

Q Given N ^{+ve} integers. All elements occurs twice except one. Find that no. ??

Eg A: 3, 6, 4, 4, 3, 8, 8.

Solⁿ ~~3^6^4^4^1^3^8^8~~

$$6^0 = \underline{\underline{6}}$$

Q Given N +ve integers. Every element occurs thrice except one which occurs only once.

Find that element (No extra space)

Eg A: 1, 3, 5, 4, 3, 1, 5, 1, 5, 3

$$\text{Ans} = \underline{\underline{4}}$$

Solⁿ

i) Sorting & iterate to check.

\Rightarrow $\{1, 1, 1, 3, 3, 3, 4, 5, 5, 5\}$

$$\text{T.C.} = O(N \log N + N)$$

2) Optimierung

- 1 =

3

5

4

e3

- 1 -

5

1

5

3

$$0 = 3 \times 0 + 4 = 3 + 1$$

4 bits

A vertical red arrow pointing downwards, indicating a downward trend or flow.

Assume

3

1
0
1
0
0
0
1
0
0
0
0
1

$$3 = 3 \times ①$$

2

- 1
- 2
- 3
- 4
- 5

A vertical number line starting at 0 and ending at 300,000,000. The number 300,000,000 is highlighted with a red box. An arrow points to the digit 0 with the label "Even".

$$\begin{array}{r} & 2 \\ & - \\ 2 & - 0 0 \end{array}$$

1
0 - 0 - 0
~~0~~
00 - 00

Even

Even

not repeating

$$2 + 2 + 2$$

For the i th bit

8

if count of nos with set bit

$\frac{x}{2}$ (Even)
ith bit in non
repeating no. is
not set

$\frac{x}{2} + 1$

ith bit in non
repeating no.
is set

if the count of elements with ith bit set

$3x$

$3x + 1$

ith bit in NRE
is not set

ith bit in NRE
is set.

Code

for ($i = 0$; $i < 32$; $i++$) // All bits

count = 0;

for ($j = 0$; $j < N$; $j++$) // All nos

.. ..

~ ~ ~

if ((A[j] & (1 << i)) > 0) {
 count++;
}

3

if (count * 3 == 1) {

// ith bit in non repeating
no. is set.

Pseudo

H.W. \Rightarrow generate the non
repeating no. \Rightarrow

3

}

2³²

$$\begin{aligned} \text{T.C.} &= O(3^{\frac{1}{2}} \times N) \underset{\text{N log N}}{\approx} \log_2 2^{32} = 32 \\ &= O(N) \end{aligned}$$

$$(\log N) = 32$$

$$\text{S.C.} = O(1)$$

Q

Given N +ve integers.

All elements occurs twice except
2 element which occurs exactly once.

Find those 2 elements. (No extra space)

Eg A: 3, 6, 4, 4, 3, 8 \Rightarrow (6, 8)

Solⁿ XOR of all the elements.

$$\cancel{B^1 G^1 F^1 S^1 8^1} = \cancel{\cancel{G^1 8}} =$$

$\begin{array}{r} 3 \\ 6 \\ 8 \\ \hline 0 & 1 & 1 & 0 & 0 \end{array}$
2 groups

$\begin{array}{r} 1 \\ 1 \\ 0 \\ 0 \end{array}$

$\begin{array}{r} 0^1 0 = 0 \\ 1^1 1 = 0 \end{array}$

 $\begin{array}{r} 0^1 1 = 0 \\ 1^1 0 = 1 \end{array}$

Group 1 \Rightarrow All the nos whose bit 1 is set

Group 2 \Rightarrow All the nos whose bit 1 is not set

	3	2	1	0
$\rightarrow 3$	(1) -	0	0	-
$\rightarrow 6$	(2) -	0	-1	-
$\rightarrow 4$	(2) -	0	-1	-
$\rightarrow 4$	(2) -	0	-1	-
$\rightarrow 3$	(1) -	0	-1	-
$\rightarrow 8$	(2) -	-1	0	-

G_1 (Set)
 3, 6, 3

G_2 (Not Set)
 4, 4, 8

A diagram showing a concave lens (indicated by a pink outline) forming a real image of a real object (indicated by a green outline). The image is inverted and smaller than the object. A pink arrow points downwards from the lens towards the image.

