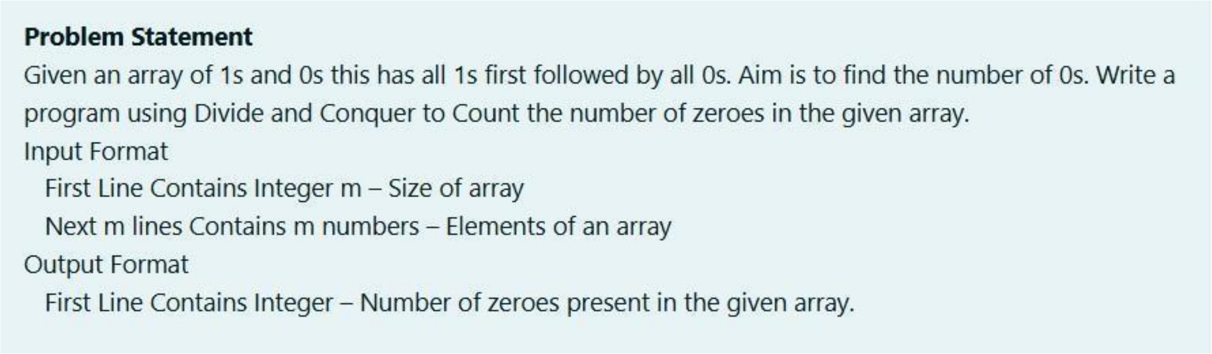
230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

DIVIDE AND CONQUER

QUESTION 4.A AIM:



Problem Statement

Given an array of 1s and 0s this has all 1s first followed by all 0s. Aim is to find the number of 0s. Write a program using Divide and Conquer to Count the number of zeroes in the given array.

Input Format

First Line Contains Integer m – Size of array

Next m lines Contains m numbers – Elements of an array

Output Format

First Line Contains Integer – Number of zeroes present in the given array.

ALGORITHM :

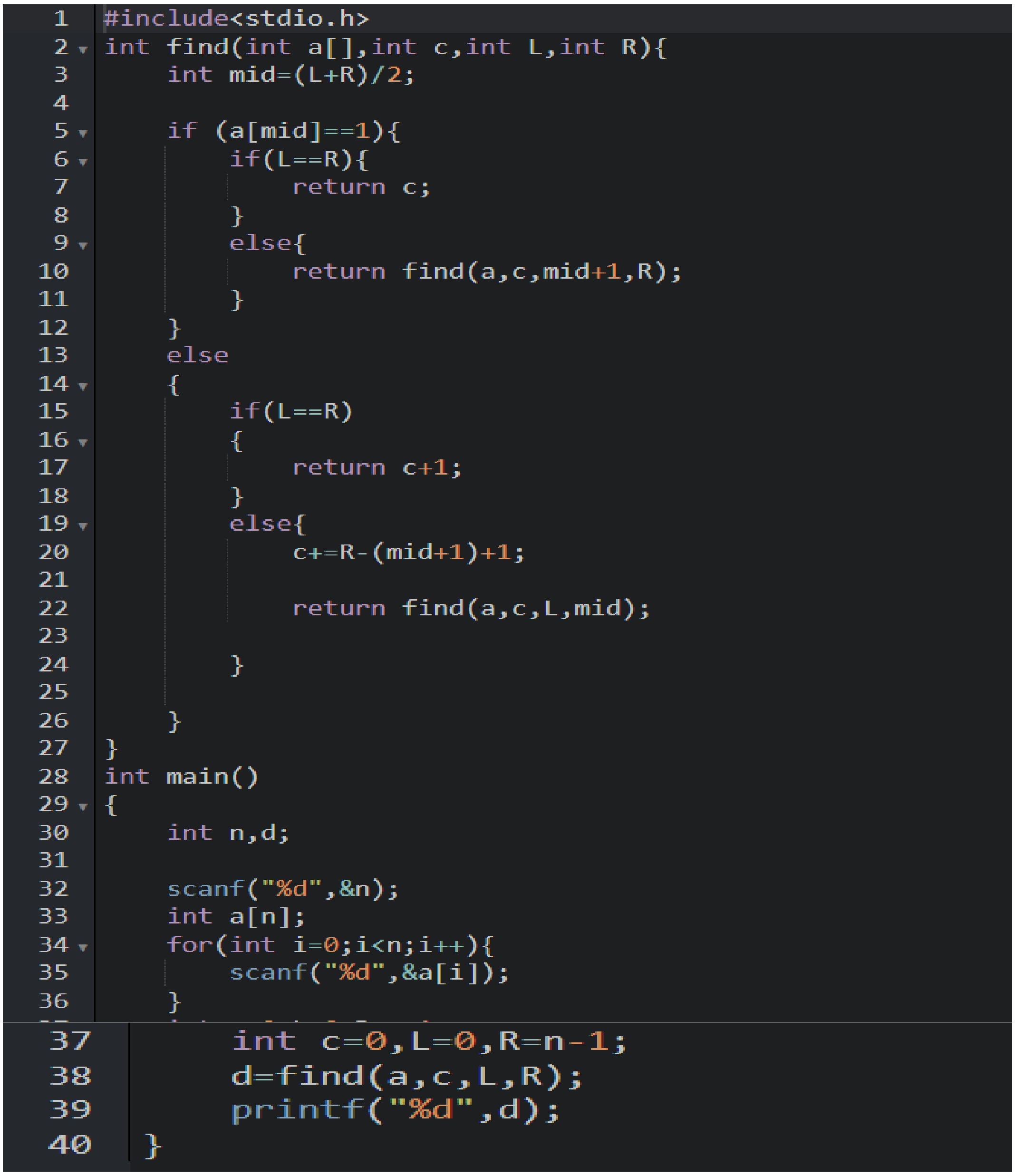
```
Step 1: Start
Step 2: Input the integer n
Step 3: Initialize array a of size n
Step 4: For each index i from 0 to n-1, input a[i]
Step 5: Call the function countz(a, 0, n - 1) and store its result in count
Step 6: Print the value of count
Step7: Stop
```

