04 - Divide and Conquer

Ex. No. : 4.1 **Date: 03.09.24**

Register No.: 230701385 **Name: S VISHWAK**

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: Read the value of n from the user and initialize an array arr of size n. Read n values into the array.

Step 3: Check if the first element of arr is 0. If true, print n and exit the program.

Step 4: Call the divide function with arr, 0, and n-1 to find the index of the first occurrence of 0.

Step 5: If the index is not 0, print the value of n - index, which represents the count of 0s in the array. Otherwise, print the index.

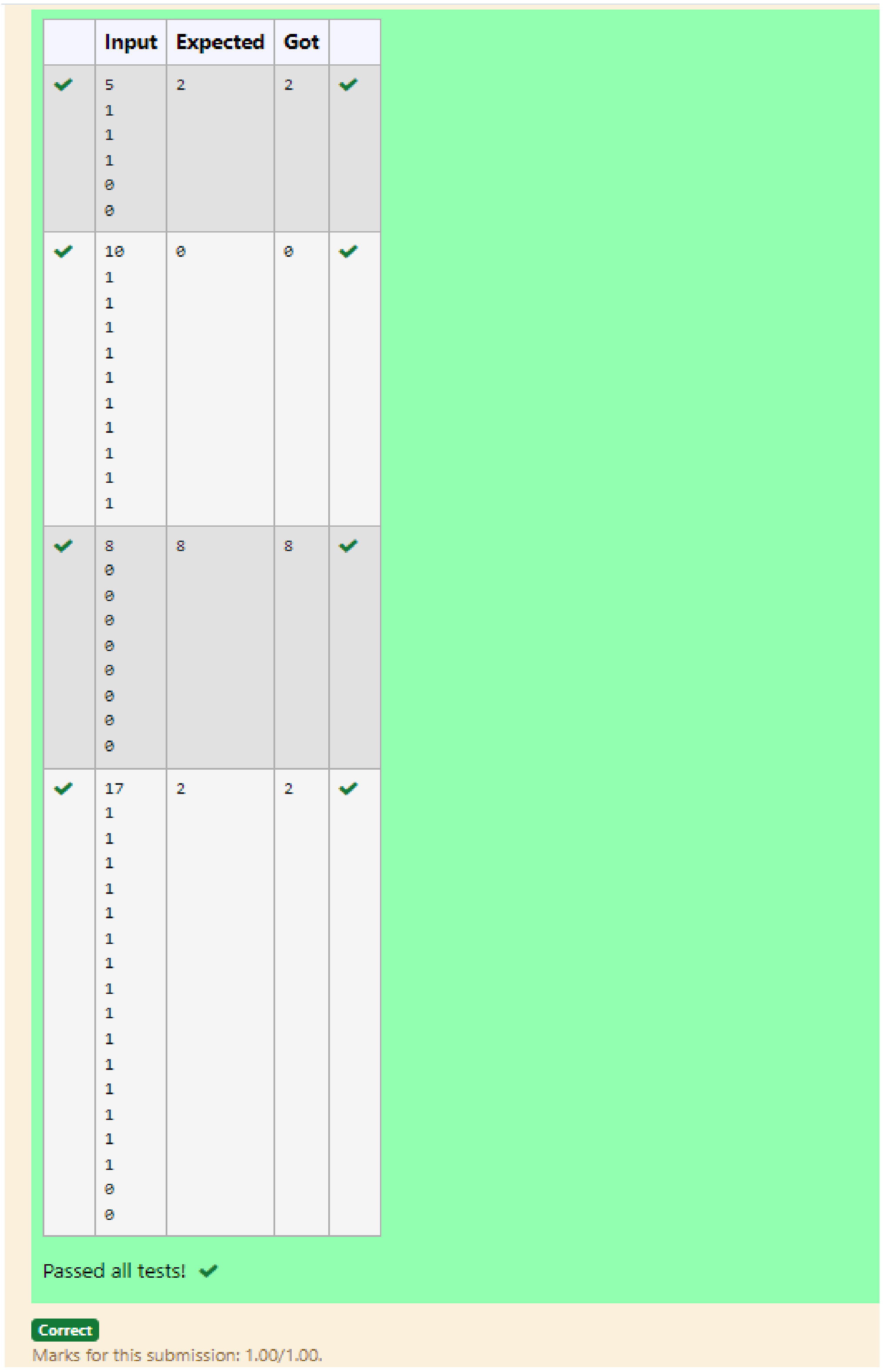
Step 6: End

PROGRAM:

```
#include <stdio.h>
int divide(int [],int,int);
int divide(int a[],int left,int right)
{
    int mid=0;
    mid=left+(right-left)/2;
    if (a[0]==0)
        return 0;
    else if (a[right-1]==1)
        return right;
    if ((a[mid]==0) && (a[mid-1]==0))
        return divide(a,0,mid);
    else if (a[mid]==0)
        return mid;
    else
        return divide(a,mid+1,right);
}
```

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

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	✓
✓	8 0 0 0 0 0 0 0 0	8	8	✓
✓	17 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0	2	2	✓

Passed all tests! ✓

Correct

Marks for this submission: 1.00/1.00.

