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IIT BHU MNC

2.5 years

WorldQuant LLC

Google, banglore SWE

Intermediate DSA

2-2.5 months

Advanced DSA

4-4.5 months

Q. Prime Numbers.

$N = 1$

1 & itself.

$N = 1$

No of factors = 2.

$N = 17$

$N = 16$

Count no of factors

$= 2$

$N = 10$

$1 \rightarrow N$

1 2 3 4 5 6 7 8 9 10
✓ ✓ ✗ ✗ ✓ ✗ ✗ ✗ ✗ ✓

no = 4

```

int cnt = 0
for( int i = 1 ; i <= N ; i++)
{
    // check if i is a factor
    if ( N % i == 0 )
        cnt++
}

```

```

if ( cnt == 2 )

```

```

    print ( "Prime" )

```

```

else

```

```

    print ( "Not Prime" )

```

10^8 iterations \rightarrow 1 second

$N = 10^8$ = 1 sec

$N = 10^9$ = 10 sec

10 crore pen = 1 Rs

100 crore pen = 10 Rs.

10 pen \rightarrow 1 Rs 10^8 iteration \rightarrow 1 sec
 1 pen \rightarrow $\frac{1}{10}$

1 iteration \rightarrow $\frac{1}{10^8}$ sec

$$10^8$$

$$10^9 \text{ iteration} \rightarrow \left(\frac{1}{10^8} \right) \times 10^9 = 10 \text{ sec}$$

$$18$$

$$N = 10$$

$$10^8 \text{ iteration} \rightarrow 1 \text{ sec}$$

$$1 \text{ iteration} \rightarrow \frac{1}{10^8} \text{ sec}$$

$$10^{18} \text{ iteration} \rightarrow \left(\frac{1}{10^8} \right) \times 10^{18}$$

$$= \frac{10^{18}}{10^8} = 10^{10} \text{ second}$$

1)

317 years

You \rightarrow Kids \rightarrow grandchids \rightarrow kid \rightarrow 5th gen

$$\frac{24}{3} = 8 \quad \frac{24}{8} = 3$$

integer
↓

$$N = 24$$

$$\frac{24}{2} = 12$$

$$j \quad N/j$$

$j = 1$	24
$j = 2$	12
$j = 3$	8
$j = 4$	6
$j = 6$	4
8	3
12	2
24	1

$$N = 24$$

$j = 1$	24
$j = 3$	8
$j = 7$	3
$j = 24$	1

$$j \leq \sqrt{N}$$

$$j * j \leq N$$

$$a * \frac{N}{a} = N$$

\uparrow factor \uparrow factor

$$(j * j)_{max} = N$$

$$(j)_{max} = \sqrt{N}$$

$$a \leq \sqrt{N}$$

$$(a)_{max} = \sqrt{N}$$

$$N = 16$$

$$\text{int cnt} = 0$$

$$\text{for}(i = 1 ; i \leq \sqrt{N} ; i++)$$

$i = 1$	16
$i = 2$	8
$i = 4$	4
$i = 8$	
$i = 16$	

\int

 if ($N \% i == 0$)

 // i & N/i are factors

{

cnt = cnt + 2

if (i*i == N) cnt--

if (cnt == 2)

print ("Prime")

else

print ("Not Prime")

cnt = 2
cnt = 4
cnt = 6
5

No of iteration = \sqrt{N}

$N = 10^{10}$

No of it = 10^5

10^8 iteration \rightarrow 1 sec

1 it $\rightarrow \frac{1}{10^8}$ sec

10^5 it $\rightarrow \frac{1}{10^8} \times 10^5$

$\rightarrow \frac{1}{10^3} = 0.001$ sec

$N = 10^{18}$

No of iteration = 10^9

$\frac{1}{10^3} \times 10^9 = 10^6$ sec.