Function **countz(a[], l, r)**:

```
Step 1: If l > r, return 0
Step 2: Calculate mid as l + (r - l) / 2
Step3: Initialize count to 0
Step 4: If a[mid] == 0, set count = 1
Step 5: Return count + countz(a, l, mid - 1) + countz(a, mid + 1, r)
```

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

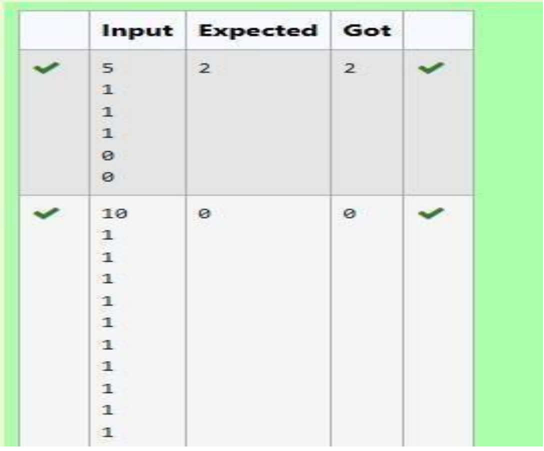
PROGRAM :



```
#include<stdio.h>
int find(int a[],int c,int L,int R){
    int mid=(L+R)/2;

    if (a[mid]==1){
        if(L==R){
            return c;
        }
        else{
            return find(a,c,mid+1,R);
        }
    }
    else
    {
        if(L==R)
        {
            return c+1;
        }
        else{
            c+=R-(mid+1)+1;

            return find(a,c,L,mid);

        }

    }
}
int main()
{
    int n,d;

    scanf("%d",&n);
    int a[n];
    for(int i=0;i<n;i++){
        scanf("%d",&a[i]);
    }
    int c=0,L=0,R=n-1;
    d=find(a,c,L,R);
    printf("%d",d);
}
```

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

OUTPUT:



	Input	Expected	Got	
✓	5 1 1 1 0 0	2	2	✓
✓	10 1 1 1 1 1 1 1 1 1 1	0	0	✓

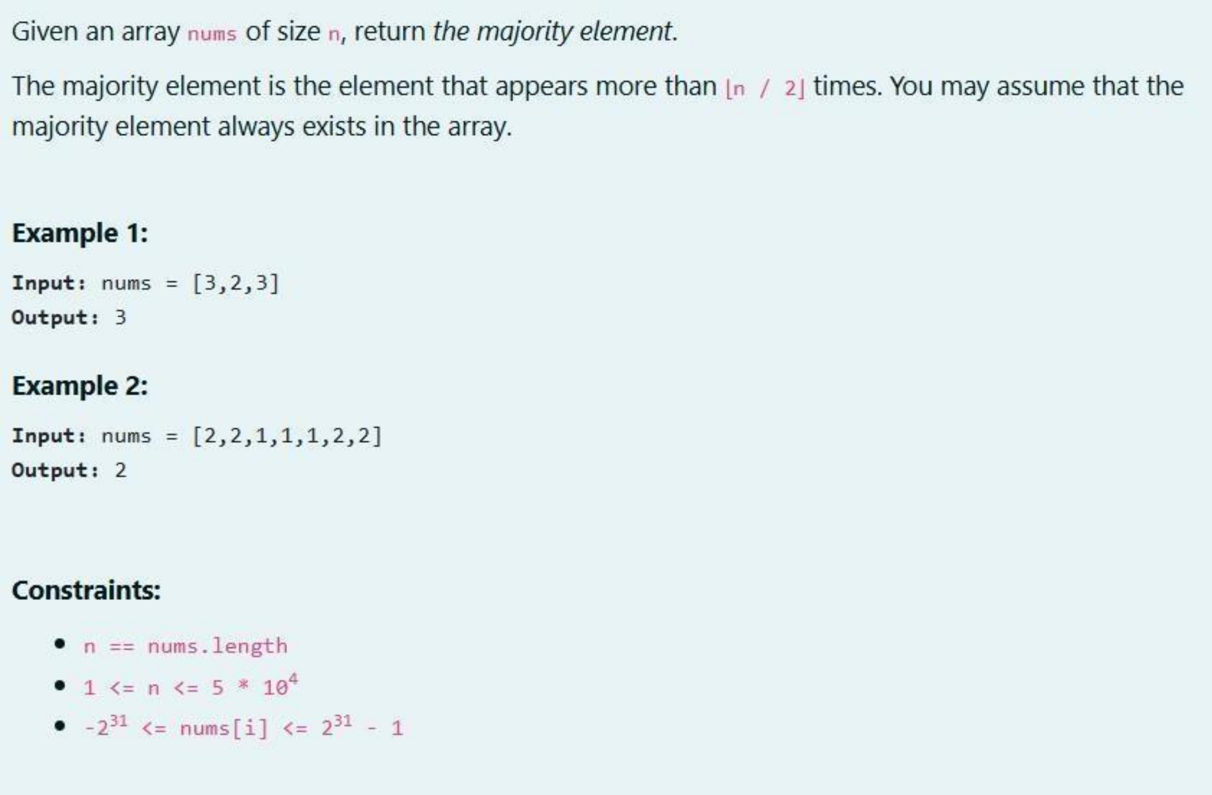
RESULT

The above program is executed successfully .

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

Q:4.B

AIM :



Given an array nums of size n, return *the majority element*.

The majority element is the element that appears more than ⌊n / 2⌋ times. You may assume that the majority element always exists in the array.

