Find the repeating and missing number

Problem Statement

Suggest Edit

You are given an array of size 'N'. The elements of the array are in the range from 1 to 'N'.

Ideally, the array should contain elements from 1 to 'N'. But due to some miscalculations, there is a number R in the range [1, N] which appears in the array twice and another number M in the range [1, N] which is missing from the array.

Your task is to find the missing number (M) and the repeating number (R).

For Example:

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Consider an array of size six. The elements of the array are { 6, 4,
3, 5, 5, 1 }.
The array should contain elements from one to six. Here, 2 is not
present and 5 is occurring twice. Thus, 2 is the missing number (M)
and 5 is the repeating number (R).
```

0 1 2 3 4 5

{ 6, 4, 3, 5, 5, 1]

2

6 { 1, 2, 3, 4, 5, 6 }

5, 2

Brute force:

sort : 1 3 4 5 5 6

Find repeating → 5

1 → 2 → n

2 → out

T.C. : $O(N \log N) + O(N) + O(N)$

map

1	1
3	1
4	1
5	2
6	1

→ 5

i →

1 → 4

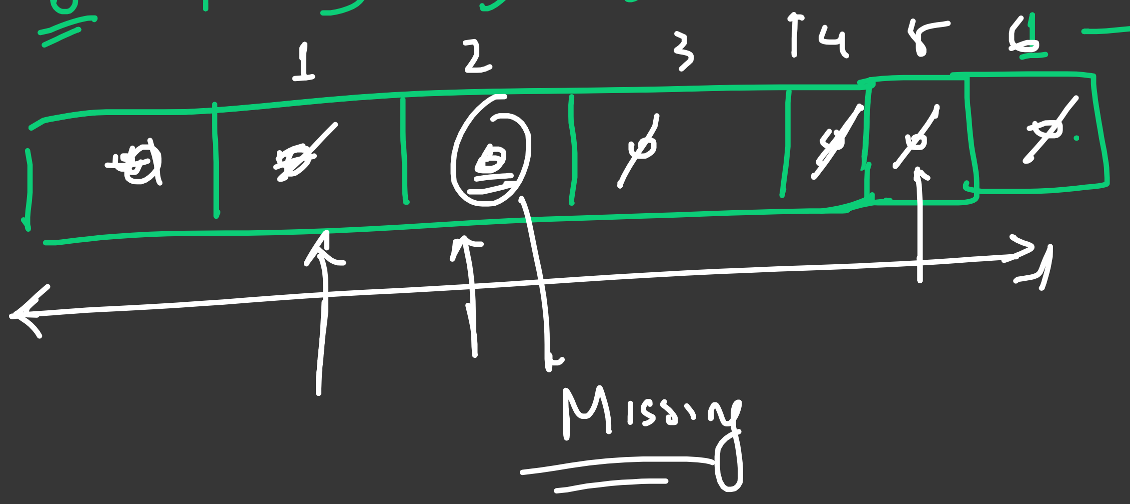
output

T.C. $O(N) + O(N)$

S.C. : $O(N)$

Better

6 4 3 5 5 1



→ N

N+1

repeat curr → 5

Optimal Solution:

(Maths)

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

$\{6, 3, 4, 5, 5, 1\}$ — Thik karna hai — unsolved array

$\{1, 2, 3, 4, 5, 6\}$ — Yeh thik hai — Perfect array

$$\overset{24}{\cancel{6}+\cancel{3}+\cancel{4}+\cancel{5}+5+\cancel{1}} - \overset{21}{(\cancel{1}+2+\cancel{3}+\cancel{4}+\cancel{5}+\cancel{6})}$$

$$5 - 2 = 3$$

$$24 - 21 = 3$$

Assuming

x → repeating

y → missing

$$\boxed{x - y = 3} \rightarrow (1) \qquad S_1^2 = \frac{n(n+1)(2n+1)}{6}$$

$$S_2 - S_{n2}$$

$$(\cancel{6^2} + \cancel{3^2} + \cancel{4^2} + 5^2 + \cancel{5^2} + \cancel{1^2}) - (\cancel{1^2} + 2^2 + \cancel{3^2} + \cancel{4^2} + \cancel{5^2} + \cancel{6^2})$$

$$5^2 - 2^2 = 25 - 4 = 21$$

$$x^2 - y^2 = 21 \cdot 4$$

$$(x-y)(x+y) = 24$$

$$\boxed{x + y = \cancel{8}\ 7}$$

$$x + y = \frac{21}{(x-y)} = \frac{21}{3} = \cancel{8}\ 7$$

$$x - y = 3$$

$$x + y = \cancel{8}\,7$$

$$2x = 7\cancel{8} + 3$$

$$x = \frac{7\cancel{8} + 3}{2} = \frac{10}{2} = \underline{\underline{5}}$$

$$x + y = val2$$

$$\boxed{y = val2 - x}$$

$$y = \cancel{8}\; 7 - x$$

$$= 7 - 5 = 2$$

$$\boxed{\begin{aligned} x &= 5 \\ y &= 2 \end{aligned}}$$

