16. Problem Statement: Binary Search Algorithm

**Problem Analysis:**

Binary search, also known as half-interval search, logarithmic search, or binary chop, is a search algorithm that finds the position of a target value within a sorted array. Binary search compares the target value to the middle element of the array; if they are unequal, the half in which the target cannot lie is eliminated and the search continues on the remaining half until it is successful. If the search ends with the remaining half being empty, the target is not in the array.

We basically ignore half of the elements just after one comparison.

*1.* Compare x with the middle element.

*2.* If x matches with middle element, we return the mid index.

*3.* Else If x is greater than the mid element, then x can only lie in right half subarray after the mid element. So we recur for right half.

*4.* Else (x is smaller) recur for the left half.

**Algorithm:**

A ← sorted array

n ← size of array

x ← value to be searched

Set lowerBound = 1

Set upperBound = n

while x not found

if upperBound < lowerBound

EXIT: x does not exists.

set midPoint = lowerBound + ( upperBound - lowerBound ) / 2

if A[midPoint] < x

set lowerBound = midPoint + 1

if A[midPoint] > x

set upperBound = midPoint – 1

if A[midPoint] = x

EXIT: x found at location midPoint

end while

end

**Source Code:**

#include<stdio.h>

int main()

{

int n,item,beg,end,mid,temp;

printf("How many elements?: ");

scanf("%d",&n);

int i,j,data[n];

printf("\nEnter the elements: ");

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

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

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

{

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

{

if(data[i]>data[j])

{

temp=data[j];

data[j]=data[i];

data[i]=temp;

}

}

}

printf("\nAfter sorting the elements we get: ");

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

{

printf("%d ",data[i]);

}

printf("\n");

printf("\nEnter the number u want to search: ");

scanf("%d",&item);

beg=0;end=n-1;

mid=(beg+end)/2;

while(beg<=end && data[mid]!=item)

{

if(item<=data[mid])

end=mid-1;

else

beg=mid+1;

mid=(beg+end)/2;

}

if(data[mid]==item)

{

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

{

if(data[mid]==data[i])

printf("\n%d is the location of the item.\n",i+1);

}

}

else

printf("\nItem is not found.\n");

return 0;

}

**Sample Input:**

How many elements: 7

Enter the elements: 9 6 4 2 7 9 5

After sorting the elements we get: 2 4 5 6 7 9 9

Enter the number u want to search: 9

**Sample Output:**

6 is the location of the item.

7 is the location of the item.