Example 1:

```
Input: nums = [3,2,3]
Output: 3
```

Example 2:

```
Input: nums = [2,2,1,1,1,2,2]
Output: 2
```

Constraints:

- n == nums.length
- $1 <= n <= 5 * 10^4$
- $-2^{31} <= nums[i] <= 2^{31} - 1$

ALGORITHM:

Step 1: Start
Step 2: Input the integer n
Step 3: Initialize array a of size n
Step 4: For each index i from 0 to n-1, input a[i]
Step 5: Call the function majority(a, 0, n - 1) and store its result in majoele
Step6: If majoele is not -1, print majoele; otherwise, print "No Majority Element" Step7: Stop

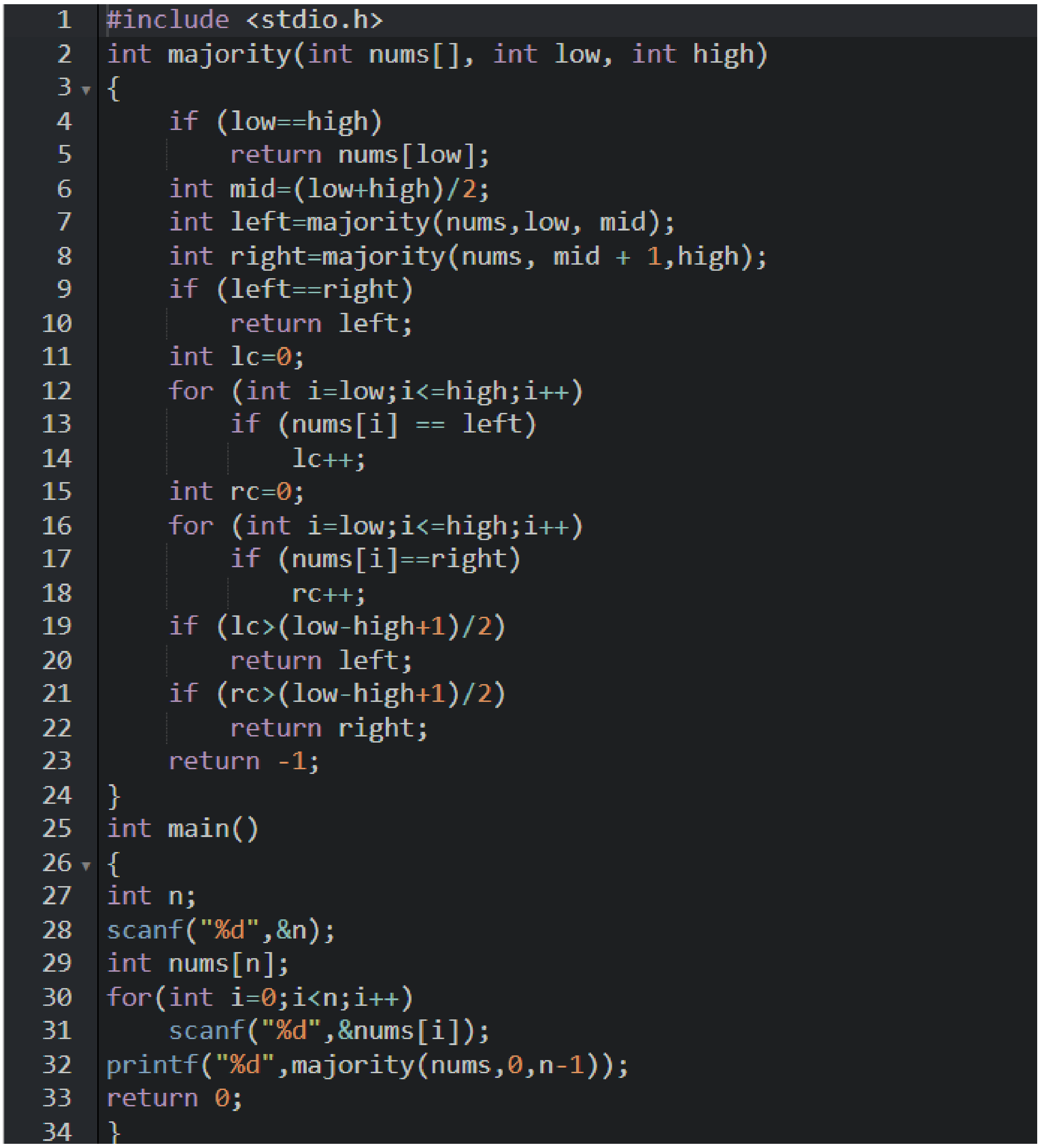
Function majority(a[], l, r):
Step 1: If l == r, return a[l]
Step 2: Calculate mid as (l + r) / 2
Step 3: Call majority(a, l, mid) and store its result in leftmajo
Step 4: Call majority(a, mid + 1, r) and store its result in rightmajo
Step 5: Initialize lc and rc to 0
Step 6: For each index i from l to r, if a[i] == leftmajo, increment lc; if a[i] == rightmajo, increment rc

Step 7: If lc > (r - l + 1) / 2, return leftmajo Step 8: If rc > (r - l + 1) / 2, return rightmajo Step 9: Return -1

PROGRAM :

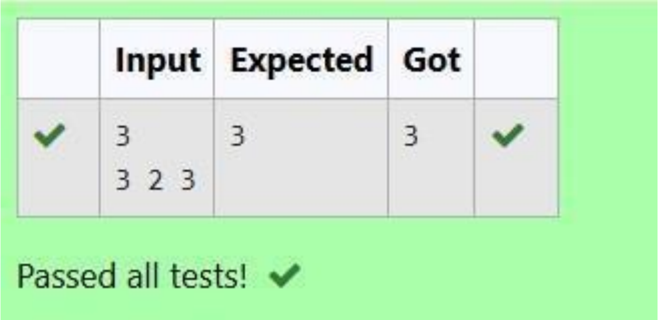
230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

