Bit-Manipulation

video-17

Leetcode -260 Medium

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260. Single Number III

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Given an integer array `nums`, in which exactly two elements appear only once and all the other elements appear exactly twice. Find the two elements that appear only once. You can return the answer in **any order**.

You must write an algorithm that runs in linear runtime complexity and uses only constant extra space.

Example :- nums = {1, 2, 1, 3, 2, 5}

Output = {3, 5}

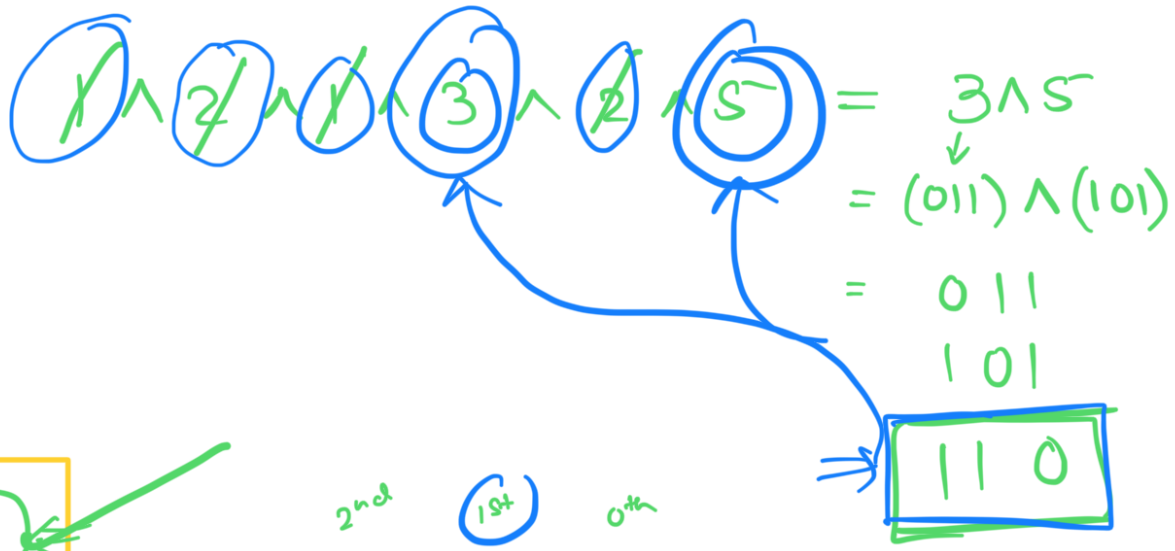
1, 1 | 2, 2 | 3, 5

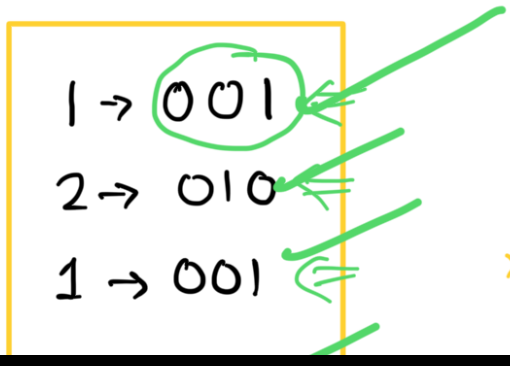
Brute Force :- Use a map $O(n)$ to store frequency.