RESULT :

Hence the above program has been executed successfully.

Ex. No. : 4.2 **Date: 03.09.24**

Register No.: 230701385 **Name: S VISHWAK**

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
```

For example:

Input	RESULT
3 3 2 3	3

7
2 2 1 1 1
2 2
	2

ALGORITHM:

Step 1: Start

Step 2: Read the value of n from the user and initialize an array arr of size n. Read n values into the array.

Step 3: Use qsort to sort the array arr in ascending order.

Step 4: Loop through the array to find the first and last indices of each element using the first and last functions. Calculate the count of occurrences (major).

Step 5: If any element's count is greater than or equal to n/2, return that element.

Step 6: Print the element that appears more than n/2 times or print 0 if none is found.

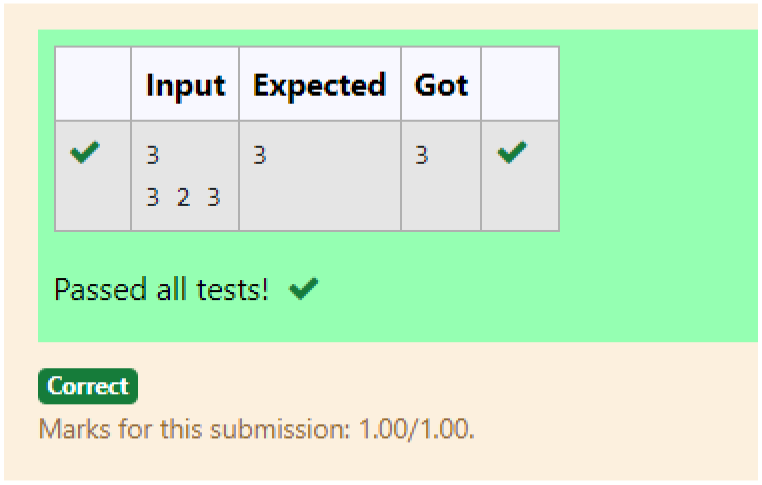
Step 7: End

PROGRAM:

```
#include <stdio.h>
int mid=0,c=0;
int Count(int [],int,int,int);
int Count(int a[],int left,int right,int key)
{
    int mid=left+(right-left)/2;
    if (a[mid]!=key)
    {
        Count(a,left,mid,key);
        Count(a,mid+1,right,key);
    }
    else
    {
        c++;
    }
    return c;
}

