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 ^ 3 ^ 8 ^ 8

6 ^ 0 = 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

Ans = 4

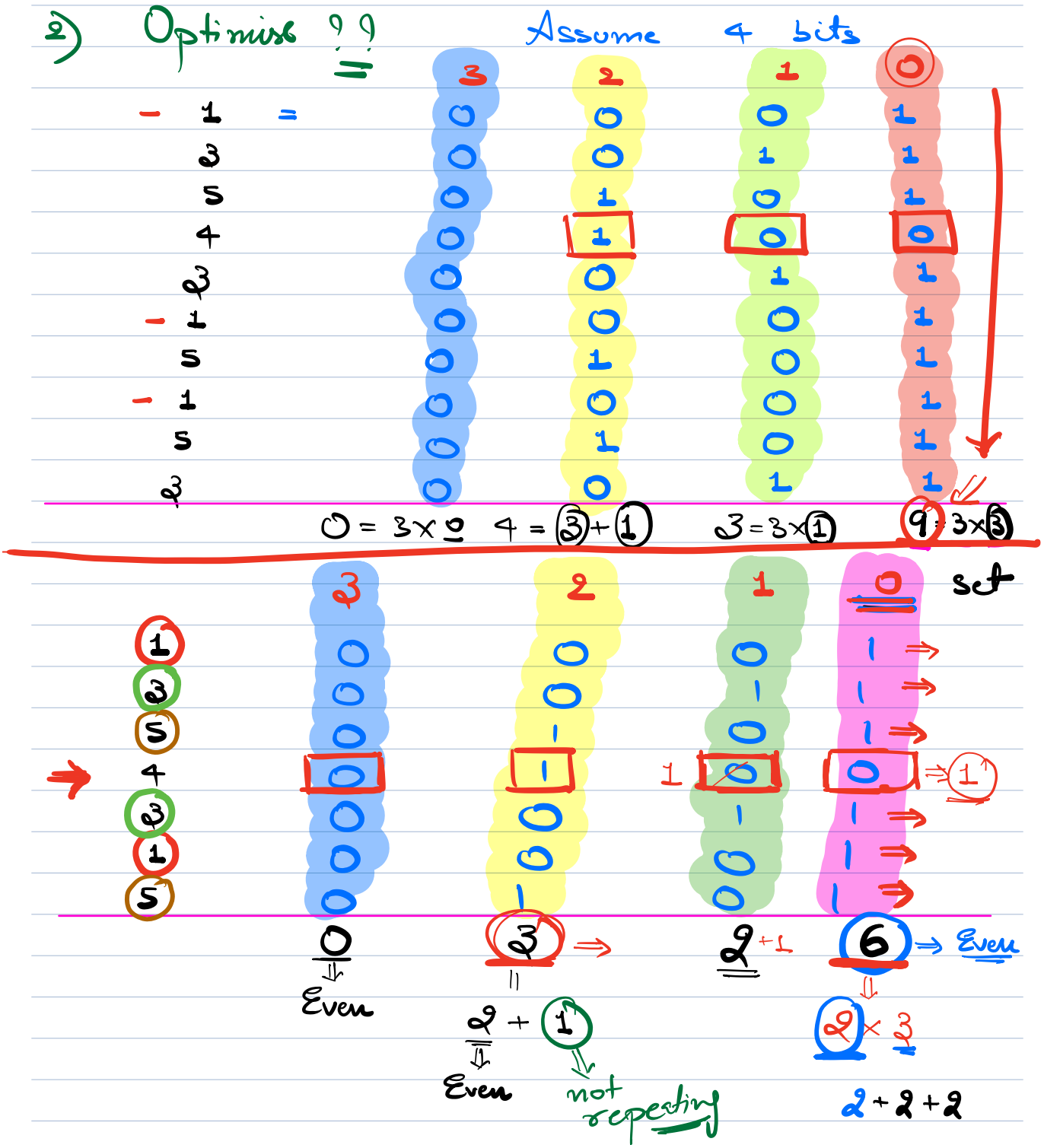
Soln

1) Sorting & iterate to chek.

1, 1, 1, 3, 3, 3, 4, 5, 5, 5

T.C. = O(NlogN + N)

2) Optimise ??



