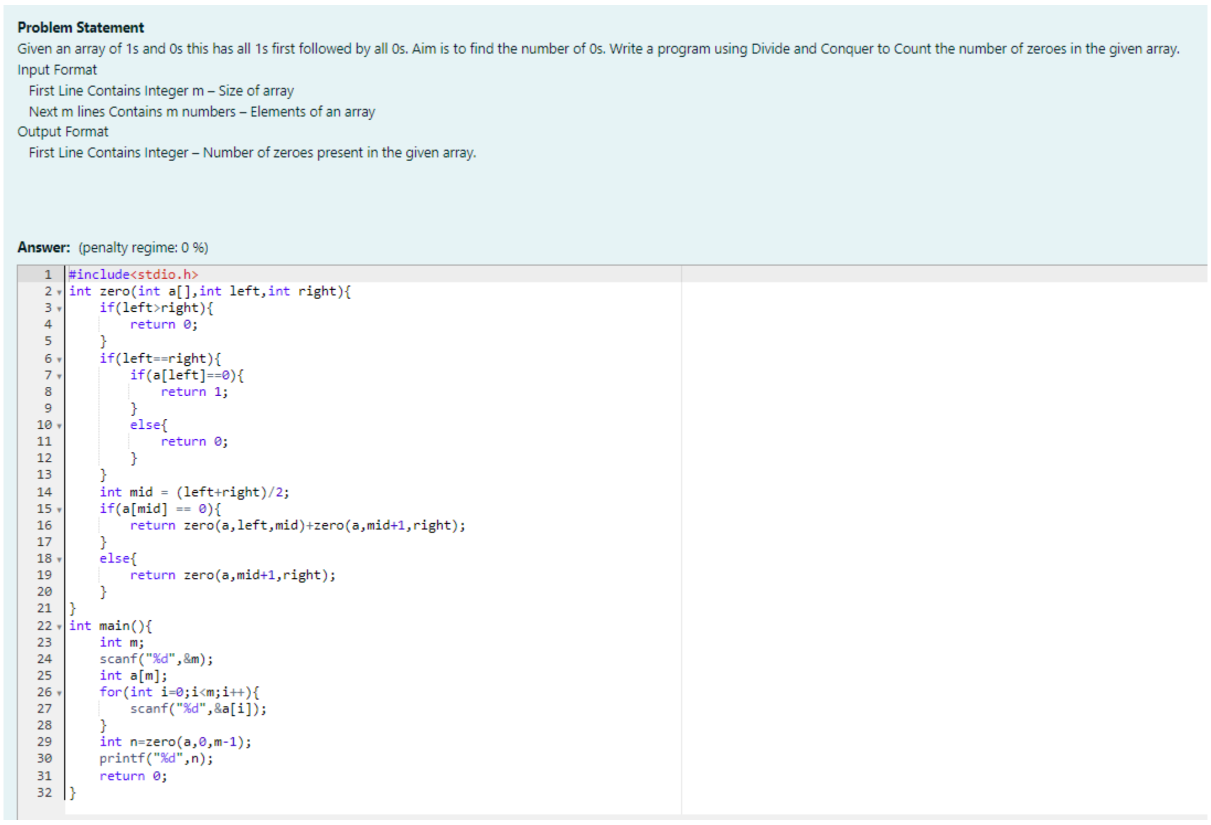
DIVIDE AND CONQUER

PROBLEM 1:



**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

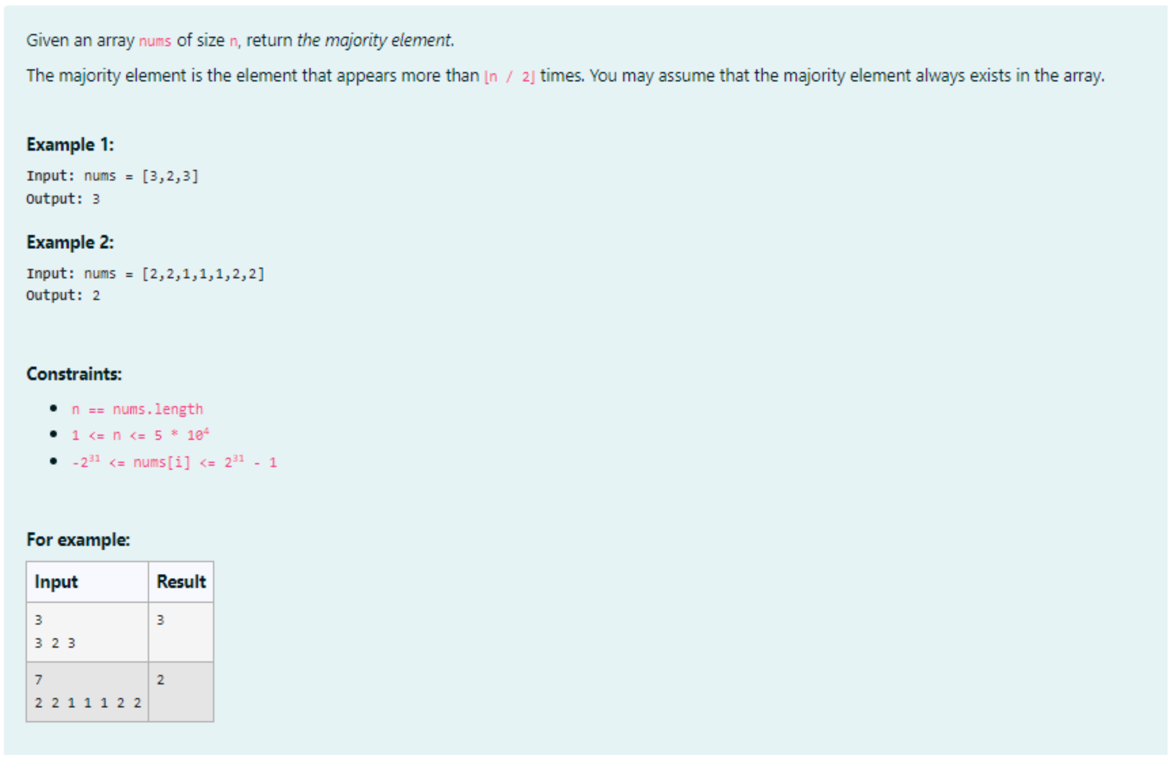
Output Format

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

**Answer:** (penalty regime: 0 %)

```c
#include<stdio.h>
int zero(int a[],int left,int right){
    if(left>right){
        return 0;
    }
    if(left==right){
        if(a[left]==0){
            return 1;
        }
        else{
            return 0;
        }
    }
    int mid = (left+right)/2;
    if(a[mid] == 0){
        return zero(a,left,mid)+zero(a,mid+1,right);
    }
    else{
        return zero(a,mid+1,right);
    }
}
int main(){
    int m;
    scanf("%d",&m);
    int a[m];
    for(int i=0;i<m;i++){
        scanf("%d",&a[i]);
    }
    int n=zero(a,0,m-1);
    printf("%d",n);
    return 0;
}
```

PROBLEM 2:



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:**

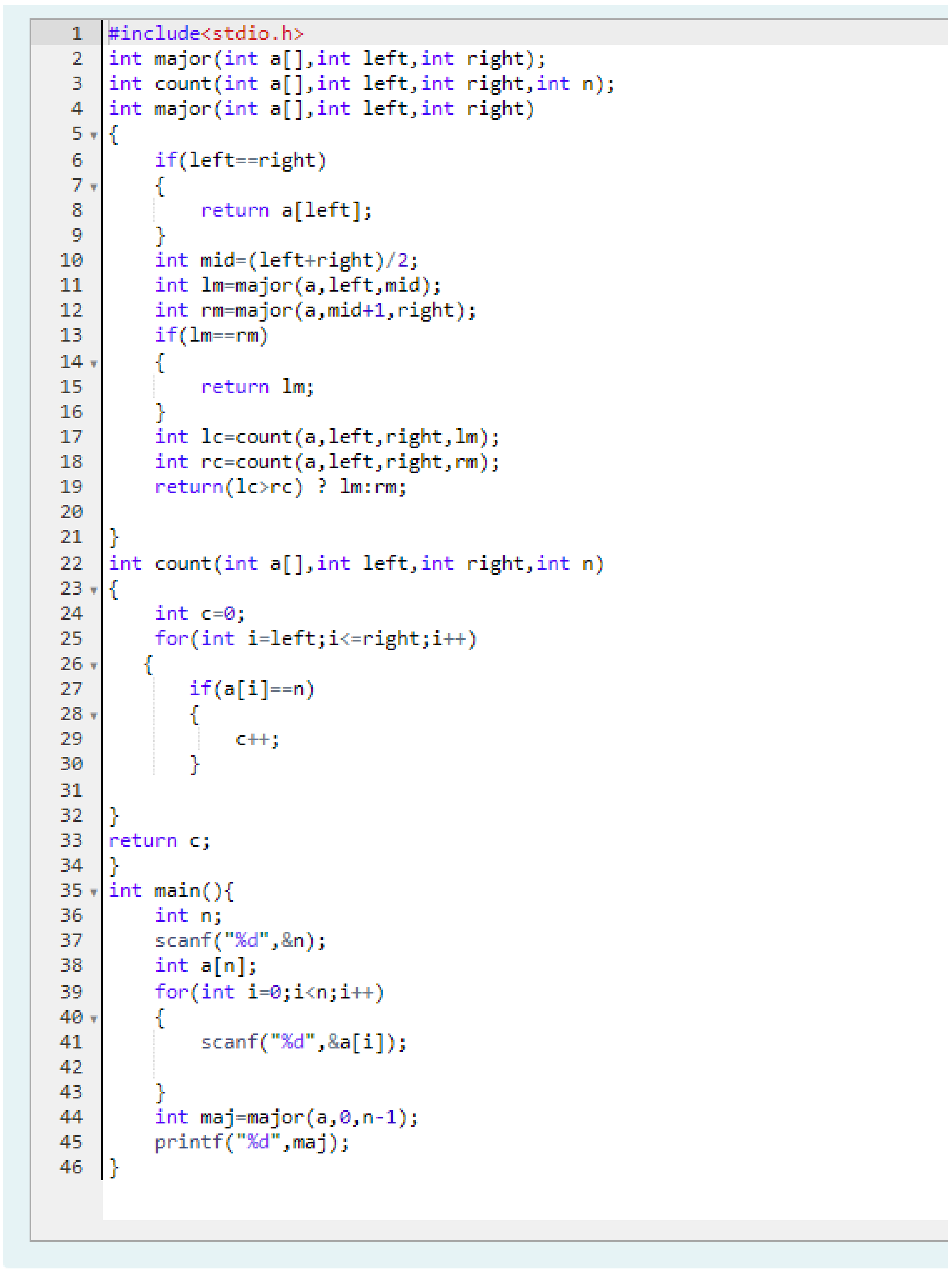
```
Input: nums = [2,2,1,1,1,2,2]
Output: 2
```