int main()
```

```
{
    int n;
    scanf("%d",&n);
    int arr[n];
    for (int i=0;i<n;i++)
         scanf("%d",&arr[i]);
    int k=arr[0];
    if (Count(arr,0,n,k)>n/2)
          printf("%d",k);
    else
    {
        for (int i=0;i<n/2;i++)
           if (arr[i]!=k)
            {
                printf("%d",k);
                break;
            }
    }
}
```

OUTPUT:



	Input	Expected	Got	
✓	3 3 2 3	3	3	✓

Passed all tests! ✓

Correct

Marks for this submission: 1.00/1.00.

RESULT :

Hence the above program has been executed successfully.

Ex. No. : 4.3 **Date: 03.09.24**

Register No.: 230701385 **Name: S VISHWAK**

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

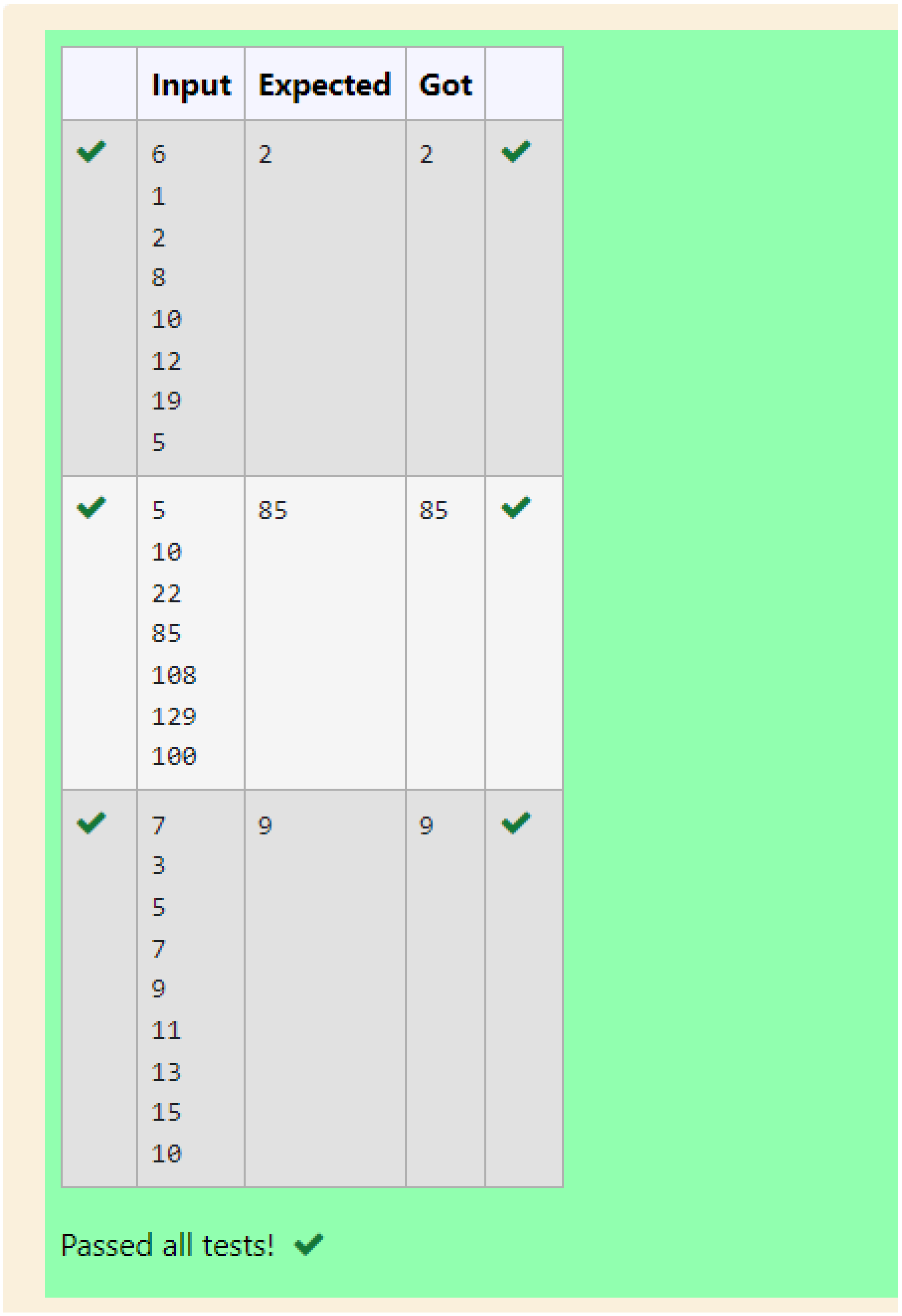
ALGORITHM:

```
Step 1: Start
Step 2: Read the value of n from the user and initialize an array
arr of size n. Read n values into the array.
Step 3: Read the integer x from the user, which will be used to find
the floor value.
Step 4: Call the search function with arr, x, 0, and n-1 to find the
largest element in arr that is less than or equal to x.
Step 5: Print the floor value returned by the search function.
Step 6: End
```

PROGRAM:

```c
#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;
}
```

OUTPUT:



	Input	Expected	Got	
✓	6 1 2 8 10 12 19 5	2	2	✓
✓	5 10 22 85 108 129 100	85	85	✓
✓	7 3 5 7 9 11 13 15 10	9	9	✓

Passed all tests! ✓

RESULT :

Hence the above program has been executed successfully.

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: Read the value of n from the user and initialize an array arr of size n. Read n values into the array.

Step 3: Read the integer x from the user, which represents the target sum.

Step 4: Call the twosum function with arr, 0, n-1, and x to find two numbers in the array that add up to x.

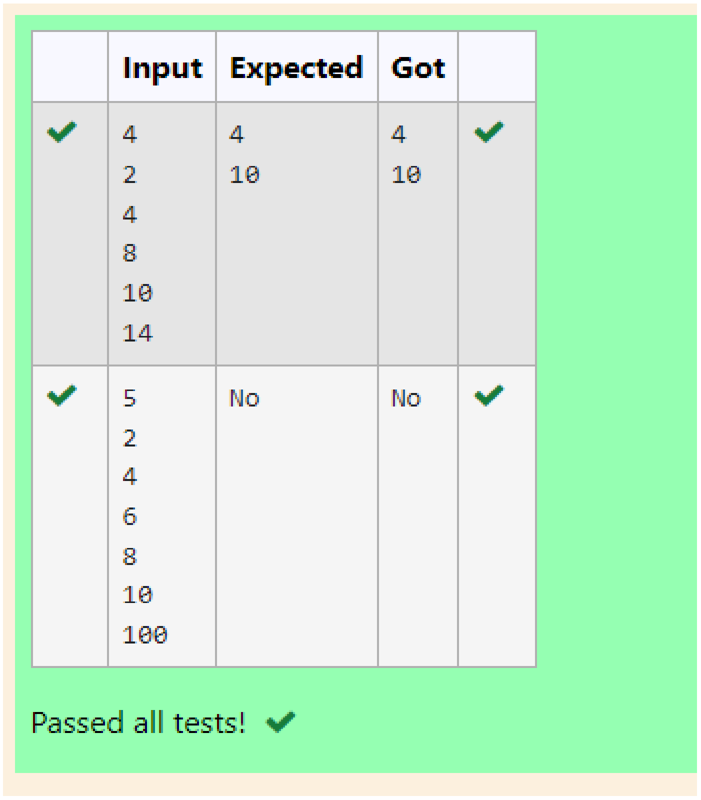
Step 5: If a pair is found, print the two numbers; otherwise, print "No" to indicate that no such pair exists.

Step 6: End

PROGRAM:

```
#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;
}
```

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 :

Hence the above program has been executed successfully..

Ex. No. : 4.5 **Date: 03.09.24**

Register No.: 230701385 **Name: S VISHWAK**

AIM:

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: Read the value of n from the user and dynamically allocate an array arr of size n. Read n values into the array.

Step 3: Call the q_sort function with arr, 0, and n-1 to sort the array using the Quick Sort algorithm.

Step 4: In the q_sort function, select a pivot and partition the array into two halves. Recursively apply the same sorting process to both halves.

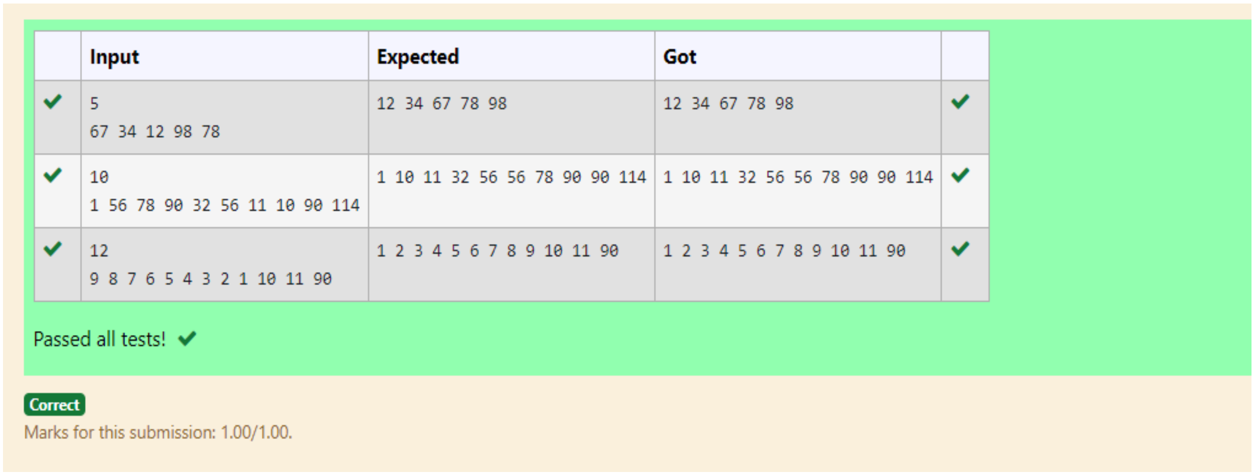
Step 5: Once sorted, iterate through the array and print the sorted values.

Step 6: End

PROGRAM:

```
#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;
            }
```

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! ✓

Correct

Marks for this submission: 1.00/1.00.

RESULT :

Hence the above program has been executed successfully..