

ARRAY : Video - 63



...E.A.S.Y...



Let's solve Both :)

Majority

Element - I & II

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229. Majority Element II

Medium 8542 377 Add to List Share

$\{-1, -1\}$ 2 maj elements.

Given an integer array of size n , find all elements that appear more than $\lfloor n/3 \rfloor$ times.

Verification.

169. Majority Element

Easy 17099 302 Add to List Share

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

1 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.

 Brute Force \rightarrow simply count frequency of each element.

$O(n)$ space.

map \rightarrow freq.

Boyer-Moore Voting Algorithm

$\lfloor n/2 \rfloor$

$\times \times \times \times \times \times \downarrow$

$$\text{nums} = [2, 2, 1, 1, 1, 2, 2], n = 7$$

^{0 1 2 3 4 5 6}
 $\uparrow \quad \uparrow$

$$\begin{aligned} \text{Candidate} &= \cancel{2} \cancel{1} 2 \\ \text{count} &= \cancel{2} \cancel{1} \cancel{0} \cancel{1} \cancel{0} 1 \end{aligned} \quad \left. \vphantom{\begin{aligned} \text{Candidate} \\ \text{count} \end{aligned}} \right\}$$

Verification:- Candidate = $\textcircled{2} \leftarrow \lfloor n/2 \rfloor$

$$[2, 2, 1, 1, 1, 2, 2]$$

$\uparrow \quad \uparrow \quad \quad \uparrow \quad \uparrow$

$$4 > \lfloor 7/2 \rfloor$$

$$\text{nums} = [2, \cancel{2}, \cancel{1}, \cancel{1}, \cancel{1}, \cancel{2}], n = 6$$

$\lfloor n/2 \rfloor$

Assumption:-

$$\left\{ \begin{aligned} \text{Candidate} &= \cancel{2} 1 \leftarrow \\ \text{count} &= \cancel{2} \cancel{1} \cancel{0} \cancel{1} 0 \end{aligned} \right.$$

Verification:-

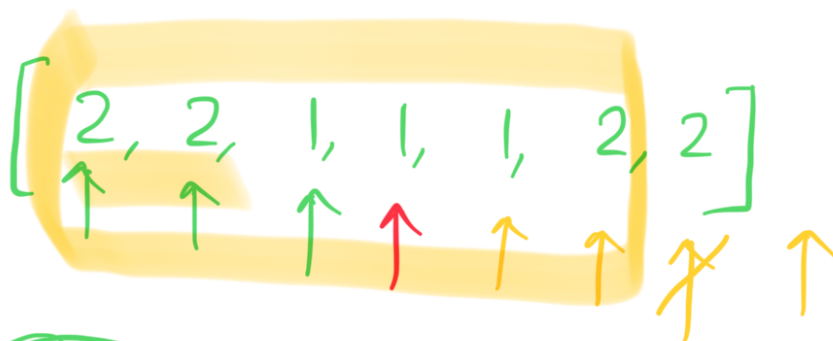
$$[2, 2, 1, 1, 1, 2]$$

$\uparrow \quad \uparrow \quad \uparrow$

$$2 \times \lfloor 6/2 \rfloor$$

How it's working :-

(What's interesting ???)



$$n = 7$$

$$\lfloor n/2 \rfloor = 3$$

$$\textcircled{2} = 1$$

$$\textcircled{1} = 0$$

$$\textcircled{2} = \textcircled{1} + 1 + 1 + 1 + 1$$

$$n = 7$$

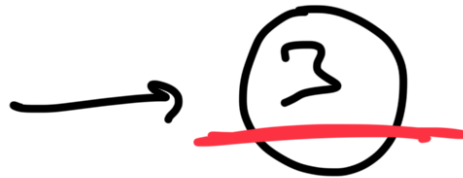
$$7 - 4 = 3 = 1 + 1 + 1$$

$$\textcircled{2} \Rightarrow \textcircled{\lfloor n/2 \rfloor}$$

$$\textcircled{1} = \lfloor 7/2 \rfloor$$

$$n = 7$$

$$\lfloor n/2 \rfloor = 3$$



$$\lfloor n/2 \rfloor = 3$$

$$n = 6$$

$$\underline{4}$$

$$n - 4 = 2$$



major element



$$\lfloor n/2 \rfloor \leftarrow$$

(2) maj elem $\leftarrow \lfloor n/3 \rfloor \leftarrow$
 3 maj elem $\leftarrow \lfloor n/4 \rfloor \leftarrow$
 ($k-1$) m. elem $\leftarrow \lfloor n/k \rfloor$

$$\lfloor n/3 \rfloor$$

$\hookrightarrow 2$

$$n = 9$$

$$\underline{\underline{\lfloor n/3 \rfloor = 3}}$$

$$[\underline{1, 1, 1, 1}, \underline{2, 2, 2, 2}, \dots]_{n=9}$$

Story to code

ma - I.

Count = 0
maj = NULL;

Count 1
Count 2
maj1
maj2

for (int i = 0; i < n; i++) {

if (Count == 0) {
 maj = nums[i];
 Count = 1

} else if (nums[i] == maj) {

 Count++;

} else {
 Count--;

}

return maj;

~~verification.~~

~~find freq of "maj"~~

$\boxed{\text{maj} \in \Pi}$
 $[n/3]$

Important catch...

$[n/3]$

[2, 1, 1, 3, 1, 4, 5, 6]

[1 1 1 1 1 1 1 1]

$$n = 8$$

$$\lfloor n/3 \rfloor = 2$$

{ Count1 = 0 1 0 1 0 1
maj1 = NULL 2 1 5

{ Count2 = 0 1 2 1 0 1
maj2 = NULL 1 6

maj2 = 1