**Constraints:**

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

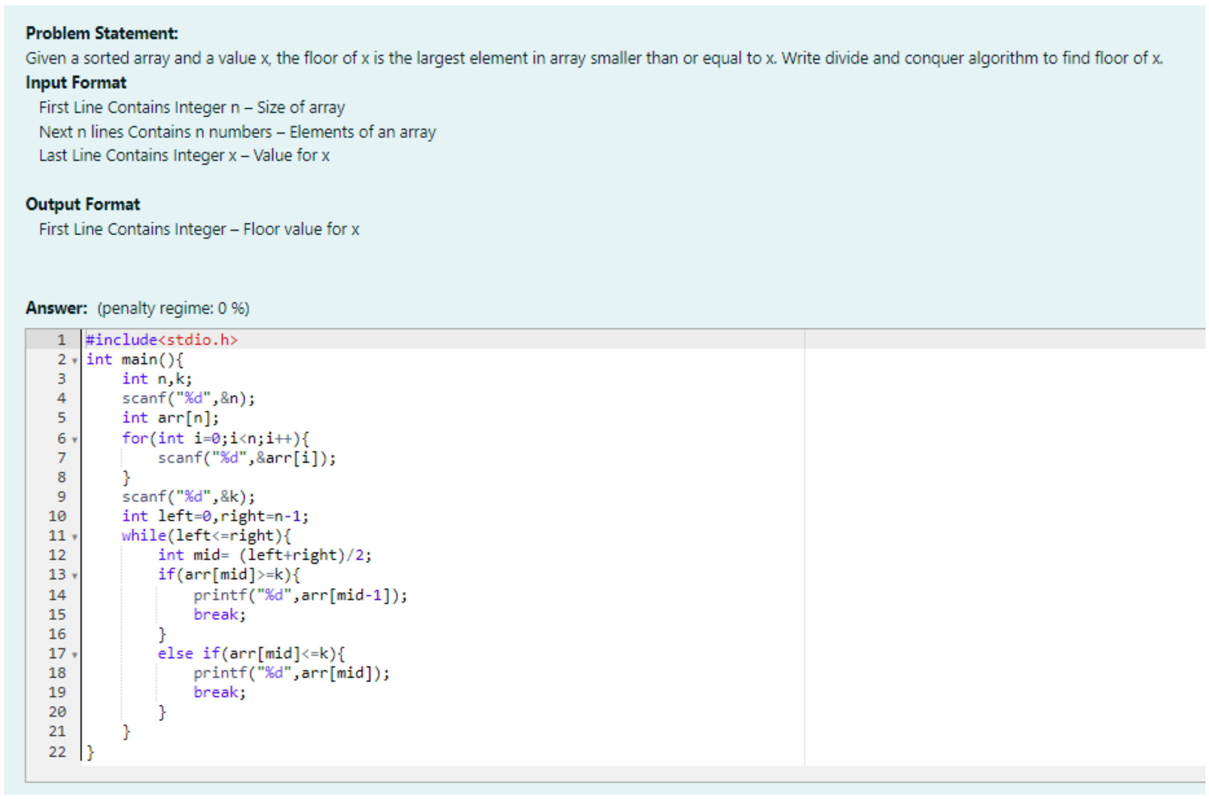
**For example:**

| Input | Result |
|---|---|
| 3<br>3 2 3 | 3 |
| 7<br>2 2 1 1 1 2 2 | 2 |



```c
#include<stdio.h>
int major(int a[],int left,int right);
int count(int a[],int left,int right,int n);
int major(int a[],int left,int right)
{
    if(left==right)
    {
        return a[left];
    }
    int mid=(left+right)/2;
    int lm=major(a,left,mid);
    int rm=major(a,mid+1,right);
    if(lm==rm)
    {
        return lm;
    }
    int lc=count(a,left,right,lm);
    int rc=count(a,left,right,rm);
    return(lc>rc) ? lm:rm;

}
int count(int a[],int left,int right,int n)
{
    int c=0;
    for(int i=left;i<=right;i++)
   {
       if(a[i]==n)
       {
           c++;
       }

}
return c;
}
int main(){
    int n;
    scanf("%d",&n);
    int a[n];
    for(int i=0;i<n;i++)
    {
        scanf("%d",&a[i]);

    }
    int maj=major(a,0,n-1);
    printf("%d",maj);
}
```

PROBLEM 3:



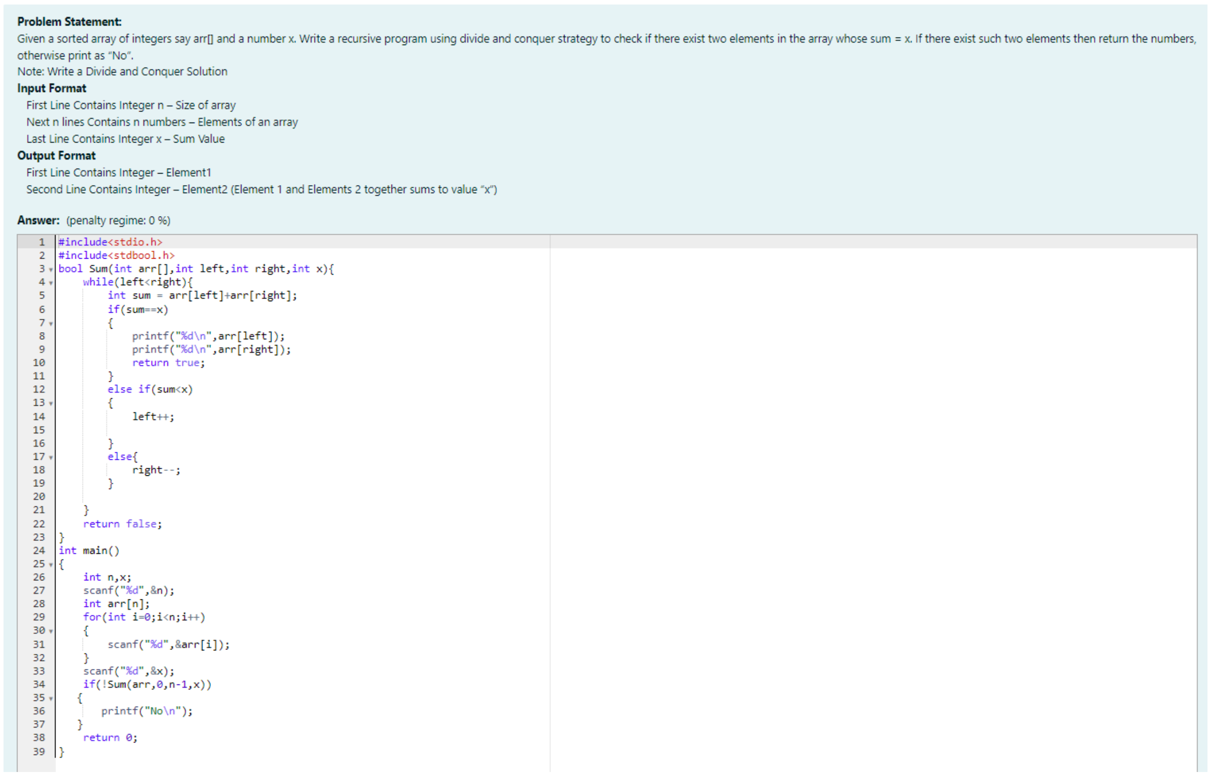
**Problem Statement:**
Given a sorted array and a value x, the floor of x is the largest element in array smaller than or equal to x. Write divide and conquer algorithm to find floor of x.
**Input Format**
First Line Contains Integer n – Size of array
Next n lines Contains n numbers – Elements of an array
Last Line Contains Integer x – Value for x

**Output Format**
First Line Contains Integer – Floor value for x

**Answer:** (penalty regime: 0 %)

```c
#include<stdio.h>
int main(){
    int n,k;
    scanf("%d",&n);
    int arr[n];
    for(int i=0;i<n;i++){
        scanf("%d",&arr[i]);
    }
    scanf("%d",&k);
    int left=0,right=n-1;
    while(left<=right){
        int mid= (left+right)/2;
        if(arr[mid]>=k){
            printf("%d",arr[mid-1]);
            break;
        }
        else if(arr[mid]<=k){
            printf("%d",arr[mid]);
            break;
        }
    }
}
```

PROBLEM 4:

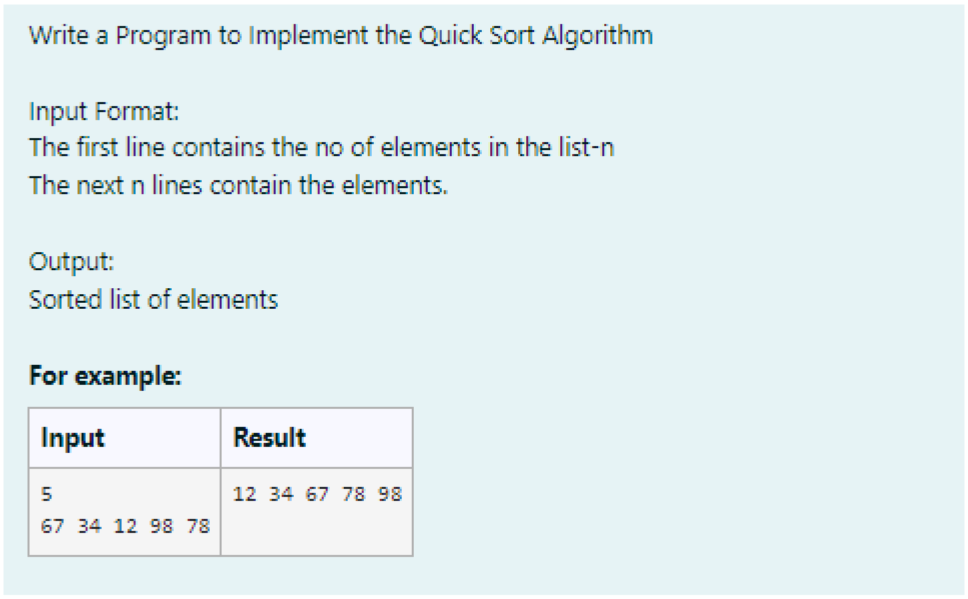


**Problem Statement:**
Given a sorted array of integers say arr[] and a number x. Write a recursive program using divide and conquer strategy to check if there exist two elements in the array whose sum = x. If there exist such two elements then return the numbers, otherwise print as "No".
Note: Write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

**Answer:** (penalty regime: 0 %)

```c
#include<stdio.h>
#include<stdbool.h>
bool Sum(int arr[],int left,int right,int x){
    while(left<right){
        int sum = arr[left]+arr[right];
        if(sum==x)
        {
            printf("%d\n",arr[left]);
            printf("%d\n",arr[right]);
            return true;
        }
        else if(sum<x)
        {
            left++;

        }
        else{
            right--;
        }

    }
    return false;
}
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);
    if(!Sum(arr,0,n-1,x))
   {
       printf("No\n");
   }
    return 0;
}
```

PROBLEM 5:



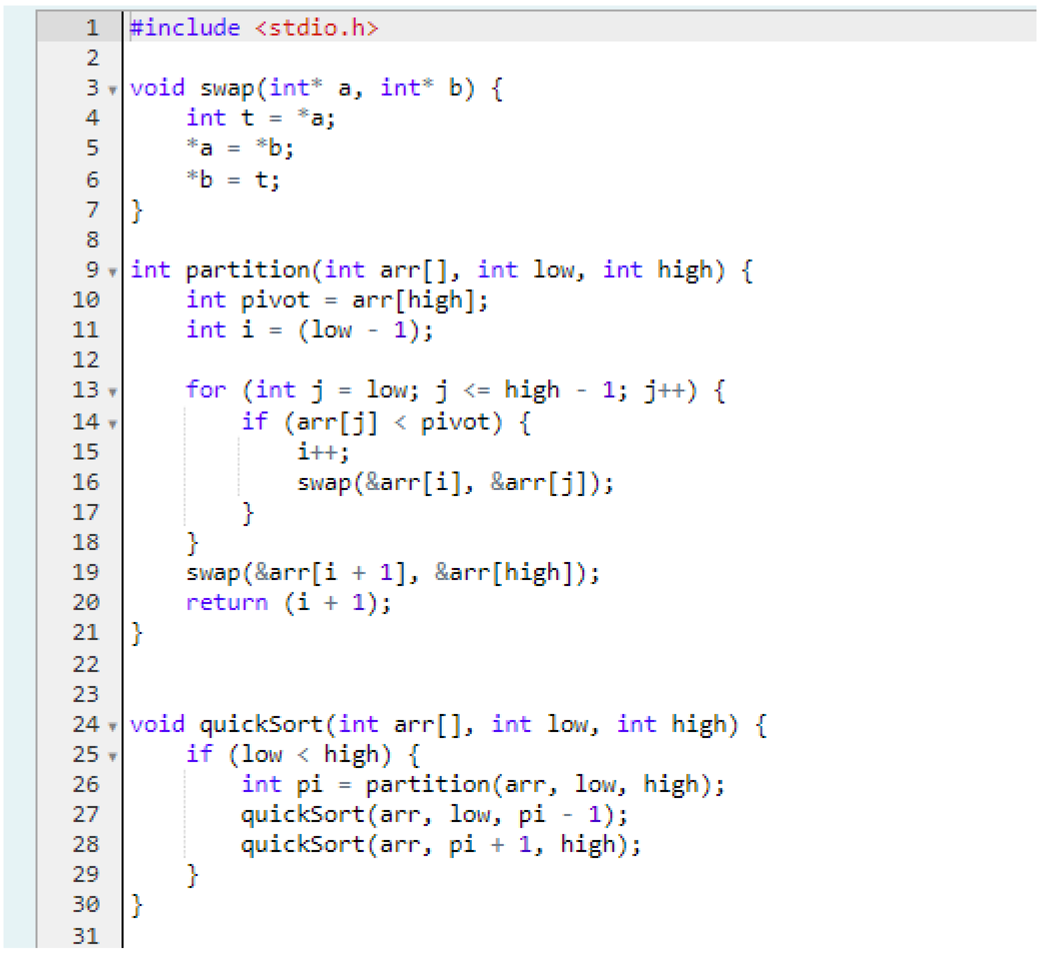
Write a Program to Implement the Quick Sort Algorithm

