MATHS...

video-14

Leetcode - 342

Easy

Power Of Four

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Company :- Two Sigma

342. Power of Four

Easy 3.3K 351

Companies

Given an integer `n`, return `true` *if it is a power of four. Otherwise, return* `false`.

An integer `n` is a power of four, if there exists an integer `x` such that `n == 4^x`.

Example 1:

```
Input: n = 16
Output: true
```

$16 = 4 * 4 = 4^2$

Example 2:

```
Input: n = 5
Output: false
```

$\rightarrow 5 \neq$

Example 3:

```
Input: n = 1
Output: true
```

$\rightarrow 4^0 = 1$

Approach-1 (simple loop)

$n = 64$

$\cancel{4} * \cancel{4} * \cancel{4}$

$64 \% 4 = 0$	$16 \% 4 == 0$	$4 \% 4 == 0$
Yes	Yes	Yes

T.C :: $\boxed{\log_4(n)}$

$n = 12/4$

$12 \% 4 == 0$
Yes

$3 \% 4 == 0$
No.

1 ⇒

```
while (n % 4 == 0) {
        n = n/4;
}
→ if (n == 1)
        return True.
r False.
```

Approach - 2.

Math.

n

$$4^x = n$$

$$x = \log_4 n$$

$$x = (\log_e n / (\log_e 4))$$

$n = 64$

$x = \log 64 / \log 4 \simeq \frac{4.1588}{1.3}$

$= 3$

$4^x \; ? \; 64$

$(4^3 == = 64)$ True.

F =

$n = 12$

$x = \log 12 / \log 4 \simeq 1$

$4^x \; ? \; 12$

$4^1 \neq 12 \quad r = 9$

$\log(n)$ ← int x = $\log(n) / \log(4)$

$\log(x)$ ← if (pow(4, x) == n)
ret True;

el False.

$\log(n) + \log(x)$

Approach - 3.

n = 8 = 1000
7 = 0111
0000

Maths + Bit Magic.

$n \& (n-1) == 0$

$$4^x = \boxed{(2^2)^x} = 2^{2x}$$

(•) Every n which is Power of 4 MUST be Power of 2 also.

(•) Every n which is Power of 4 has a property as follows :-

$4 - 1 = 3$ | $16 - 1 = 15$ | $64 - 1 = 63$ .....

$$(n-1) \% 3 == 0$$

$$(4^x - 1) \% 3 == 0$$

Proof:- (Induction)

$4^k - 1 = 3x$

$4^k = (3x+1)$

Assume:- K, $(4^k - 1) \% 3 == 0$

$(k+1) \Rightarrow (4^k - 1) \rightarrow (4^{k+1} - 1)$

$$(4^k \cdot 4) - 1 \rightarrow$$

$$[(3x+1) \cdot 4] - 1$$

$$(12x + 4) - 1$$

$$12x + 4 - 1 = 12x + 3$$

$$= \boxed{3(4x+1)}$$

$$(4^k - 1) \% 3 == 0$$

if(n == 0) Fa...

if ($(n \& (n-1)) == 0$ && $(n-1) \% 3 == 0$)

re True.