Q Given a no. N. Count the factors of N.

```
int countFactors(int N){
    int c = 0;
    for(i = 1; i <= N; i++){
        if(N % i == 0){
            c++;
        }
    }
    return c;
}
```

\# of iterations = N.

Assumption:

10^8 iterations in 1 second.

$N = 10^9 \Rightarrow$ # of iterations $= 10^9$

10^8 iterations $\longrightarrow$ 1 second

10^9 " $\longrightarrow \frac{10^9 \times 1}{10^8}$

$\Rightarrow$ 10 second.

$\boxed{N = 10^{18}} \Rightarrow$ # of iterations $= 10^{18}$

$\Rightarrow \frac{10^{18}}{10^8}$ seconds

$\Rightarrow 10^{10}$ seconds $\Rightarrow$ 317 years

You $\longrightarrow$ Kids $\longrightarrow$ Grandkids $\longrightarrow$ 4th Gen $\longrightarrow$ 5th Gen

If a, b, N are 3 positive integers

$\rightarrow a * b = N \longrightarrow \boxed{\frac{N}{a} = b}$

$\rightarrow$ a, b are factors of N

$\rightarrow a, \frac{N}{a}$ are factors of N.

$\Rightarrow$ If a is a factor of N,
then $\frac{N}{a}$ will also be factor of N. } (1)

$N = 24$

i	N/i	count
1	24	+2
2	12	+2
3	8	+2
4	6	+2
6	4	
8	3	
12	2	
24	1	

8

$\boxed{i <= \frac{N}{i}}$

$\boxed{i^2 <= N}$

$\boxed{i <= \sqrt{N}}$

$\boxed{i_{max} = \sqrt{N}}$ ✓

$i \times i <= N$

$N = 100 \rightarrow 9$

i	N/i	count
1	100	+2
2	50	+2
4	25	+2
5	20	+2
10	10	+1
20	5	
25	4	
50	2	
100	1	

9

```
int countFactors(int N) {
    int c = 0;                    [1, √N]
    for( i = 1; i*i <= N; i++) {
        if(N % i == 0) {
            if (i == N/i) {
                c = c+1;
            }
            else {
                c = c+2;
            }
        }
    }
    return c;
}
```

$\#$ of iterations $= \sqrt{N}$

$N = 10^{18}$

$\#$ of iterations $= \sqrt{10^{18}}$
$= 10^9$

10^8 iterations – 1 sec

10^9 " – 10 sec

$\boxed{317 \text{ years} \longrightarrow 10 \text{ sec}}$

Carl Friedrich Gauss :-

$S = 1 + 2 + 3 + 4 + \cdots + 96 + 97 + 98 + 99 + 100$

$S = 100 + 99 + 98 + 97 + \cdots + 5 + 4 + 3 + 2 + 1$

$+$

$2S = 101 + 101 + 101 + 101 + \cdots + 101 + 101 + 101 + 101 + 101$

$2S = 100 * 101$

$S = \frac{100 \times 101}{2} = 5050$

$S = 1 + 2 + 3 + \cdots + N-2 + N-1 + N$

$S = N + N-1 + N-2 + \cdots + 3 + 2 + 1$

$+$

$2S = (N+1) + (N+1) + (N+1) + \cdots + (N+1) + (N+1) + (N+1)$

$2S = N * (N+1)$

$$\boxed{S = \frac{N * (N+1)}{2}}$$

$\rightarrow 1, 2, 3, 4, 5$

$0, 1, 2, 3, 4,$

Sum of 1st N whole Numbers :-

$0 + 1 + 2 + \cdots + N-1$

$(1 + 2 + 3 + \cdots + N-1) \Rightarrow$ first N-1 Natural Numbers.

$$\boxed{S \Rightarrow \frac{(N-1) * (N)}{2}}$$

$$S = \frac{N*(N+1)}{2} - N$$

5 Min Break

$\frac{8}{2} = 4$ $\qquad$ $\frac{7}{2} = 3$

- Given N, Number of times we need to divide it by 2 until it becomes 1. $\Rightarrow \boxed{\text{floor}(\log_2 N)}$

$$\boxed{\log_{a^t} a^m = m}$$

$N = 2 \xrightarrow{/2} 1$

$N = 4 \xrightarrow{/2} 2 \xrightarrow{/2} 1$

$N = 8 \xrightarrow{/2} 4 \xrightarrow{/2} 2 \xrightarrow{/2} 1$

$N = 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1$

Ans	N	ans
1	2^1	$\log_2 2^1 = 1$
2	2^2	$\log_2 2^2 = 2$
3	2^3	$\log_2 2^3 = 3$
4	2^4	$\log_2 2^4 = 4$

$N = 32 \rightarrow 16$ 5 2^5 $\log_2 2^5 = 5$

$N = 9 \rightarrow 4 \rightarrow 2 \rightarrow 1$ 3 2^3 $\log_2 9 = 3$

$N = 27 \rightarrow 13 \rightarrow 6 \rightarrow 3 \rightarrow 1$ 4 2^4 $\log_2 27 = 4$

Given a **perfect square**. Find the square root of it.