108 ~ 10

Card gauss

(4th class)

$$S = 1 + 2 + 3 + \dots + 99 + 100$$

$$S = 100 + 99 + 98 + \dots + 3 + 2 + 1$$

$$2S = 101 + 101 + 101 + \dots + 101 + 101$$

$$2S = 100 \times 101$$

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

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

$$\log_a b = x$$

$$a^x = b$$

$$\log_2 16 = 4$$

$$2^4 = 16$$

$$\log_3 9 = 2$$

$$3^2 = 9$$

$$\log_4 4 = 1$$

$$4^1 = 4$$

$$\log_2 10 \approx 3.32$$

$$2^3 = 8$$

$$2^4 = 16$$

$$\log_2 2^6 = 6$$

$$2^x = 2^6$$

Q. Given N. How many times we need to divide it by 2, till it become 1

Integer division

$$\text{ans} = 2$$

$$7 \xrightarrow{/2} 3 \xrightarrow{/2} 1$$

$$10 \rightarrow 5 \rightarrow 2 \rightarrow 1$$

$$\text{ans} = 3$$

Input

$$N = 1$$

ans

N

$$0$$

$$2^0$$

$$N = 2 \rightarrow 1$$

$$1$$

$$2^1$$

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

$$2$$

$$2^2$$

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

$$3$$

$$2^3$$

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

$$4$$

$$2^4$$

$$N = 15 \rightarrow 7 \rightarrow 3 \rightarrow 1 \quad 3.32$$

$$N = 25 \rightarrow 12 \rightarrow 6 \rightarrow 3 \rightarrow 1 \quad 4$$

$$\text{ans} = \left(\log_2 N \right)_{\text{integer part}}$$

Q. Given a perfect square. Find square root of Given number.

$$N = 49$$

$$\text{ans} = 7$$

$$N = 81$$

$$\text{ans} = 9$$

$$2 \times 2 = 4$$

$$3 \times 3 = 9$$

$$4 \times 4 = 16$$

$$5 \times 5 = 25$$

$$6 \times 6 = 36$$

$$7 \times 7 = 49$$

$$8 \times 8 = 64$$

$$9 \times 9 = 81$$

$$10 \times 10 = 100$$

$$11 \times 11 = 121$$

$$12 \times 12 = 144$$

⋮

int Sqrt(int N)

```

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

```

$$N = 49$$

$$i = 1$$

N

X

Sqrt(N)