PROGRAM :



```
#include <stdio.h>
int majority(int nums[], int low, int high)
{
    if (low==high)
        return nums[low];
    int mid=(low+high)/2;
    int left=majority(nums,low, mid);
    int right=majority(nums, mid + 1,high);
    if (left==right)
        return left;
    int lc=0;
    for (int i=low;i<=high;i++)
        if (nums[i] == left)
            lc++;
    int rc=0;
    for (int i=low;i<=high;i++)
        if (nums[i]==right)
            rc++;
    if (lc>(low-high+1)/2)
        return left;
    if (rc>(low-high+1)/2)
        return right;
    return -1;
}
int main()
{
int n;
scanf("%d",&n);
int nums[n];
for(int i=0;i<n;i++)
    scanf("%d",&nums[i]);
printf("%d",majority(nums,0,n-1));
return 0;
}
```

OUTPUT :



	Input	Expected	Got	
✓	3 3 2 3	3	3	✓

Passed all tests! ✓

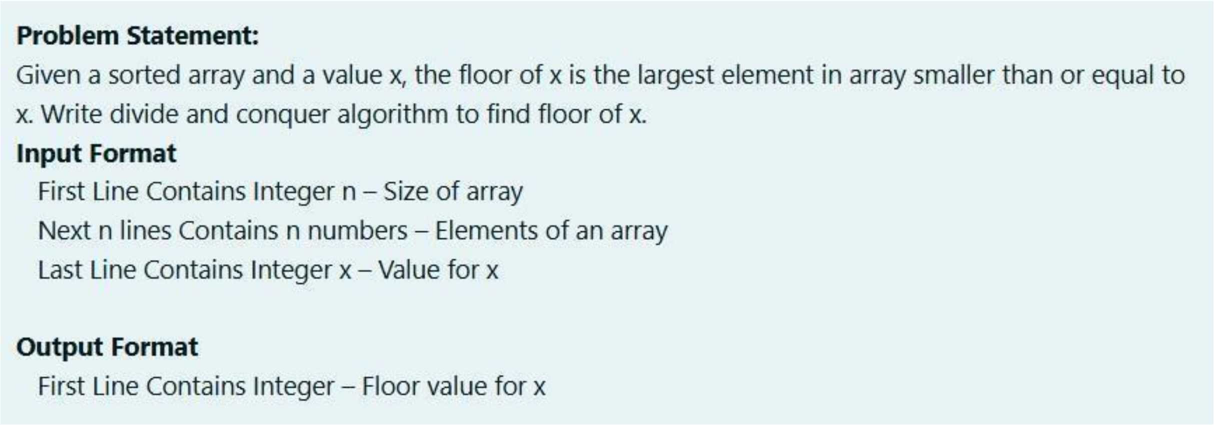
RESULT :

The above program is executed successfully.

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

Q: 4.C

AIM :



Problem Statement:

Given a sorted array and a value x, the floor of x is the largest element in array smaller than or equal to x. Write divide and conquer algorithm to find floor of x.

Input Format

First Line Contains Integer n – Size of array
Next n lines Contains n numbers – Elements of an array
Last Line Contains Integer x – Value for x

Output Format

First Line Contains Integer – Floor value for x

ALGORITHM :

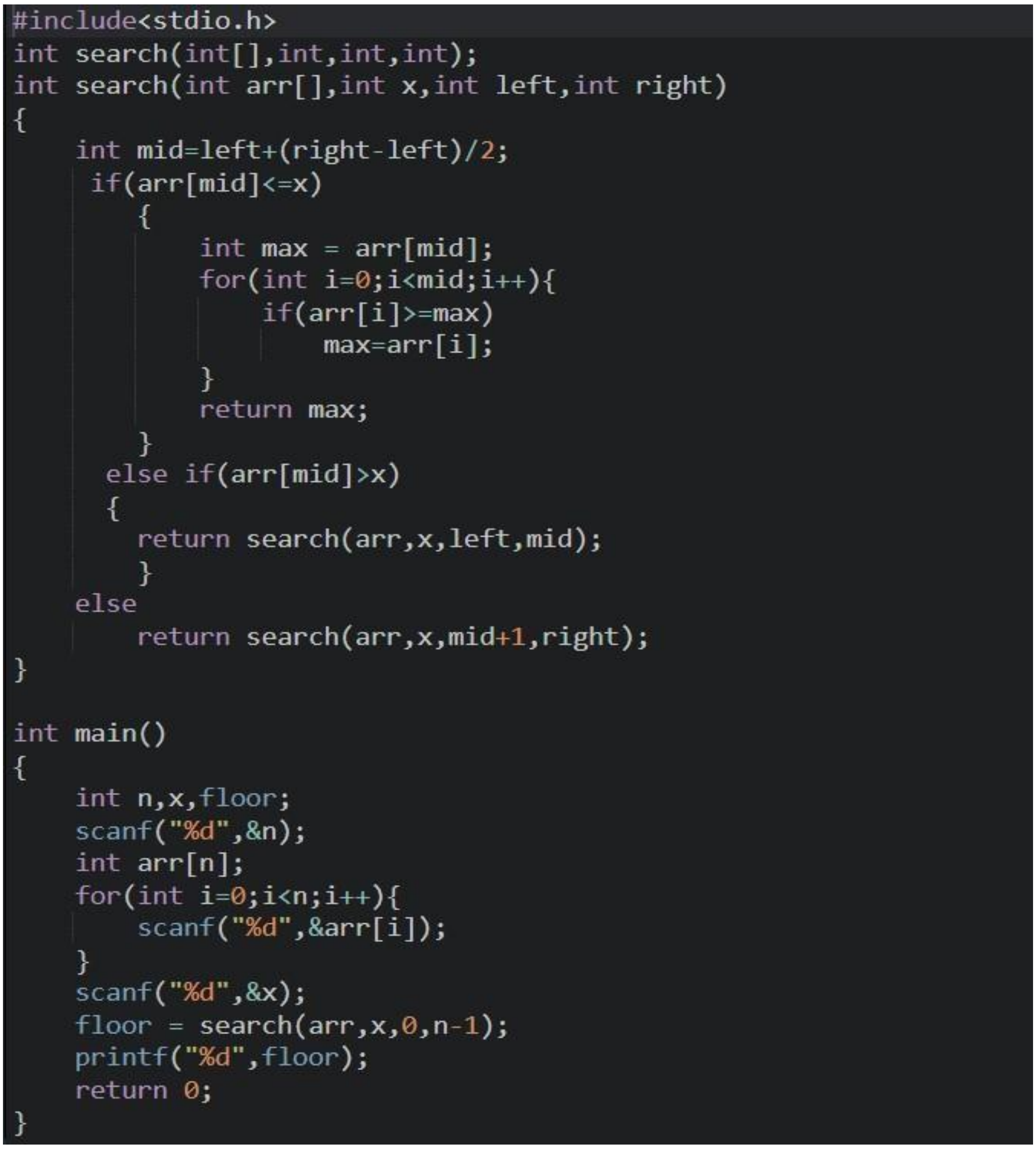
```
Step 1: Start
Step 2: Input the integer n
Step 3: Initialize array a of size n
Step 4: For each index i from 0 to n-1, input a[i]
Step 5: Input integer k
Step 6: Call findfloor(a, 0, n - 1, k)
Step7: Stop
```

