

Monday, 8 November 2021

$0 \rightarrow \text{False}$

$$x \ll 1 \rightarrow x \approx 2$$

$$\begin{array}{r} 6 \\ -4 \\ \hline 2 \end{array}$$

2	15	0
2	7	1
2	3	1
1	1	1

$$x \ll 2 = x \approx 4$$

$$x \ll i = x * 2^i$$

$$23 \gg 1 \rightarrow 11$$

$$\therefore \begin{array}{r} 10110 \\ 168421 \\ \hline 1011 \end{array} \rightarrow \underline{\underline{11}}$$

$$x \gg i = x / 2^i$$

$$20 \rightarrow 10100$$

$$20 \gg 1 = 1010 = \underline{\underline{10}}$$

$$\begin{array}{r} 22 \\ 10110 \\ \hline 1011 = \underline{\underline{11}} \end{array}$$

$11 \rightarrow 1011$   
 LSB

$x \& 1$   $\rightarrow 0 \rightarrow x = \text{even}$

$x = 11 \rightarrow 1011$   
 $\begin{array}{r} & 1 \\ & 0 \\ \times & 1 \\ \hline 0 & 0 \\ 0 & 1 \\ \hline 0 & 0 & 0 & 1 \end{array}$

$6 \rightarrow 0110$   
 $x_1 \quad \begin{array}{r} & 1 \\ & 0 \\ \hline 0 & 0 \\ 0 & 0 \\ \hline 0 & 0 & 0 & 0 \end{array}$

$10 \& 12 = 8$

$10 / 12 = 14$

$8 / 7 = 15$

$x \mid 1$   
 $\frac{1010}{\text{or } 0001} \rightarrow \underline{\underline{11}}$   
 $\text{or } 0001 \rightarrow \underline{\underline{11}}$

$\frac{1010}{1110 \rightarrow \underline{\underline{14}}}$   
 $10^1 11$   
 $\text{xOR }$   
 $\frac{1010}{1011} \rightarrow \underline{\underline{0001 \rightarrow \underline{\underline{1}}}}$

$10^1 x = 0$   
 $11 \wedge 12 = \underline{\underline{7}}$   
 $1011 > 011$

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Q → Check if  $i^{\text{th}}$  bit is set.  
 $x = 10$   
 $i = 1$   
 $\dots \downarrow \quad 3 \quad 2 \quad 1 \quad 0$   
 $00 \quad \dots \quad 1010$   
Ans = True

Solt 1 →  $(x \gg i) \& 1$   
 $x \gg i$   
 $\text{Solt 2} \rightarrow x \& (1 \ll i)$

$10 \gg 1 = \underline{\underline{5}} \rightarrow 101$   
 $1010$   
 $\frac{0010}{0010 = (1 \ll i)}$

Q → check if  $x$  is power of 2. ( $x = 2^k$  for  $1 \ll k$ )

$x=8$       Ans = True  
 $x=6$       Ans = False

Only one bit is set ✓

$1000$   
 $\underline{0110}$

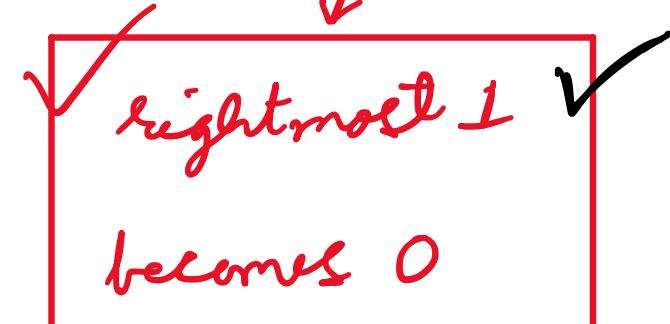
$8-1 = 7$   
 $\begin{array}{r} 1000 \\ -1 \\ \hline 0111 \end{array}$

$000-11001$   
 $\begin{array}{r} 101 \quad x \\ \times 00011 \\ \hline -1 \end{array}$

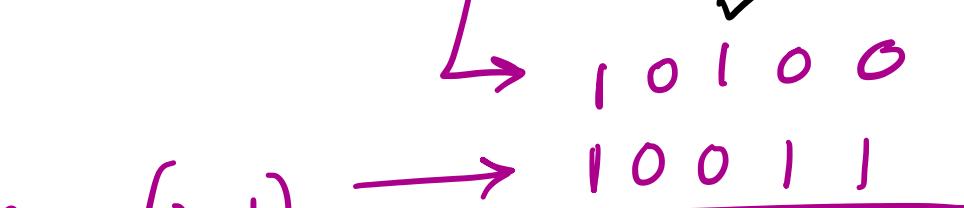
$10110$   
 $\begin{array}{r} 101 \\ -1 \\ \hline 10100 \end{array}$

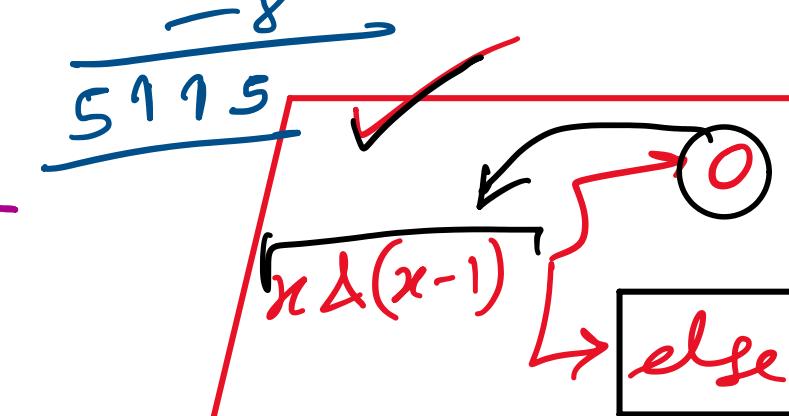
$(x-1) \rightarrow$  makes right most 1 = 0 & every

