# Majority Element

**Majority Element:** A majority element in an array A[] of size n is an element that appears more than n/2 times (and hence there is at most one such element).

Write a function which takes an array and emits the majority element (if it exists), otherwise prints NONE as follows:

```
       I/P : 3 3 4 2 4 4 2 4 4
       O/P : 4

       I/P : 3 3 4 2 4 4 2 4
       O/P : NONE
```

**METHOD 1 (Basic)**
The basic solution is to have two loops and keep track of maximum count for all different elements. If maximum count becomes greater than n/2 then break the loops and return the element having maximum count. If maximum count doesn't become more than n/2 then majority element doesn't exist.

**Time Complexity:** O(n*n).
**Auxiliary Space :** O(1).

**METHOD 2 (Using Binary Search Tree)**
Thanks to Sachin Midha for suggesting this solution.

Node of the Binary Search Tree (used in this approach) will be as follows.

Interview Experiences
Advanced Data Structures
Dynamic Programming
Greedy Algorithms
Backtracking
Pattern Searching
Divide & Conquer
Mathematical Algorithms
Recursion

```
struct tree
{
  int element;
  int count;
}BST;
```

Insert elements in BST one by one and if an element is already present then increment the count of the node. At any stage, if count of a node becomes more than n/2 then return.
The method works well for the cases where n/2+1 occurrences of the majority element is present in the starting of the array, for example {1, 1, 1, 1, 1, 2, 3, 4}.

**Time Complexity:** If a binary search tree is used then time complexity will be O(n^2). If a self-balancing-binary-search tree is used then O(nlogn)
**Auxiliary Space:** O(n)

### METHOD 3 (Using Moore’s Voting Algorithm)

This is a two step process.
1. Get an element occurring most of the time in the array. This phase will make sure that if there is a majority element then it will return that only.
2. Check if the element obtained from above step is majority element.

*1. Finding a Candidate:*
The algorithm for first phase that works in O(n) is known as Moore’s Voting Algorithm. Basic idea of the algorithm is if we cancel out each occurrence of an element e with all the other elements that are different from e then e will exist till end if it is a majority element.

```
findCandidate(a[], size)
1.  Initialize index and count of majority element
     maj_index = 0, count = 1
2.  Loop for i = 1 to size – 1
    (a)If a[maj_index] == a[i]
        count++
    (b)Else
        count--;
    (c)If count == 0
        maj_index = i;
```

Geometric Algorithms

Popular Posts
All permutations of a given string
Memory Layout of C Programs
Understanding “extern” keyword in C
Median of two sorted arrays
Tree traversal without recursion and without stack!
Structure Member Alignment, Padding and Data Packing
Intersection point of two Linked Lists
Lowest Common Ancestor in a BST.
Check if a binary tree is BST or not
Sorted Linked List to Balanced BST

```
        count = 1
3.  Return a[maj_index]
```

Above algorithm loops through each element and maintains a count of a[maj_index], If next element is same then increments the count, if next element is not same then decrements the count, and if the count reaches 0 then changes the maj_index to the current element and sets count to 1.
First Phase algorithm gives us a candidate element. In second phase we need to check if the candidate is really a majority element. Second phase is simple and can be easily done in O(n). We just need to check if count of the candidate element is greater than n/2.

Example:
A[] = 2, 2, 3, 5, 2, 2, 6
Initialize:
maj_index = 0, count = 1 –> candidate ‘2?
2, 2, 3, 5, 2, 2, 6

Same as a[maj_index] => count = 2
2, 2, 3, 5, 2, 2, 6

Different from a[maj_index] => count = 1
2, 2, 3, 5, 2, 2, 6

Different from a[maj_index] => count = 0
Since count = 0, change candidate for majority element to 5 => maj_index = 3, count = 1
2, 2, 3, 5, 2, 2, 6

Different from a[maj_index] => count = 0
Since count = 0, change candidate for majority element to 2 => maj_index = 4
2, 2, 3, 5, 2, 2, 6

Same as a[maj_index] => count = 2
2, 2, 3, 5, 2, 2, 6

Different from a[maj_index] => count = 1

Finally candidate for majority element is 2.

First step uses Moore's Voting Algorithm to get a candidate for majority element.

2. *Check if the element obtained in step 1 is majority*

```
printMajority (a[], size)
1.  Find the candidate for majority
2.  If candidate is majority. i.e., appears more than n/2 times.
       Print the candidate
3.  Else
       Print "NONE"
```

**Implementation of method 3:**

```
/* Program for finding out majority element in an array */
# include<stdio.h>
# define bool int

int findCandidate(int *, int);
bool isMajority(int *, int, int);

/* Function to print Majority Element */
void printMajority(int a[], int size)
{
  /* Find the candidate for Majority*/
  int cand = findCandidate(a, size);

  /* Print the candidate if it is Majority*/
  if(isMajority(a, size, cand))
    printf(" %d ", cand);
  else
    printf("NO Majority Element");
}

/* Function to find the candidate for Majority */
int findCandidate(int a[], int size)
{
    int maj_index = 0, count = 1;
    int i;
    for(i = 1; i < size; i++)
    {
        if(a[maj_index] == a[i])
            count++;
        else
            count--;
```

705

Subscribe

## Recent Comments

**Aman** Hi, Why arent we checking for conditions...

Write a C program to Delete a Tree. · 18 minutes ago

kzs please provide solution for the problem...

Backtracking | Set 2 (Rat in a Maze) · 22 minutes ago

**Sanjay Agarwal** bool tree::Root_to_leaf_path_given_sum(tree...

Root to leaf path sum equal to a given number · 47 minutes ago

**GOPI GOPINATH** @admin Highlight this sentence "We can easily...

Count trailing zeroes in factorial of a number · 48 minutes ago

**newCoder3006** If the array contains negative numbers also. We...

Find subarray with given sum · 1 hour ago

**newCoder3006** Code without using while loop. We can do it...

Find subarray with given sum · 1 hour ago

```
        if(count == 0)
        {
            maj_index = i;
            count = 1;
        }
    }
    return a[maj_index];
}

/* Function to check if the candidate occurs more than n/2 times */
bool isMajority(int a[], int size, int cand)
{
    int i, count = 0;
    for (i = 0; i < size; i++)
      if(a[i] == cand)
         count++;
    if (count > size/2)
       return 1;
    else
       return 0;
}

/* Driver function to test above functions */
int main()
{
    int a[] = {1, 3, 3, 1, 2};
    printMajority(a, 5);
    getchar();
    return 0;
}
```

**Time Complexity:** O(n)
**Auxiliary Space :** O(1)

Now give a try to below question
Given an array of 2n elements of which n elements are same and the remaining n elements are all different. Write a C program to find out the value which is present n times in the array. There is no restriction on the elements in the array. They are random (In particular they not sequential).

## Related Tpoics:

- Remove minimum elements from either side such that 2*min becomes more than max
- Divide and Conquer | Set 6 (Search in a Row-wise and Column-wise Sorted 2D Array)
- Bucket Sort
- Kth smallest element in a row-wise and column-wise sorted 2D array | Set 1
- Find the number of zeroes
- Find if there is a subarray with 0 sum
- Divide and Conquer | Set 5 (Strassen’s Matrix Multiplication)
- Count all possible groups of size 2 or 3 that have sum as multiple of 3

30 Tweet 0 4

**Writing code in comment?** Please use **ideone.com** and share the link here.