number of test cases3

enter the number of elements:5

enter the sorted array12 23 36 39 41

enter the element to be searched41

Present 3

enter the number of elements:8

enter the sorted array21 39 40 45 51 54 68 72

enter the element to be searched69

not Present3

enter the number of elements:10

enter the sorted array101 246 438 561 796 896 899 4644 7999 8545

enter the element to be searched7999

Present 4