For the ith bit

if count of no's with set bit

- 2(x) (Even) → ith bit in non repeating no. is not set
- 2x + 1 → ith bit in non repeating no is set

---

if the count of elements with ith bit set

- 3x → ith bit in NRE is not set
- 3x + 1 → 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
```

(i = 0: 1 bit; i < 32: 32 bits)

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

if (count % 3 == 1){
    // ith bit in non repeating no. is set.
    Pankaj
    H.W. ⇒ Generate the non repeating no.
}
}
```

2^{32}

T.C. $= O(32 \times N) \approx O(N)$ $\quad \log_2 2^{32} = 32$

$N \log N$ $\quad \log N = 32$

S.C. $= O(1)$

Q Given N +ve integers.

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

Find those 2 elements. (No extra space)

Eg A: 3, 6, 4, 4, 3, 8 ⇒ (6, 8)

Soln XOR of all the elements.

3 ^ 6 ^ 4 ^ 3 ^ 8 ^ 4 = 6 ^ 8 =

2 groups

	3	2	1	0
6 =	0	1	1	0
8 =	1	0	0	0
XOR	1	1	1	0

0 ^ 0 = 0
1 ^ 1 = 0

0 ^ 1 = 1
1 ^ 0 = 1

- Group 1 ⇒ All the no's whose bit 1 is set
  6
- Group 2 ⇒ All the no's whose bit 1 is not set
  8

		3	2	1	0
→ 3	(1)	0	0	1	1
→ 6	(2)	0	1	1	0
→ 4	(2)	0	1	0	0
→ 4	(2)	0	1	0	0
→ 3	(1)	0	0	1	1
→ 8	(1)	1	0	0	0

G1 (Set): 3, 6, 3, ⇒

G2 (Not Set): ⇐ 4, 4, 8

All elements repeating twice except 1

Code

S1

```
XOR ALL = 0;
for (i = 0; i<N; i++){
    XORALL = XORALL ^ A[i];
}
```

XOR of all no's

```
int X = 0;
for (X = 0; X <32; X++){
    if((XORALL & (1 << X ) > 0){
        break;
    }
}
```

```
XOR1=0, XOR2 = 0
for (i=0; i<N; i++){ //All nos
    if ((A[i] & (1<< X ) >0){
        XOR1 = XOR1 ^ A[i];
    }
```

```
        else {
            XOR2 = XOR2 ^ A[i];
        }
    }
    return XOR1, XOR2
```

T.C. = O(N)

Q3 linked in shoutout

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.

N = 4

A: [3, 6, 1, 4] → 2, 5

[1, 6]