Function findfloor(a[], l, r, key):

```
Step 1: If a[r] <= key, print a[r] and
returnStep 2: If l < r, do Steps 3 and 4
Step 3: Calculate mid as (l + r) / 2
Step 4: Call findfloor(a, mid + 1, r, key)
Step 5: Call findfloor(a, l, mid, key)
```

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

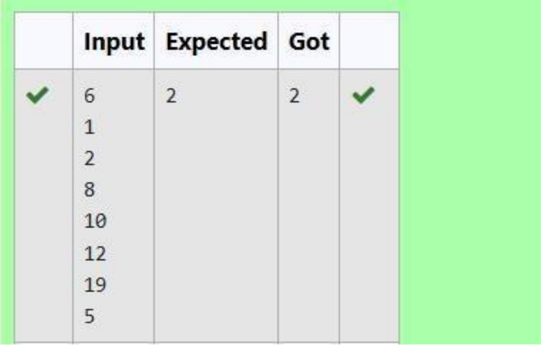
PROGRAM :



```
#include<stdio.h>
int search(int[],int,int,int);
int search(int arr[],int x,int left,int right)
{
    int mid=left+(right-left)/2;
     if(arr[mid]<=x)
        {
            int max = arr[mid];
            for(int i=0;i<mid;i++){
                if(arr[i]>=max)
                    max=arr[i];
            }
            return max;
        }
      else if(arr[mid]>x)
      {
        return search(arr,x,left,mid);
        }
    else
        return search(arr,x,mid+1,right);
}

int main()
{
    int n,x,floor;
    scanf("%d",&n);
    int arr[n];
    for(int i=0;i<n;i++){
        scanf("%d",&arr[i]);
    }
    scanf("%d",&x);
    floor = search(arr,x,0,n-1);
    printf("%d",floor);
    return 0;
}
```

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

OUTPUT:



	Input	Expected	Got	
✓	6 1 2 8 10 12 19 5	2	2	✓

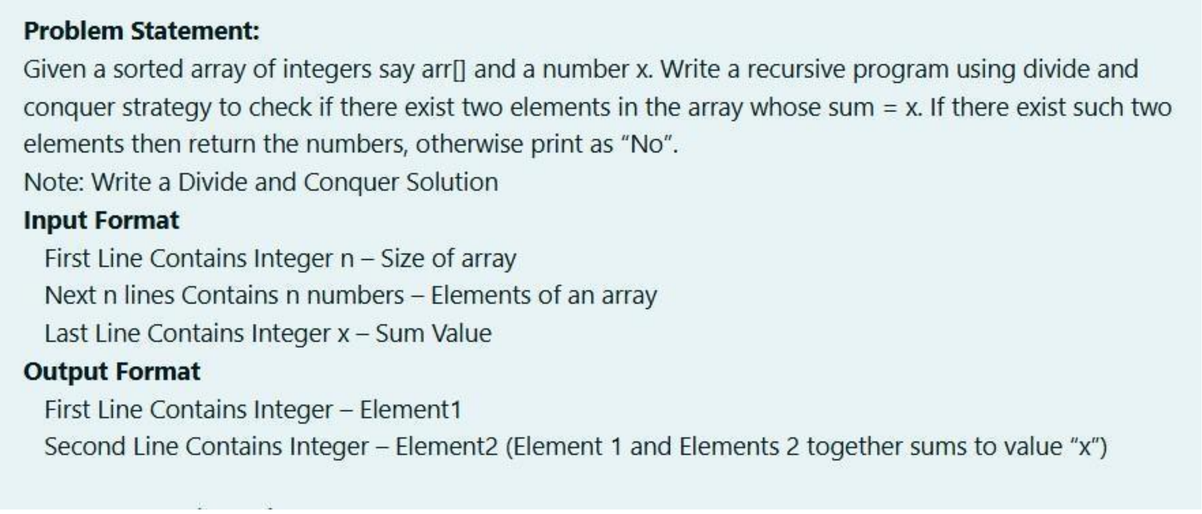
RESULT:

The above program is executed successfully.

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

Q:4.B

AIM :



Problem Statement:

Given a sorted array of integers say arr[] and a number x. Write a recursive program using divide and conquer strategy to check if there exist two elements in the array whose sum = x. If there exist such two elements then return the numbers, otherwise print as “No”.