$i * i = N$

Amazon MCQ

```
int sqrt(int N) {
    for(i = 1; i <= N; i++) {
        if (i * i == N) {
            return i;
        }
    }
}
```

$N = 36$ → 6 iterations

i	
1	✗
2	✗
3	✗
4	✗
5	✗
6	✓

$i = \sqrt{N}$

$N = 100$

$\rightarrow 10$

$i = 1$ to $\sqrt{N}$

# of iterations $= \sqrt{N}$

$\sqrt{N} \in [1, N]$

$N = 100$

$m = \frac{l+r}{2}$

$\rightarrow [1, 100]$

100

mid = 50

$50 * 50 > 100$

$\underbrace{1, 2, 3, \ldots 49}$ 50, 51, 52, 53, - - - -

$[1, 49]$

50

mid = 25

$25 * 25 > 100$

$\underbrace{1, 2, \ldots 24}$ 25, 26, 27, - - - -

$[1, 24]$

25

mid = 12

$12 * 12 > 100$

$\underbrace{1, \ldots 11}$ 12, 13, - - - - - -

$[1, 11]$

12

mid = 6

$6 * 6 < 100$

1, 2, 3, 4, 5, 6 7, 8, - - 11

$[7, 11]$

6

mid = 9

$9 * 9 < 100$

7, 8, 9, 10, 11

$[10, 11]$

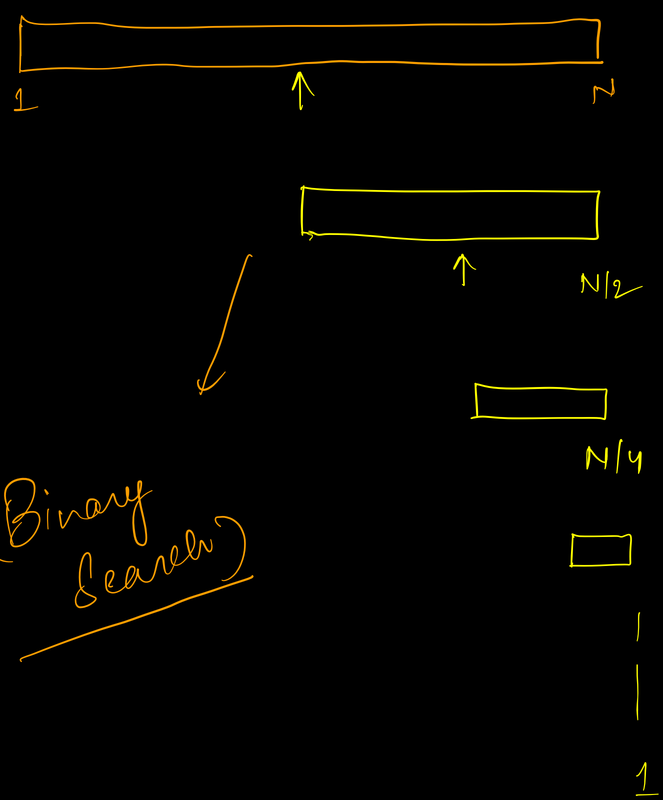
3

mid = 10

$10 * 10 = 100$

Stop

$\Rightarrow$ 10 is the answer



(Binary Search)

$l = h$

$N \rightarrow \frac{N}{2} \rightarrow \frac{N}{4} \rightarrow \cdots$

$\log_2 N$

$32 = \log_2 2^{32}$

	$\sqrt{N}$	$\log_2 N$
$N = 2^{32}$	2^{16}	32
$N = 2^{64}$	2^{32}	64

Power of Observation

Walkthrough of Intermediate Sessions :-

1) Time Complexity & Space Complexity (2)

2) Arrays (6)
   - → Intro to Arrays
   - → Prefix Sums
   - → Carry forward technique
   - → Subarrays | Sliding window | Contribution technique
   - → 2D Matrices
   - → Interview Problems

3) Bit Manipulations (2)

4) Maths & Arrays (2)

5) Sorting | Strings | Hashmaps (4)

6) Recursion (2)

7) Subset & Subsequences (1)

8) Linked Lists Basics

9) Stacks | Queues

24 sessions

(0) Binary Trees (2)

DSA Advances - 4 1/2 months

CS fundamentals

Thank You