✓

$$j = 2$$

$\log N$ X

$$j = 3$$

$$j = 4$$

$$j = 5$$

$$j = 6$$

$$j = 7$$

$$N = 10^{10}$$

$$t = 0.001 \text{ sec}$$

$$N = 10^{18}$$

$$t = 10 \text{ sec}$$

$$N = 100$$

$$j = 50$$

$$[1, 100]$$

$$50 \times 50 > 100$$

1 2 3 ... 49

50 51 ... 100

$$[1, 49]$$

$$25 \times 25 > 100$$

1 2 3 ... 24

25 26 ... 49

$$[1, 24]$$

$$12 \times 12 > 100$$

$$[1, 11]$$

$$6 \times 6 < 100$$

1 2 ... 4 5 6 7 8 ... 11

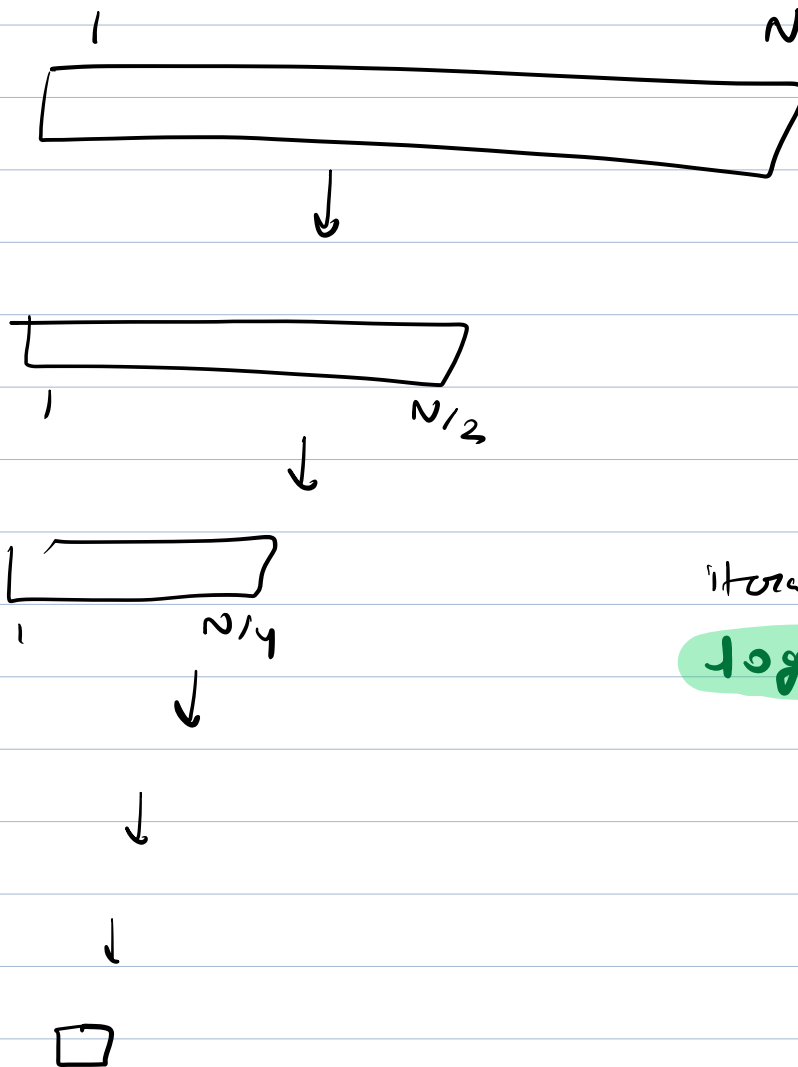
[7, 11]

$$9 \times 9 < 100$$

7 8 9 10 11

[10, 12]

$$10 \times 10 = 100$$



iteration =

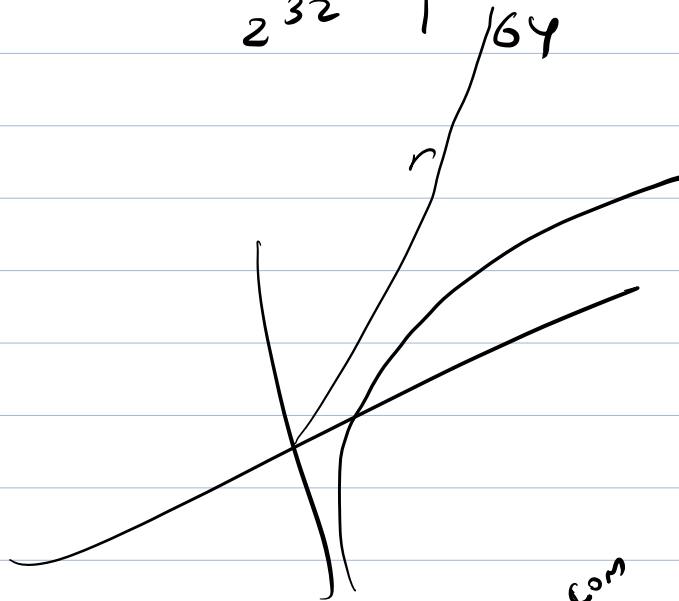
$$\log_2 N$$

$$N = 1024 = 2^{10}$$

$$N = 2^{32}$$

$$N = 2^{64}$$

$\text{sqrt}(N)$	$\log(N)$
32	10
2^{16}	32
2^{32}	64



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