Note: Write a Divide and Conquer Solution

Input Format

First Line Contains Integer n – Size of array
Next n lines Contains n numbers – Elements of an array
Last Line Contains Integer x – Sum Value

Output Format

First Line Contains Integer – Element1
Second Line Contains Integer – Element2 (Element 1 and Elements 2 together sums to value “x”)

ALGORITHM :

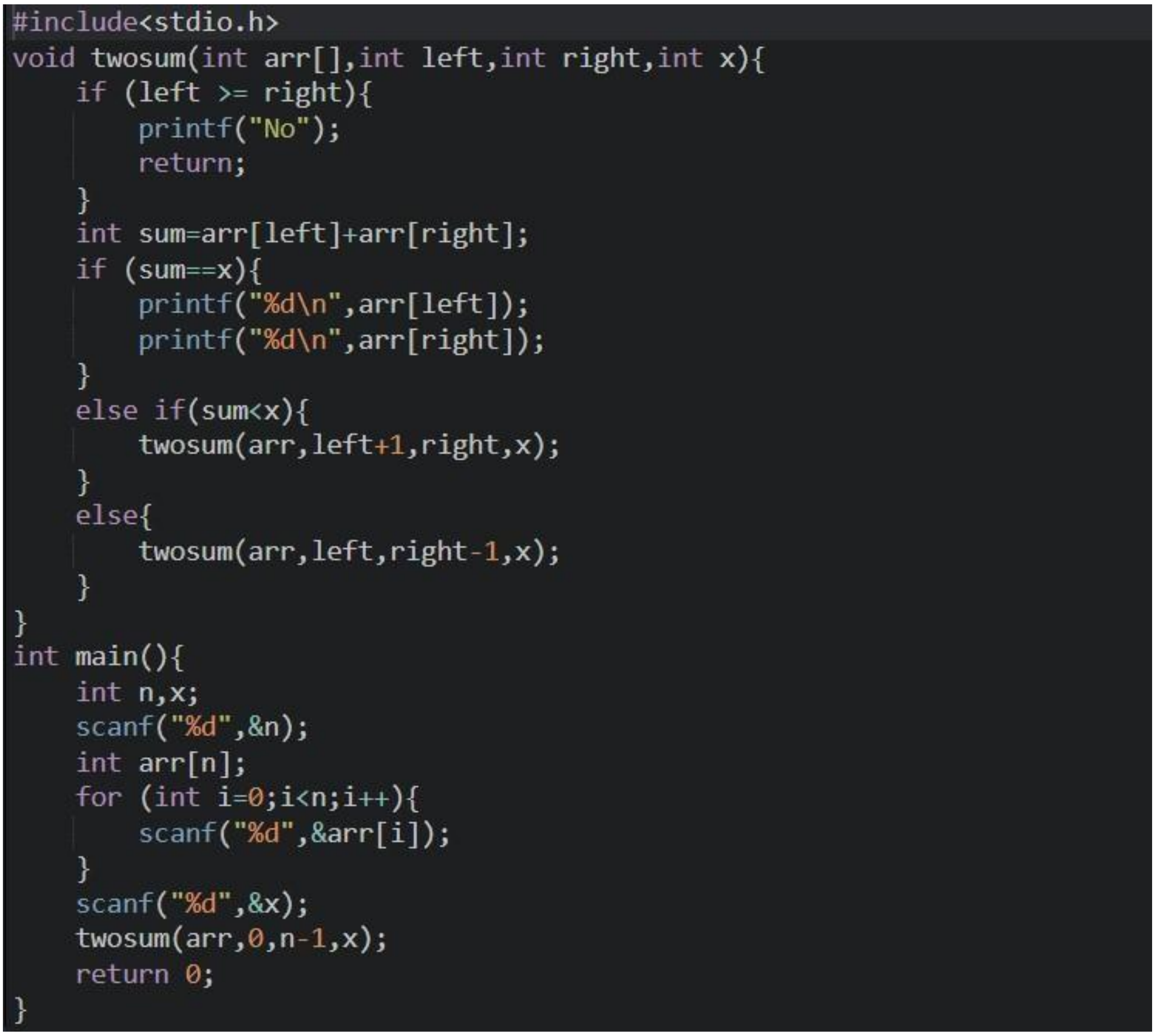
```
Step 1: Start
Step 2: Input the integer n
Step 3: Initialize array arr of size n
Step 4: For each index i from 0 to n-1, input arr[i]
Step 5: Input integer x
Step 6: Call findPair(arr, 0, n - 1, x)
Step7: Stop
```

Function findPair(arr[], left, right, x):

```
Step 1: If left >= right, print "No" and
returnStep 2: Calculate sum as arr[left] +
arr[right]
Step 3: If sum == x, print arr[left] and arr[right], and
returnStep 4: If sum < x, call findPair(arr, left + 1, right, x)
Step 5: Otherwise, call findPair(arr, left, right - 1, x)
```

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

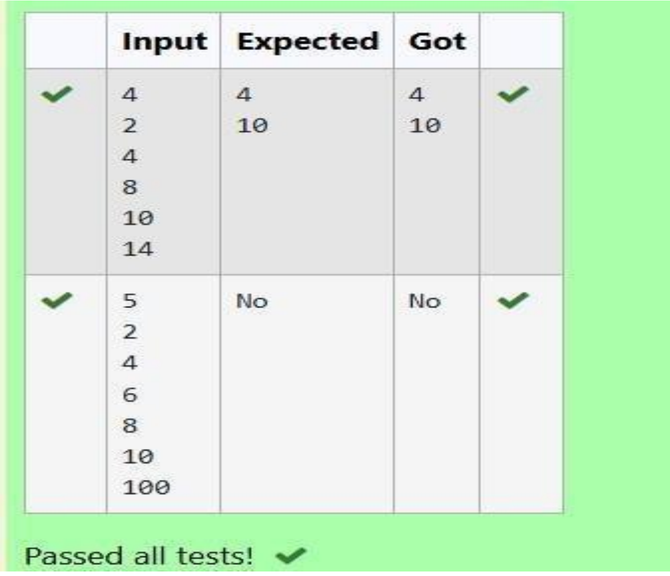
PROGRAM :



```c
#include<stdio.h>
void twosum(int arr[],int left,int right,int x){
    if (left >= right){
        printf("No");
        return;
    }
    int sum=arr[left]+arr[right];
    if (sum==x){
        printf("%d\n",arr[left]);
        printf("%d\n",arr[right]);
    }
    else if(sum<x){
        twosum(arr,left+1,right,x);
    }
    else{
        twosum(arr,left,right-1,x);
    }
}
int main(){
    int n,x;
    scanf("%d",&n);
    int arr[n];
    for (int i=0;i<n;i++){
        scanf("%d",&arr[i]);
    }
    scanf("%d",&x);
    twosum(arr,0,n-1,x);
    return 0;
}
```