Soln

1, 2, 3, 4, 5, 6

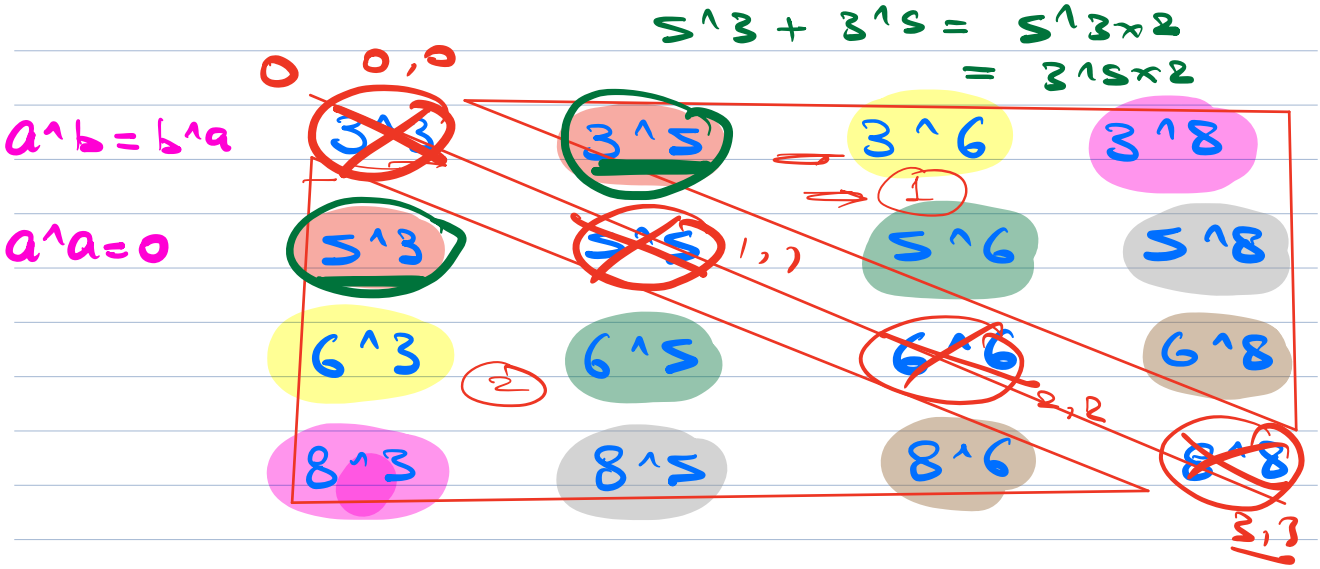
3, 6, 1, 4

HW: Sheets

S.C. O(1)

Q) Given an array of N elements. Calculate the sum of XOR of all the pairs. (i, j) != (j, i)

Eg : A: 3, 5, 6, 8



1) Brute force

```
ans = 0;
for (i = 0; i < N; i++) {
    for (j = i+1; j < N; j++) {
        ans += A[i] ^ A[j];
```

$i \Rightarrow (x) \times (N-x) \times 2^i$

return ans x 2;

N ⇒ x set

(N-x) ⇒ N-x set

A: 2, 3, 5, 6, 8

	3	2	1	0
2	0	0	1	0
3	0	0	1	1
5	0	1	0	1
6	0	1	1	0
8	1	0	0	0
	1x4	2x3	2x2	2x3
	4	6	6	6

Find a pair s.t. one ele has set bit & one has unset bit

	3	2	1	0
2^3 =	0	0	0	1
2^5 =	0	0	1	1
2^6 =	0	1	0	1
2^8 =	0	1	1	0
3^5 =	0	0	1	0
3^6 =	0	1	0	0
3^8 =	0	1	1	1
5^6 =	0	1	1	1
5^8 =	1	0	0	1
6^8 =	1	1	1	0
	4 (2^3)	6 (2^2)	6 (2^1)	6 (2^0)

Sum = $6\times2^0 + 6\times2^1 + 6\times2^2 + 4\times2^3 = 74 \times 2$

$8 + 6 = 14$

$(1000)_2 + (0110)_2 = 14$

$(1\times2^3 + 0\times2^2 + 0\times2^1 + 0\times2^0) + (0\times2^3 + 1\times2^2 + 1\times2^1 + 0\times2^0)$

$1\times2^3 + 1\times2^2 + 1\times2^1 + 0\times2^0 = 14$

⇒ If we find out in how many pairs, i^{th} bit is set, the contri. of i^{th} bit =

$$\left(\begin{array}{c}\text{No. of pairs in which} \\ i^{th} \text{ bit is set}\end{array}\right) \times 2^i$$

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

Magician

Set	Not Set
R1 R2	W1 W2
R3 R4	W3 W4
	W5 W6

(1 R) & (1 W) OR (+)

$4 \times 6 = 24$

Code ⇒ H.W.

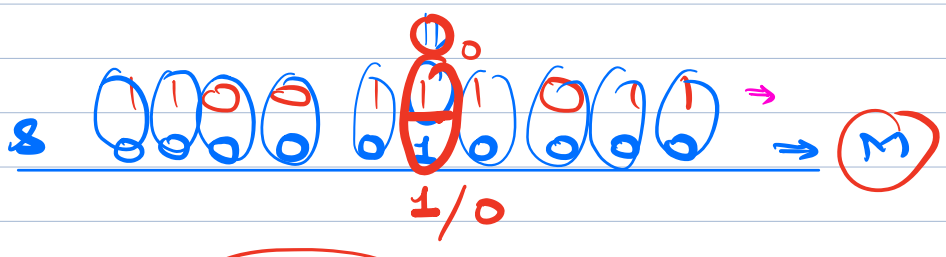
1 problem

Representation → -ve nos

Ranges

TLE

Doubt



1 << i

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

0 → +1

1 → -1

-1, -1, -1, -1, -1, 1, 1, 1, -1, -1, 1, 1, -2, 1, 1, -1, -1, -1, -1, 1, 1, -1

Max Subarray Sum ⇒ Kadane's

5, 6, 11, 11, 11, 14, 8

13
17

11