

1 → 2

$A \times \text{size} - DT$

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

Quiz

$$N = (N^i \ (1 \leq i))$$

$$A^0 = A$$

$N:$ 

6	5	4	3	2	1	0
1	0	1	1	0	1	1
0	0	0	1	0	0	0
<hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/>						
1	0	1	0	0	1	1

$N:$ 

6	5	4	3	2	1	0
1	0	1	0	0	1	1
0	0	0	1	0	0	0
<hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/>						
1	0	1	1	0	1	1

# Hamming Distance

$$HD(4, 3) \rightarrow 3$$

100  
011

$$HD(7, 15) \rightarrow 1$$

0111  
1111

$$HD(5, 6) \rightarrow 2$$

101  
110

Q Given an array. Return the sum of HD of all pairs in the array.

3, 2, 4, 1

$$3, 2 \rightarrow 1$$

$$2, 4 \rightarrow 2$$

$$4, 1 \rightarrow 2$$

$$3, 4 \rightarrow 3$$

$$2, 1 \rightarrow 2$$

$$3, 1 \rightarrow 1$$

$$\Rightarrow 11$$

Brute Force

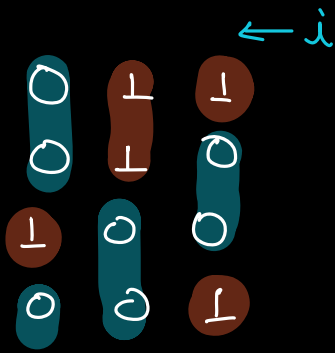
$\rightarrow$  Iterate over all pairs  $\rightarrow O(N^2)$

$\rightarrow$  count set bits in XOR of the pair

$O(\log M)$

TC:  $O(N^2 \log M)$

3, 2, 4, 1



$$\underline{3 + 4 + 4} \Rightarrow 11$$

Ques

$$a = 5, \quad b = 7;$$

$$a = a^b;$$

$$b = a^b;$$

$$a = a^b;$$

$$\text{SOP}(a);$$

$$\text{SOP}(b);$$

$$// \quad a = 5^7$$

$$// \quad b = (5^7)^7 \Rightarrow 5$$

$$// \quad a = (5^7)^5 \Rightarrow 7$$

$$\rightarrow 7$$

$$\rightarrow 5$$

$$\left. \begin{array}{l} a^b = c \\ a = c^b \\ b = c^a \end{array} \right\}$$

Q Given an array. Find the min XOR pair.

9, 5, 3  $\rightarrow$  6

$$9 \wedge 5 \rightarrow 12$$

$$9 \wedge 3 \rightarrow 10$$

$$5 \wedge 3 \rightarrow 6$$

3 1 4 5 2

$$\rightarrow 1$$

$$3 \wedge 2 \rightarrow 1$$

Brute Force

$O(N^2)$

3 5 9

1 2 3 4 5

15 16 17

a, b

$a < b$

a 0 0 1 0 \_ \_ \_ \_

b 0 0 1 1 \_ \_ \_ \_

$a < c < b$

a 0 0 1 0 \_ \_ \_ \_  
c \_ \_ \_ 0 \_ \_ \_ \_  
b 0 0 1 1 \_ \_ \_ \_

$a \wedge c$

a 0 0 1 0 \_ \_ \_ \_  
c \_ \_ \_ 1 \_ \_ \_ \_  
b 0 0 1 1 \_ \_ \_ \_

$c \wedge b$

TC:  $O(N \log N)$

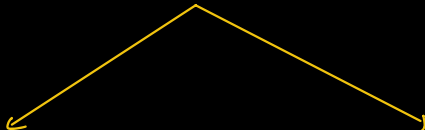
Tree  
(Binary Tree)

1	-	-	-
1	-	-	-
0	-	-	-
0	-	-	-
0	-	-	-



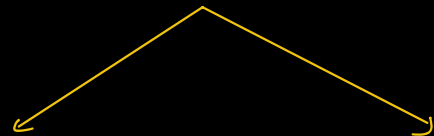
0	-	-	-
0	-	-	-
0	-	-	-
0	-	-	-
0	-	-	-

1	-	-	-
1	-	-	-
1	-	-	-
1	-	-	-
1	-	-	-



0	-	-	-
0	-	-	-
0	-	-	-
0	-	-	-
0	-	-	-

0	-	-	-
0	-	-	-
0	-	-	-
0	-	-	-
0	-	-	-



1	-	-	-
1	-	-	-
1	-	-	-
0	-	-	-
0	-	-	-

1	-	-	-
1	-	-	-
1	-	-	-
1	-	-	-
1	-	-	-

Q Given an array. Find the max AND pair.

A: 27, 18, 20  $\rightarrow$  18

$$\begin{array}{r} 27 \& 18 \\ 11011 \\ \& 10010 \\ \hline 10010 \\ \Rightarrow 18 \end{array}$$

$$\begin{array}{r} 27 \& 20 \\ 11011 \\ \& 10100 \\ \hline 10000 \\ \Rightarrow 16 \end{array}$$

$$\begin{array}{r} 18 \& 20 \\ 10010 \\ \& 10100 \\ \hline 10000 \\ \Rightarrow 16 \end{array}$$

26, 13, 23, 28, 27, 7, 25  $\rightarrow$  26  
26 & 27  $\rightarrow$  26

Brute Force  $\rightarrow O(N^2)$

26, 13, 23, 28, 27, 7, 25

$\downarrow$

26	1	1	0	1	0
13	0	1	1	0	1
23	1	0	1	1	1
28	1	1	1	0	0
27	1	1	0	1	1
7	0	0	1	1	1
25	1	1	0	0	1
<hr/>					
	1	1	0	1	0

$\rightarrow$  26

ans = 0;

for (i = 31; i >= 0; i--) {

→  $O(\log M)$

count = 0;

(size of DT)

for (j = 0; j < N; j++) {

if (checkBit(A[j], i)) {

count++;

}

}

if (count >= 2) {

ans = setBit(ans, i);

for (j = 0; j < N; j++) {

if (!checkBit(A[j], i)) {

A[j] = 0;

}

N

}

}

}

TC:  $O(N \log M)$

→ Return the pair

→  $\max(a \& b \& c)$

→  $\max(a \& b \& c \& d)$

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