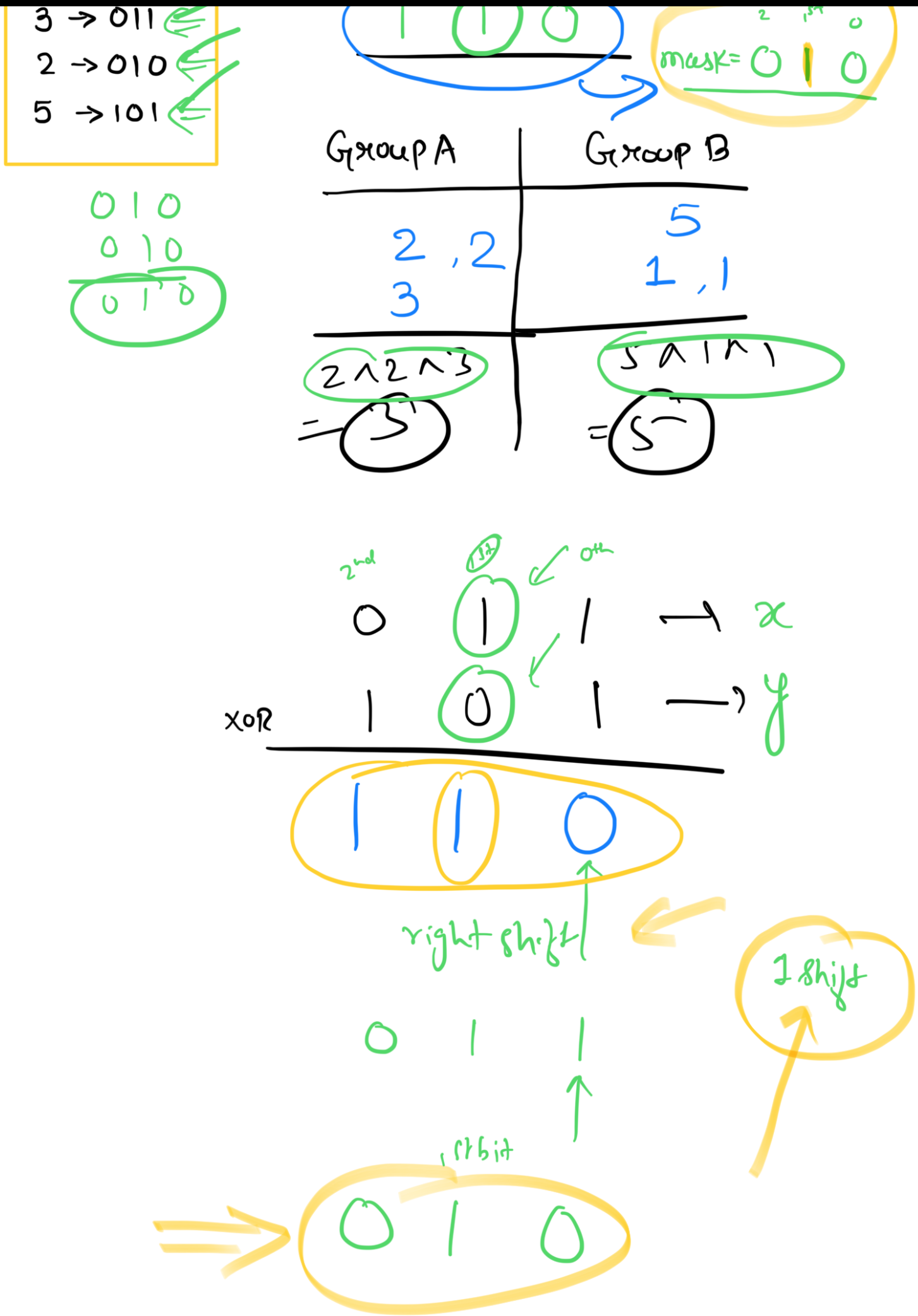
Or, Sort the array and find. $n \log n$

Optimal Approach ...

nums = {1, 2, 1, 3, 2, 5}






3 → 011
2 → 010
5 → 101
1 1 0
mask= 0 1 0
0 1 0
0 1 0
0 1 0
Group A
Group B
2 , 2
3
5
1 , 1
2^2^3
=3
5^1^1
=5
2nd
1st
0th
0 1 1 → x
xor 1 0 1 → y
1 1 0
right shift
0 1 1
1 shift
1st bit
0 1 0

1 → 0 0 0 0 1

0 0 0 1 0

XOR = 3^5 = 1 1 0

(1 1 0) & (- (1 1 0))

2's complent

(1 1 0) & (0 1 0)

1 1 0 → invert → 0 0 1 → +1 → 1

0 1 0

= 1 1 0

0 1 0

mask = 0 1 0

⇒ XOR & (-XOR)

① XOR all numbers = xor

② mask = (xor & (-xor))

③ mask & nums[i]