

13 May 2023

Some imp tricks:

① Divide by 2 : $x \gg= 1$ means $x = x \gg 1$

$$x = 10 \quad \text{i.e. } 1010$$

$$x \gg 1 \quad 0101 \quad \text{i.e. } 5$$

② Multiply by 2: $x \ll= 1$

$$x = 7 \quad \text{i.e. } 0111$$

$$x \ll 1 \quad 1110 \quad \text{i.e. } 14$$

③ Find rightmost digit of a no. : $x \& 1$

④ Clear the lowest set bit for x : $x \& (x-1)$

⑤ Extracting the lowest set bit of x : $x \& \sim(x-1)$

⑥ Clearing all the bits from LSB to i th bit
 $\text{bitmask} = \sim((1 \ll i) - 1); x \& = \text{mask}$

⑦ Clearing all bits from MSB to i th bit
 $\text{bitmask} = (1 \ll i) - 1; x \& = \text{mask}$

⑧ A number x with lowest cleared bit set.
 $x | (x+1)$

⑨ Extract the lowest cleared bit of x
 $x | \sim(x+1)$

⑩ Checking if a no x is a power of 2 or not

if $(x \& \sim(x \& (x-1))) == 1$ then x is a power of 2.

Bitwise & Logical operators:

$$2 \mid 1 = 3$$
$$2 \& 1 = 0$$

$$2 \parallel 1 = \text{true}$$
$$2 \& 1 = \text{true}$$

// WAP that uses function to count the number of 1 bits in an integer

```
5
6 public static int countOnes(int num)
7 {
8     int count = 0;
9     while(num!=0)
10    {
11        System.out.println("num&1: "+(num&1));
12        count += num&1;
13        num >>= 1;
14        System.out.println("num: "+num);
15    }
16    return count;
17 }
18
```

23 = 10111

count = 4

num&1: 1 ✓
num: 11 ✓
num&1: 1 ✓
num: 5 ✓
num&1: 1 ✓
num: 2 ✓
num&1: 0 ✓
num: 1 ✓
num&1: 1 ✓
num: 0 ✓
The number of 1 bits in 23 is 4
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J Main.java 1 x

J Main.java > Main > countOnes(int)

$$(23)_{10} = (10111)_2$$

```

4 public class Main {
5
6     public static int countOnes(int num)
7     {
8         int count = 0;
9         while(num!=0)
10        {
11            System.out.println("num&1: "+(num&1));
12            count += num&1;
13            num >>= 1;
14            System.out.println("num: "+num);
15        }
16        return count;
17    }
18

```

$$\begin{array}{r} \text{num} = 23 \text{ } \& 2 \\ \text{count} = 0 + 23 \text{ } 4 \end{array}$$

$$\begin{array}{r} \text{num} \& 1 \\ 10111 \\ \underline{20000} \\ 00001 = 1 \end{array}$$

$$10111 \rightarrow (1011)_2 \rightarrow (11)_{10}$$

$$\begin{array}{r} \text{num} \& 1 = \\ 1011 \\ \underline{0000} \\ 0001 = 1 \end{array}$$

$$1011 \rightarrow (101)_2 \rightarrow (5)_{10}$$

PROBLEMS 1 OUTPUT DEBUG CONSOLE TERMINAL

```

num&1: 1 ✓
num: 11 ✓
num&1: 1 ✓
num: 5 ✓
num&1: 1 ✓
num: 2 ✓
num&1: 0 ✓
num: 1 ✓
num&1: 1 ✓
num: 0 ✓
The number of 1 bits in 23 is 4
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```

$$\begin{array}{r} \text{num} \& 1 \Rightarrow \\ 101 \\ \underline{000} \\ 001 = 1 \end{array}$$

$$101 \rightarrow (10)_2 \rightarrow (2)_{10}$$

$$\begin{array}{r} \text{num} \& 1 \Rightarrow \\ 10 \\ \underline{01} \\ 01 = 1 \end{array}$$

$$10 \rightarrow (1)_2 = (1)_{10}$$

0 1 Live Share

Ln 7, Col 6 Spaces: 4 UTF-8 LF {} Java

// WAP that finds the pair of integers in an array with minimum XOR value.

{ 3, 6, 9, 2, 7, 1 }

Pair	XOR
3, 6	5
3, 9	10
3, 2	1
3, 7	4
3, 1	2
6, 9	15
6, 2	4
6, 7	1
6, 1	7
9, 2	11
9, 7	14
9, 1	8
2, 7	5
2, 1	3
7, 1	6

Min = 1

$$\begin{array}{r} 3 = 0011 \\ 6 = 10110 \\ \hline 0101 = 5 \end{array}$$