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

OUTPUT:



	Input	Expected	Got	
✓	4 2 4 8 10 14	4 10	4 10	✓
✓	5 2 4 6 8 10 100	No	No	✓

Passed all tests! ✓

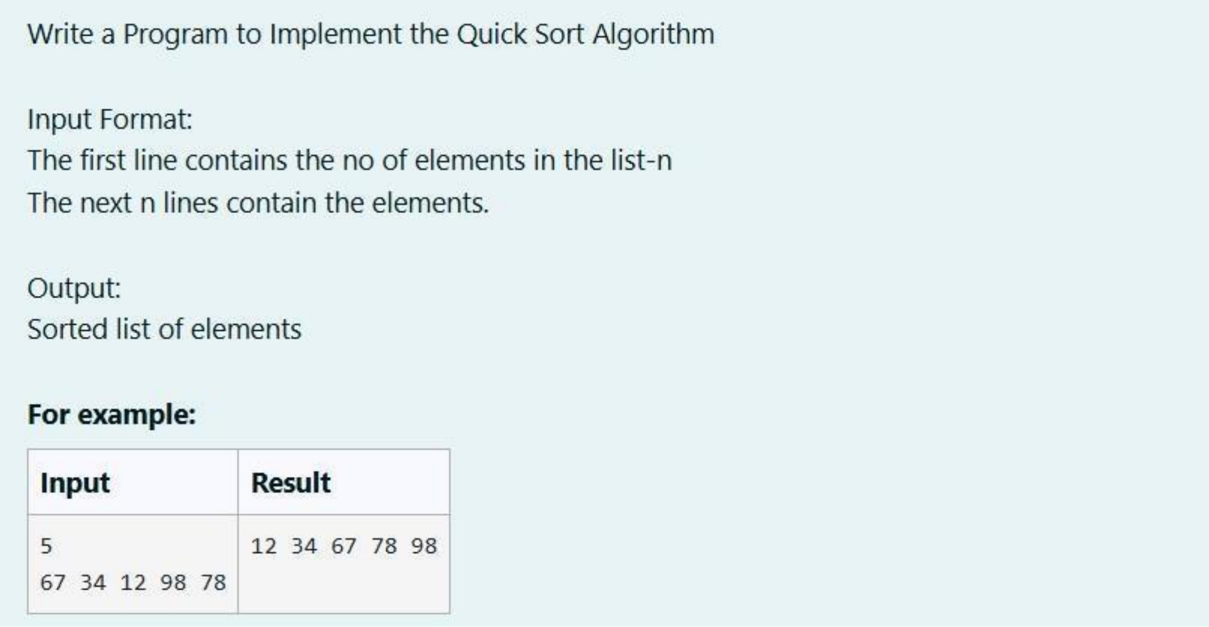
RESULT:

The above program is executed successfully.

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

QUESTION

4.EAIM:



Write a Program to Implement the Quick Sort Algorithm

Input Format:
The first line contains the no of elements in the list-n
The next n lines contain the elements.

Output:
Sorted list of elements

For example:

Input	Result
5 67 34 12 98 78	12 34 67 78 98

ALGORITHM :