$x \Delta (x-1)$  

rightmost 1 becomes 0 

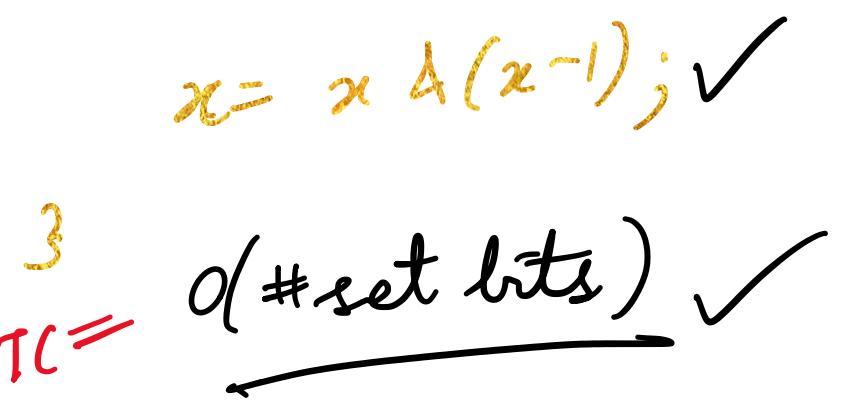
$x = 20$  

$q = (x-1) \rightarrow$  

$x \Delta (x-1)$  

$x = 16 \rightarrow$  

$(x-1) = 15 \quad \& \quad$  

$T.C = O(\# \text{set bits})$  

~~Q5~~ Given an array of integers, every number appears twice except for one number. Find that number.

$A = [1, 2, 1, 3, 3, 2, 5, 7, 7]$

(Ans)

Ans  $\rightarrow$  XOR of all numbers.

$x \wedge x = 0$

$x \wedge x \wedge 0 = x$

Every number appears twice except for 2 numbers. Find both numbers.

$A = [2, 7, 3, 4, 11, 11, 2, 3, 5, 5]$

2 2    3 3    5 5    7    4    11 11

Sort &

XOR of all numbers =  $x \wedge y$  ✓ where  $x, y \rightarrow$  an

$\theta = O(n^2)$

for ( $i=0$ ;  $i < n$ ;  $i++$ )  
 $P = P \wedge A[i];$   
 $\beta$   $\Rightarrow P = 7 \wedge q$   
 $\quad\quad\quad 3 \ 2 \ 1 \ 0$   
 $\quad\quad\quad 0 \ 1 \ 1 \ 1$   
 $\quad\quad\quad \wedge \ 1 \ 0 \ 0 \ 1$   
 $\quad\quad\quad \hline 1 \ 1 \ 1 \ 0$   
 $\quad\quad\quad \rightarrow 14$   
 $Tc = O(N)$   
 $\rightarrow$  either set for x or y but not for  
 $2 \quad 7 \quad 3 \quad 9 \quad 11 \quad 11 \quad 2 \quad 3 \quad 5 \quad 5$   
 $i=1$  set  
 $\downarrow$   
 $11 \quad 1001$   
 $Tc = O(N)$   
 $Sc = O(1)$   
 $i=1$   
 $2, 7, 3, 11, 11, 2, 3$   
 $9, 5$   
 $\downarrow$   
 XOR all elements  $\rightarrow \underline{\underline{7}} \rightarrow (\text{Ans}) \leftarrow \underline{\underline{9}}$   
 $x = y = 0;$   
 $\forall j \text{ from } 0 \xrightarrow{x = x \wedge A[j]}$ , if  $i^{\text{th}}$  bit is set for  $A[j]$   
 $\rightarrow$   
 $x = 0 \wedge A[i] \quad \text{if } i^{\text{th}}$  bit is unset for  $A[i]$

$x = 20 \rightarrow 10\boxed{1}00$   
 $x-1 = 19 \rightarrow \frac{1001}{10000} \rightarrow 16$   
 AND  
 $20 \rightarrow 10100$   
 $-10000$   
 ~~$\underline{00100}$~~

$x - (x \& (x-1)) \rightarrow$  Right most set bit of  $x$ .  
 $x=20$   
 $\boxed{10} \rightarrow 9 \cdot 2 = 1$   
 $\boxed{10} \rightarrow 9 \cdot 2 = 1$   
 $\boxed{10} \rightarrow 9 \cdot 2 = 1$   
 $30 \rightarrow 24$   
 $11\boxed{1}10$

$x \rightarrow 100101000$   
 $- (00101000)$   
 $\underline{00000100} \rightarrow n$

$x \rightarrow 10010$   
 $(x-1) \rightarrow 100101$

$A - (\text{everything in } A \text{ but } x) = x$   
 $x \rightarrow \frac{x100101}{100101}$

$3210$

count no. of set bits  
for all nos. from

$x/2$

$[x/4] * 2 + (x \% 4)$

$b = 4 \Rightarrow 2^{\text{nd}} \text{ bit is set}$

$b = \text{XOR of all elements}$