**WEEK 1**

1. **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).**

Ans I. **PROGRAM**

#include<stdio.h>

#define MAX 100

void linear\_search(int A[],int n ,int key)

{

int comparisons =0;

int flag=0;

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

{

comparisons++;

if(A[i]==key)

{

flag=1;

printf("Element found at index %d",i+1);

break;

}

}

if(flag==0)

{

printf("Key not found");

}

printf("\nTotal comparisons :%d",comparisons);

}

int main()

{

int key;

int A[MAX],n;

int t;

scanf("%d",&t);

while(t--)

{

printf("\nEnter the size of the array :");

scanf("%d",&n);

printf("Enter the elements in the array :");

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

{

scanf("%d",&A[i]);

}

printf("Enter the key:");

scanf("%d",&key);

linear\_search(A,n,key);

}

}

**OUTPUT**

**1**

**Enter the size of the array :5**

**Enter the elements in the array :1 0 3 6 7**

**Enter the key:3**

**Element found at index 3**

**Total comparisons :3**

1. **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).**

Answer II. **PROGRAM**

#include<stdio.h>

#define MAX 100

void binary\_search(int A[], int lb, int ub ,int key)

{

int comparisons =0;

int flag=0;

while(lb<ub)

{

int mid=(lb+ub)/2;

if(A[mid]==key)

{

comparisons++;

printf("Element is found at position %d",mid+1);

printf("/nTotal comparisons :%d",comparisons);

flag=1;

break;

}

if(A[mid]>key)

{

comparisons++;

ub=mid;

}

if(A[mid]<key)

{

comparisons++;

lb=mid+1;

}

}

if(flag==0)

{

printf("Element not found");

printf("\nTotal comparisons :%d",comparisons);

}

}

int main()

{

int key;

int A[MAX],n;

int t;

scanf("%d",&t);

while(t--)

{

printf("\nEnter the size of the array :");

scanf("%d",&n);

printf("Enter the elements in the array :");

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

{

scanf("%d",&A[i]);

}

printf("Enter the key:");

scanf("%d",&key);

binary\_search(A,0,n,key);

}

}

**OUTPUT**

**2**

**Enter the size of the array :5**

**Enter the elements in the array :1 9 3 5 6**

**Enter the key:3**

**Element is found at position 3/nTotal comparisons :1**

**Enter the size of the array :8**

**Enter the elements in the array :12 34 56 78 90 100 112 113**

**Enter the key:100**

**Element is found at position 6/nTotal comparisons :3**

1. **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[2k ] and so on. Once the interval (arr[2k ] < key < arr[ 2k+1] ) is found, perform a linear search operation from the index 2k to find the element key. (Complexity < O(n), where n is the number of elements need to be scanned for searching):**

**ANSWERS III. PROGRAM**

#include<stdio.h>

#include<math.h>

#define MAX 100

void jump\_search(int A[],int n ,int key)

{

int flag=0 ;

int comparisons=0;

int start=0;

int end=pow(2,start);

while(A[end]<key && end<n)

{

int k=1;

start=end-1;

end=start+pow(2,k);

k++;

}

for(int i=start ;i<=end ;i++)

{

comparisons++;

if(A[i]==key)

{

flag=1;

printf("Present\t%d",comparisons);

break;

}

}

if(flag==0)

{

printf("Element not found\t %d",comparisons);

}

}

int main()

{

int key;

int A[MAX],n;

int t;

scanf("%d",&t);

while(t--)

{

printf("\nEnter the size of the array :");

scanf("%d",&n);

printf("Enter the elements in the array :");

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

{

scanf("%d",&A[i]);

}

printf("Enter the key:");

scanf("%d",&key);

jump\_search(A,n,key);

}

return 0;

}

**OUTPUT**

**2**

**Enter the size of the array :5**

**Enter the elements in the array :1 3 5 8 90**

**Enter the key:8**

**Present 3**

**Enter the size of the array :6**

**Enter the elements in the array :12 34 56 78 90**

**91**

**Enter the key:56**

**Present 3**