

Direct - i

Q Given an array of size  $N$ . Given  $Q$  queries of  $s$  &  $e$ .  
For every query return the sum of all even indexed elements in the range from  $s$  to  $e$ .

Ex:  $\overset{0}{2}, \overset{1}{3}, \overset{2}{1}, \overset{3}{6}, \overset{4}{4}, \overset{5}{5}$

$Q = 4$

$s$	$e$	
1	3	$\longrightarrow 1$
2	5	$\longrightarrow 5$
0	4	$\longrightarrow 7$
3	3	$\longrightarrow 0$

$A: \overset{0}{2}, \overset{1}{3}, \overset{2}{1}, \overset{3}{6}, \overset{4}{4}, \overset{5}{5}$

~~$\times PS: 2, 5, 6, 12, 16, 21$~~

$PS_e: 2, 2, 3, 3, 7, 7$

$PS_e[i] \rightarrow$  Sum of all even indexed elements from index 0 to  $i$ .

$$PS_e[i] = \begin{cases} PS[i-1] & \text{if } i \text{ is odd} \\ PS[i-1] + A[i] & \text{if } i \text{ is even} \end{cases}$$

$A: \overset{0}{2}, \overset{1}{4}, \overset{2}{3}, \overset{3}{1}, \overset{4}{5}$   
 $PS_o: 0, 4, 4, 5, 5$

Google  
CodeNation  
Direct-i  
JP Morgan.

Q Given an array. Count number of special index in the array.  
Special Index : after removing which,

Sum of all even indexed elements = Sum of all odd indexed elements.

A :	0	1	2	3	4	5			
	4	3	2	7	6	-2			
i	A[i]						S <sub>e</sub>	S <sub>o</sub>	
0	4	3	2	7	6	-2	8	8	✓
1	4	2	7	6	-2		9	8	✗
2	4	3	7	6	-2		9	9	✓
3	4	3	2	6	-2		4	9	✗

Quiz

0 1 2 3 4 5  
4, 1, 5, 3, 7, 10  
4 1 3, 7, 10

0 1 2 3 4 5 6 7 8 9  
2, 3, 1, 4, 0, -1, 2, -2, 10, 8  
2, 3, 1, 0, -1, 2, -2, 10, 8

Sum of odd indexed elements after removing index 3 :

Sum of odd indexed elements from index 0 to 2  
3

+

Sum of even indexed elements from index 4 to 9

0 + 2 + 10 ⇒ 12

Sum of even indexed elements after removing index 3 :

Sum of even indexed elements from index 0 to 2

$$2 + 1 +$$

Sum of odd indexed elements from index 4 to 9

$$-1 + -2 + 8$$

After removal of index  $i$

$$S_E = S_E[0, i-1] + S_O[i+1, N-1]$$

$$S_O = S_O[0, i-1] + S_E[i+1, N-1]$$

$PS_E \rightarrow$  Even indexed elements

$PS_O \rightarrow$  Odd indexed elements

$$S_E[0, i-1] = PS_E[i-1]$$

$$S_O[0, i-1] = PS_O[i-1]$$

$$S_O[i+1, N-1] = PS_O[N-1] - PS_O[i]$$

$$S_E[i+1, N-1] = PS_E[N-1] - PS_E[i]$$

$$Sum[L, R] = PS[R] - PS[L-1]$$

$$TC : O(N)$$

$$SC : O(N)$$

Google  
Facebook

Q Majority element

Given an array of  $n$  numbers.

Return, if there exists an element with frequency  $> n/2$  ( $n$  is length of array)

SC:  $O(1)$

A : <sup>0</sup>1, <sup>1</sup>6, <sup>2</sup>1, <sup>3</sup>1, <sup>4</sup>2, <sup>5</sup>1  
→ 1

$N = 6$   
 $|ME| > 3$

A : 3, 4, 3, 6, 1, 3, 2, 5, 3, 3, 3  
→ 3

$N = 11$   
 $|ME| > 5$

A : 4, 6, 5, 3, 4, 5, 6, 4, 4, 4  
→ -1

$N = 10$   
 $|ME| > 5$



- There can only be 1 majority element in the array.



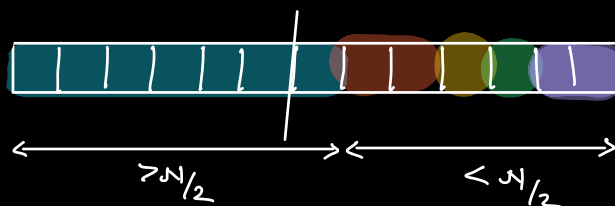
→ Blue



→ Blue



→ Blue



If we remove any 2 distinct elements,  
the majority element remains the same.

~~0~~, ~~1~~, ~~2~~, ~~3~~, ~~4~~, ~~5~~, ~~6~~, ~~7~~, 8, 9, 10  
3, 4, 3, 6, 1, 3, 2, 5, 3, 3, 3

ME  $\rightarrow$  3

~~0~~, ~~1~~, 2, ~~3~~, ~~4~~, 5  
1, 6, 1, 1, 2, 1

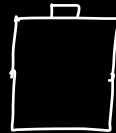
$\rightarrow$  1

436

400

$\rightarrow$  36

OP	:	:	:	:	:	:	:	:	:	:
YP	:	:	:	:	:	:	:	:	:	:
RP	:	:	:	:	:	:	:	:	:	:
GP	:	:	:	:	:	:	:	:	:	:



Winner :

OP	GP
<del>1</del>	<del>2</del>
<del>2</del>	<del>1</del>
<del>3</del>	<del>3</del>
<del>4</del>	<del>4</del>
<del>5</del>	<del>5</del>
<del>6</del>	<del>6</del>
<del>7</del>	<del>7</del>
<del>8</del>	<del>8</del>
<del>9</del>	<del>9</del>
<del>10</del>	<del>10</del>

$\downarrow$

0 1 2 3 4 5 6 7 8 9 10  
3, 4, 3, 6, 1, 3, 2, 5, 3, 3, 3

ME	<del>3</del>	<del>4</del>	<del>3</del>	<del>6</del>	<del>1</del>	<del>3</del>	<del>2</del>	<del>5</del>	<del>3</del>	<del>3</del>	<del>3</del>
Count	1	0	1	0	1	0	1	0	1	1	3

$\downarrow$

ME : 1, 2, 1, 4, 1, 5, 1  
Count : 1 0 1 0 1 0 1

TC :  $O(N)$   
SC :  $O(1)$

4, 6, 5, 3, 4, 5, 6, 4, 4, 4

ME : ~~4~~ ~~6~~ ~~5~~ ~~3~~ (4)  $\longrightarrow$  Iterate over array to  
Count : ~~1~~ ~~0~~ ~~1~~ ~~0~~ ~~1~~ ~~0~~ ~~1~~ ~~0~~ ~~1~~ 2 validate the ans.

## Moore's Voting Algo

HW Q. Majority element

Given an array of the numbers.

Return, if there exists an element with  
frequency  $> N/3$  (N is length of array)

SC:  $O(1)$

ME1

ME2

Count1

Count2

	0	1	2	3	4	5	6	7	8	9	10
	3	4	3	6	1	3	2	5	3	3	3
ME				3							
Count											3

return ME;