七

All elements
repeating twice
except 1

Code

~~S1~~ $\text{xOR ALL} = 0;$
 for ($i = 0;$, $i < N$; $i++$) {
 ~~XOR~~
 ~~of~~
 ~~all no's~~
 ~~b~~
 $\text{xOR ALL} = \text{xOR ALL} \wedge \text{A}[i];$
 int ~~X~~ = 0;
 for (~~X = 0;~~, ~~X < 32;~~, ~~X ++~~) {
 if ((~~xOR ALL~~ \wedge ~~(1 << X)~~) > 0) {
 ~~b~~
 break;
 }
 }
 ~~b~~

$$\underline{x \oplus R_1 = 0}, \quad x \oplus R_2 = 0$$

for (i = 0; i < N; i++) { // All now
 if ((A[i] & (i << X)) > 0) {
 XOR1 = XOR1 ^ A[i];
 }

else if

$$\text{xor2} = \text{xor2} \ ^\text{A[i]};$$

b

return xor1, xor2

$$\text{T.C.} = \underline{\mathcal{O}(n)}$$

O₃

linked
list
shorcut

Given an array of size N

containing all elements from 1 to
 $N+2$ except 2 elements

(No extra
space)

find the 2 missing elements.

$$\underline{\underline{N=4}}$$

$$[1, \underline{6}]$$

$$A: [3, \underline{6}, \underline{1}, 4] \Rightarrow 2, \underline{5}$$

Sol^m

$$1, \underline{2}, 3, 4, \underline{5}, 6$$

$$3, \underline{6}, \underline{1}, 4$$

H.W.

Shorcut

S.C. o(a)

Θ

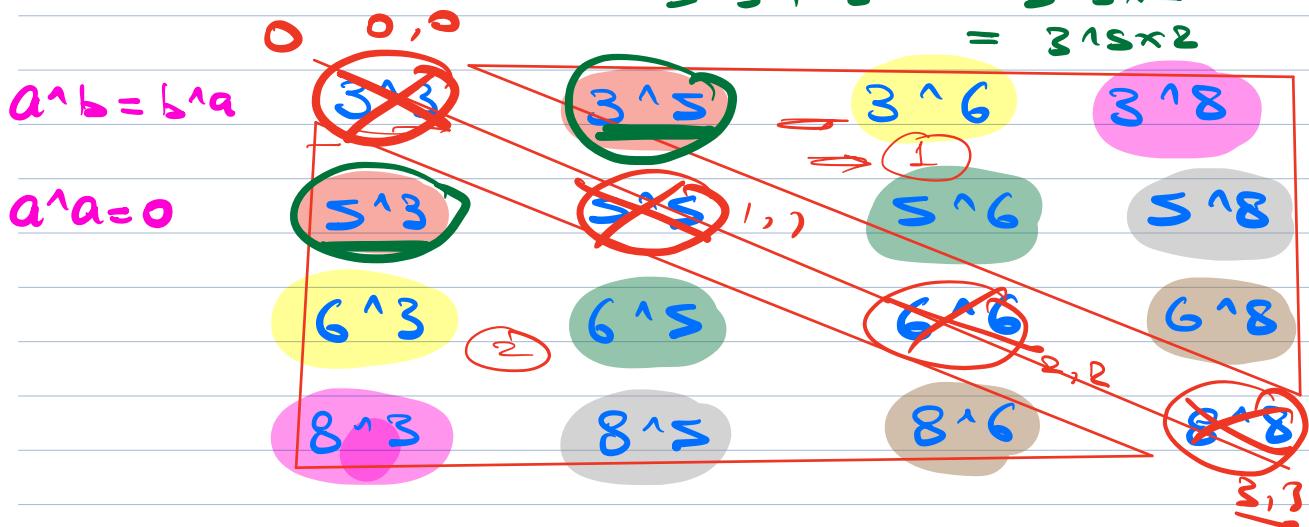
Given an array of N elements.
Calculate the sum of XOR of all

the pairs.