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

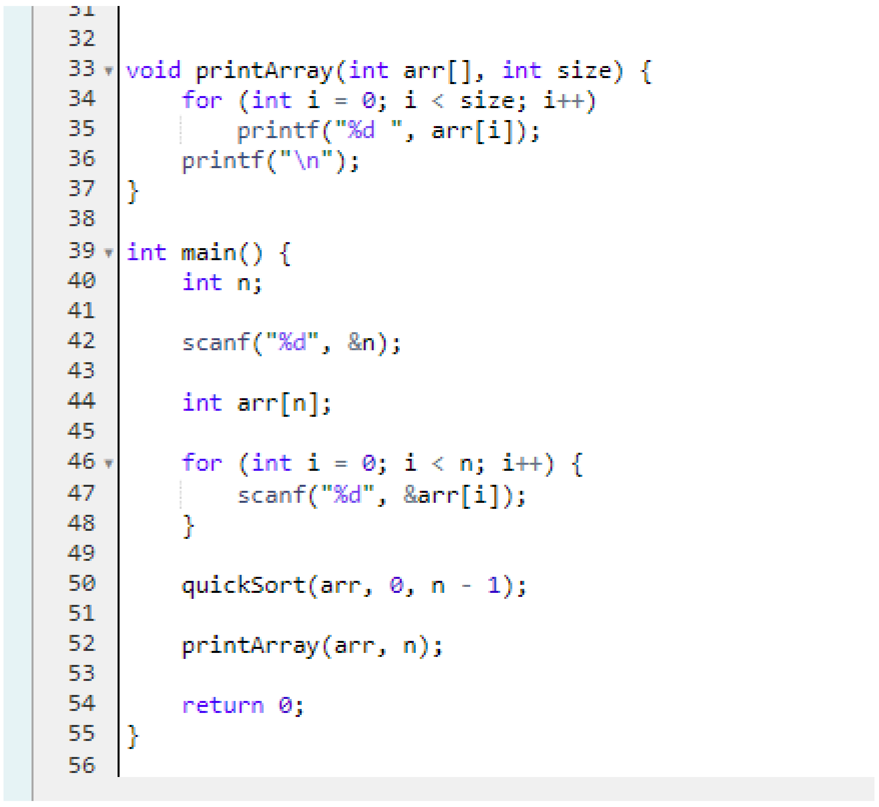
Output:
Sorted list of elements

**For example:**

| Input | Result |
|---|---|
| 5<br>67 34 12 98 78 | 12 34 67 78 98 |



```c
#include <stdio.h>

void swap(int* a, int* b) {
    int t = *a;
    *a = *b;
    *b = t;
}

int partition(int arr[], int low, int high) {
    int pivot = arr[high];
    int i = (low - 1);

    for (int j = low; j <= high - 1; j++) {
        if (arr[j] < pivot) {
            i++;
            swap(&arr[i], &arr[j]);
        }
    }
    swap(&arr[i + 1], &arr[high]);
    return (i + 1);
}


void quickSort(int arr[], int low, int high) {
    if (low < high) {
        int pi = partition(arr, low, high);
        quickSort(arr, low, pi - 1);
        quickSort(arr, pi + 1, high);
    }
}

```



```c


void printArray(int arr[], int size) {
    for (int i = 0; i < size; i++)
        printf("%d ", arr[i]);
    printf("\n");
}

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);

    printArray(arr, n);

    return 0;
}

```