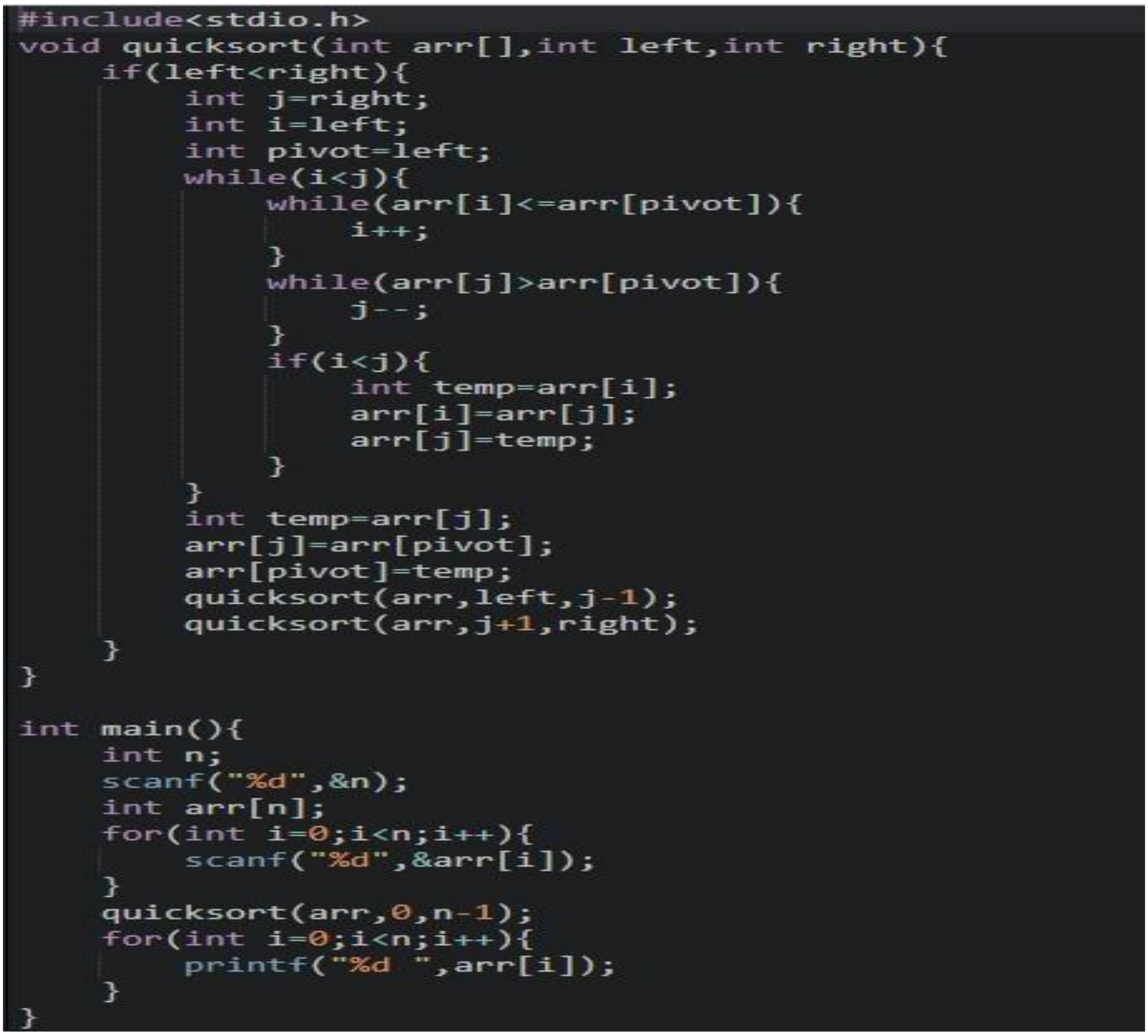
Step 1: Start
Step 2: Input the integer n
Step 3: Initialize array arr of size n
Step 4: For each index i from 0 to n-1, input arr[i]
Step 5: Call quickSort(arr, 0, n - 1)
Step 6: For each index i from 0 to n-1, print arr[i]
Step7: Stop

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

Function quickSort(arr[], left, right):

```
Step 1: If left < right, do Steps 2
to 7Step 2: Set pivot to (left +
right) / 2
Step 3: Initialize i to left and j to right
Step 4: While i < j, do Steps 5.1 to 5.4
Step 5.1: While arr[pivot] >= arr[i],
increment i Step 5.2: While arr[pivot] <
arr[j], decrement j Step 5.3: If i <= j, swap
arr[i] and arr[j]
Step 6: Swap arr[j] and arr[pivot]
Step 7: Call quickSort(arr, left + 1, right)
```

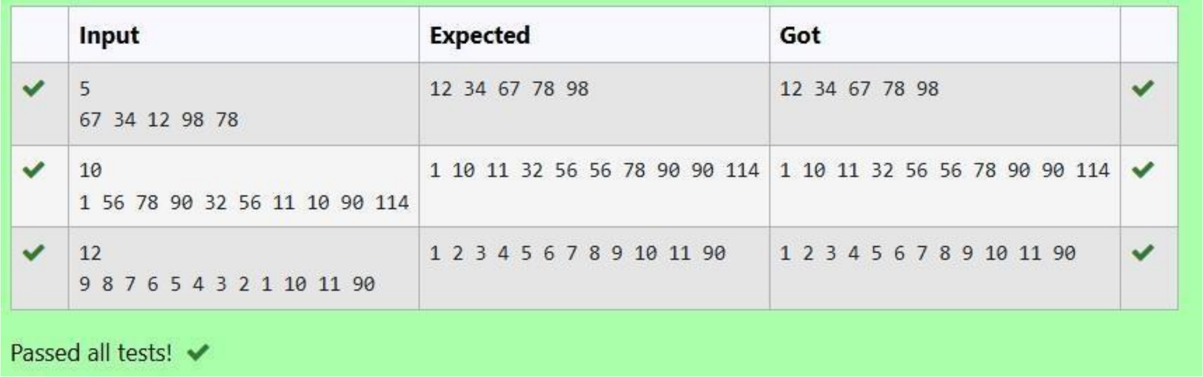
PROGRAM :



```c
#include<stdio.h>
void quicksort(int arr[],int left,int right){
    if(left<right){
        int j=right;
        int i=left;
        int pivot=left;
        while(i<j){
            while(arr[i]<=arr[pivot]){
                i++;
            }
            while(arr[j]>arr[pivot]){
                j--;
            }
            if(i<j){
                int temp=arr[i];
                arr[i]=arr[j];
                arr[j]=temp;
            }
        }
        int temp=arr[j];
        arr[j]=arr[pivot];
        arr[pivot]=temp;
        quicksort(arr,left,j-1);
        quicksort(arr,j+1,right);
    }
}

int main(){
    int n;
    scanf("%d",&n);
    int arr[n];
    for(int i=0;i<n;i++){
        scanf("%d",&arr[i]);
    }
    quicksort(arr,0,n-1);
    for(int i=0;i<n;i++){
        printf("%d ",arr[i]);
    }
}
```

230701521
JABARAJ E
BE COMPUTER SCIENCE ENGINEERING
‘A’

OUTPUT :



	Input	Expected	Got	
✓	5 67 34 12 98 78	12 34 67 78 98	12 34 67 78 98	✓
✓	10 1 56 78 90 32 56 11 10 90 114	1 10 11 32 56 56 78 90 90 114	1 10 11 32 56 56 78 90 90 114	✓
✓	12 9 8 7 6 5 4 3 2 1 10 11 90	1 2 3 4 5 6 7 8 9 10 11 90	1 2 3 4 5 6 7 8 9 10 11 90	✓

Passed all tests! ✓

RESULT:

The above program is executed successfully .