

04 - Divide and Conquer



Ex. No. : 4.1

Date: 03.09.24

Register No.: 230701393

Name: THARUN KUMAR S

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 1 1	0	0	✓
✓	8 0 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.: 230701393

Name: THARUN KUMAR S

AIM:

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

The majority element is the element that appears more than $\lfloor n / 2 \rfloor$ 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	3	✓
	3 2 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.: 230701393

Name: THARUN KUMAR S

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:

```
#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.

Ex. No. : 4.4

Date: 03.09.24

Register No.: 230701393

Name: THARUN KUMAR S

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	4	4	✓
	2	10	10	
	4			
	8			
	10			
	14			
✓	5	No	No	✓
	2			
	4			
	6			
	8			
	10			
	100			

Passed all tests! ✓

RESULT :

Hence the above program has been executed successfully..

Ex. No. : 4.5

Date: 03.09.24

Register No.: 230701393

Name: THARUN KUMAR S

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..