$$(i, j) \neq (j, i)$$

Eg : A : 3, 5, 6, 8

$$5^3 + 3^5 = 5^3 \times 2 \\ = 3^5 \times 2$$



1) Brute force

ans = 0;

for ($i = 0$; $i < N$; $i++$) {

 for ($j = \underline{i+1}$; $j < N$; $j++$) {

 ans += A[i] ^ A[j];

$$i \rightarrow (x) \times (n-x) \times \underline{\underline{\Sigma^i}}$$

return ans * 2; $N \rightarrow x$ set
 $(N-x) \rightarrow N+x$ set

A:	2, 3,	5,	6,	8	\downarrow	\downarrow	\downarrow	\downarrow
- 2	3	2	1					
- 3	0	0	- 1					
- 5	0	0	- 1					
- 6	0	- 1	- 1					
- 8	0	0	0					
	1×4	2×3	2×2	2×3	3^4	3^6	3^8	3^{10}
	4	6	6	6	81	729	6561	59049
	Find a pair s.t.							
	one ele has set							
	bit \neq one has							
	unset bit							

$$\text{Sum} = 6 \times 2^0 + 6 \times 2^1 + 6 \times 2^2 + 4 \times 2^3 = \underline{\underline{74 \times 2}}$$

$$8 + \underline{6} = 14$$

$$\left(\begin{smallmatrix} \downarrow & \downarrow & \downarrow \\ 1 & 0 & 0 & 0 \\ \Sigma^3 & 2^2 & 2^1 & 2^0 \end{smallmatrix} \right)_2 + \left(\begin{smallmatrix} \downarrow & \cdot \\ 0 & 110 \\ \Sigma^3 & \Sigma^2 & \Sigma^1 & \Sigma^0 \end{smallmatrix} \right)_2 = 14$$

$$(1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0) + (0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0)$$

$$\underline{\underline{1}} \times 2^3 + \underline{\underline{1}} \times 2^2 + \underline{\underline{1}} \times 2^1 + \underline{\underline{0}} \times 2^0 = \underline{\underline{14}}$$

\Rightarrow If we find out in how many pairs, i th bit is set, the combi. of its set =

$$\left(\text{No. of pairs in which } i\text{th bit is set} \right) \times \underline{\Sigma}^i$$

Q Find in how many unique pairs i th bit will be set.



$$\begin{array}{c}
 \textcircled{1R} \quad \textcircled{\cancel{S}} \quad \textcircled{1W} \\
 4 \quad \times \quad 6 \quad = \quad \underline{\Sigma}^4
 \end{array} \qquad \text{OR (+)}$$

Code \Rightarrow H.W.

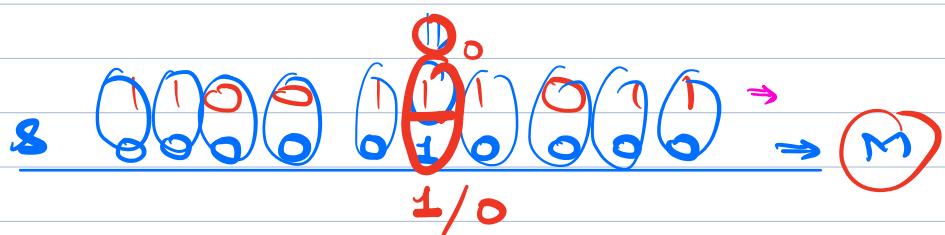
1 problem

Representations ↗ -ve no's

Rangers

TLE

Doubt



$1 < < \bar{c}$

$$(11111000\cancel{1}200100)111101$$

The diagram illustrates the effect of a magnetic dipole on a current loop. On the left, two curved arrows indicate the direction of the dipole's field. On the right, a red current loop is shown with a blue arrow indicating its direction. The dipole's field (indicated by pink circles) interacts with the current loop, creating a net magnetic moment (indicated by a pink arrow). This interaction results in a clockwise torque, causing the current loop to rotate clockwise.

$$\text{(-1, -1, -1, -1, -1, 1, 1, 1, -1, -1, 1, 1, 1, -2, 1, 1, -1, -1, -1, -1, -1, -1)}$$

Max Subarray sum \Rightarrow Kadane's

13
17

11