ans

$$\boxed{\begin{aligned} T.C &= O(N) \\ S.C. &= O(1) \end{aligned}}$$

Optimal Solution Using XOR:

$\{\cancel{4}, \cancel{3}, \cancel{6}, \cancel{2}, 1, \cancel{1}\} \wedge \{\cancel{1}, \cancel{2}, \cancel{3}, \cancel{4}, 5, \cancel{6}\}$

$1 \wedge 5 = 4$

$x \quad y$

$1 \wedge 5 = 4$

$x \wedge y = 4$

rep missing

bit No = 2

2 bit set

0 0 1
1 0 1
1 0 0

set bit

XOR

same ^ same = 0

$1 \wedge 1 = 0$

$0 \wedge 0 = 0$

$1 \wedge 0$, $0 \wedge 1$ → 1

0 0 1
1 0 1
1 0 0

In XOR

same ^ same

$1 \wedge 1 = 0$

$1 \wedge 1 \wedge 1 = 1$

0 0 1
1 0 1

100 001
001 100

2 bit

0 ^ 3 ^ 2 ^ 1 ^ 1 ^ 1 ^ 2 ^ 3 = 1

1, 4, 6, 4, 5, 6 = 5

100 011
110

1 , 5

{4, 3, 6, 2, 1, 1}

{1, 2, 3, 4, 5, 6}

xor
$1 \wedge 1 = 0$ (even)
$1 \wedge 1 \wedge 1 = 1$

for (i = 0 → n)

1

val

count 1

{ 1, 5 }

{ 5, 1 }

2's

101
011
101

→ 100

4(5-1)

111
100 ~~0~~

n & (-n)

4 4
(-4)
3

101
011
001

0

2's 5

45 + 1

-4 = 011

1

5 → 101

010
+ 1
011

XOR Step

- XOR all the element in the array and $1 \longrightarrow n$
- ~~Step~~ Find the bit No ~~at~~ position of the rightmost set bit of the no
- Segregate the element in array and $1 \longrightarrow n$ ~~also~~ in with zero and one at bit no.
- XOR all the 0th ~~bit no~~ club and 1th club
- Iterate and find the repeating and missing numbers

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

$\cancel{4} \wedge \cancel{3} \wedge \cancel{5} \wedge 1 \wedge \cancel{1} \wedge \cancel{1} \wedge 2 \wedge \cancel{3} \wedge \cancel{4} \wedge \cancel{5}$

001
010
011

001
010
011

$1 \wedge 2 = 3$

011

100
+1
101

rightmost bit No = $3 \wedge (-3)$

$= 3 \wedge \{\sim(3-1)\}$

011
001

$-3 = 2\text{'s } 3$

$= 3 \wedge \sim(2)$

$= 3 \wedge 1$

$= 1$

$\sim 3 + 1$

$\sim(3-1)$
~ 2

0

10
01

011
101
001

010
101

011
001
001

bitno 1

$(4, 3, 5, 1, 1)$

0	1
~~4~~	~~3~~
2	~~5~~
~~4~~	~~1~~
	~~1~~
	1
	~~3~~
	~~5~~
2	1

$4 \rightarrow 100$

$3 \rightarrow 011$

$2 \rightarrow 010$

$1 \rightarrow 001$

2 1 0

$5 \rightarrow 101$

bitno

0	1
~~4~~	~~3~~
~~5~~	~~2~~
~~1~~	~~3~~
~~1~~	
~~1~~	
~~4~~	
~~5~~	
2	2

$(1 << \text{bitno.})$

4

100

001

000

generate every time

1 << bitNo

while(1)

if((1<<bitNo)&1)

break;

bitNo++.

for upper example 001

this gdone generated every time we use it

we store it in a val. = 001

= 1