

Hello Everyone

→ Welcome to Scales

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→ Interned at FDI

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→ worked full time

- Microsoft (SDE)
- Pepcoding → Co-founder
- Scales (SD and Instructor)

Today's Content :-

→ Count no. of factors

→ Gauss Sum

→ Divide num/2 till it reaches 1

→ S & +

→ How to make best of course.

FAQ's a) Notes will be uploaded right after session

b) Assignments will be unlocked once session ends

c) No dead line for assignments.

d) No attendance during doubt session

e) Language Independent, ~~2~~ 3 ends Code 3

## Quote

I wanted the reward and not the struggle.

I wanted the result and not the process.

I was not in love with the fight but only the victory.

And life doesn't work that way.



Count no. of factors

Q1: Is 4 a factor of 24  $\rightarrow$  yes,  $24 \div 4 = 6$

$N = 10$ :  $\rightarrow \{1, 2, 5, 10\} \rightarrow 4$

$N = 12$ :  $\rightarrow \{1, 2, 3, 4, 6, 12\} \rightarrow 6$

$\rightarrow$  Ans:  $10^8$  iterations per sec

int countFactors(N) {

int c = 0;

for (i = 1; i <= N; i++) {

if (N % i == 0) {

c = c + 1;

}

}

return c;

}

Input

12

Iterations

12

$10^8$

$10^8$

N

N

$10^8$  iter = 1 sec

1 iter =  $\frac{1}{10^8}$  sec

$10^8$  iter =  $\frac{1}{10^8} \times 10^9$  sec  
= 10 sec

Input

$10^8$

Iterations

$10^8$

Execution Time

1 sec

$10^9$

$10^9$

10 sec

$10^{18}$

$10^{18}$

$\frac{1}{10^8} \times 10^{18}$  sec  $\rightarrow 10^{10}$  sec

$\downarrow$

317 years

Q2:  $S = 10$

$$i \nmid j = N$$

$(i \text{ \& } j \text{ are factors of } N)$

$$j = N/i$$

$(i \text{ \& } \frac{N}{i}) \text{ are factors of } N.$

$$2 \nmid 6 = 12$$

$$55 \times 2 = 110$$

2 is a factor of 10

$\frac{10}{2}$  is also a factor of 10

after this point selection starts

$$N = 24$$

$$N = 100$$

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

$$i \leq N/i$$

$$i^2 \leq N$$

$$i \leq \sqrt{N}$$

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

$$36 \rightarrow (1 \text{ to } 6)$$

i	$N/i$
1	36
2	18
3	12
4	9
6	6



```
int CountFactors(n) {
```

```
    int c = 0;
```

```
    for (i = 1; i <=  $\sqrt{n}$ ; i++) {
```

```
        if (n % i == 0) {
```

```
            if (i == n/i) {
```

```
                c = c + 1;
```

```
            } else {
```

```
                c = c + 2;
```

```
            }
```

```
    return c;
```

Input

16

100

N

$10^8$

Output

4

10

$\sqrt{n}$

$\sqrt{10^8}$

= 10000

10 seconds

↑

huge impo.

over 3/4

years

Intermediate

↳ Increasing observation skills.

↳ Learn interesting techniques

Tricks:-

Shilpa:

↳ 4th class

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

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

---

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

---

$$2S = (101) \times (100)$$

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

# Sum of first  $n$ , natural numbers

$$= \frac{n \times (n+1)}{2}$$

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

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

---

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

---

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



## log Basics

$\log_b^a = c$ ,  $b^c = a$  } To what power we need to raise  $b$  to get val  $a$ ?

$$\log_2^{64} = 6$$

$$\log_2^8 = 3$$

$$\log_3^{27} = 3$$

$$\log_2^{10} = \underline{3}$$

$$\log_5^{25} = 2$$

$$\log_2^{32} = 5$$

$$\log_2^{40} = 5$$

$$\log_2(2^{10}) = 10$$

$$\log_a a^n = n$$

very important

$$\log_3 3^5 = 5$$

$$N = 2^k \Rightarrow (\log_2 N) = k$$

// Given +ve  $N$ , how many times, we  
need to divide it by 2, until it reaches 1  
↳ Next session 3

$N$ ;

1

2

4

8

9

12

24

16

32



## Perfect Square

Given  $N$  a perfect square find  $\text{sqrt}(N)$

$$N = 25 \rightarrow 5$$

$$N = 36 \rightarrow 6$$

$$N = 49 \rightarrow 7$$

$$N = 30 \rightarrow \{\text{not a valid input}\}$$

int  $\text{sqrt}(N)$

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

Calculate iterations

a)  $N$     b)  $N/2$

c)  $\log_2 N$     d)  $\sqrt{N}$

$N = 36 = 1, 2, 3, 4, 5, 6$  {return 6} # 6 iterations

$N = 64 = 1, 2, 3, 4, 5, 6, 7, 8$  {return 8}

$N = 25 = 1, 2, 3, 4, 5$  {return 5}

10: 16 pm  $\rightarrow$  10: 26 pm  $\rightarrow$  Break

## Sqrt (n)

Note: If  $N$  is not perfect square, return floor ( $\sqrt{N}$ )

$$N = 49 \rightarrow 7$$

$$N = 60 \rightarrow 7$$

$$N = 31 \rightarrow 5$$

$$N = 29 \rightarrow 5$$

$$N = 16 \rightarrow 4$$

floor Sqrt (n) {

$i = 1, ans = 1$

while ( $i * i \leq N$ ) {

$ans = i$

$i = i + 1$

return ans;

$i = [1, \sqrt{n} + 1]$

Code 5n  
iterations

$N = 50$

$i \quad i * i = 50$

1  $ans = 1$

2  $ans = 2$   $2 * 2 = 4$

3  $ans = 3$   $3 * 3 = 9$

4  $ans = 4$   $4 * 4 = 16$

5  $ans = 5$   $5 * 5 = 25$

6  $ans = 6$   $6 * 6 = 36$

7  $ans = 7$   $7 * 7 = 49$

8  $\times$  break  $8 * 8 = 64$

$N = 35$

$i \quad i * i$

1  $ans = 1$

2  $ans = 2$

3  $ans = 3$

4  $ans = 4$

5  $ans = 5$

6  $36 > 35$



// sqrt (n)

idea 1  $\rightarrow \{ \sqrt{n} \text{ iterations} \}$

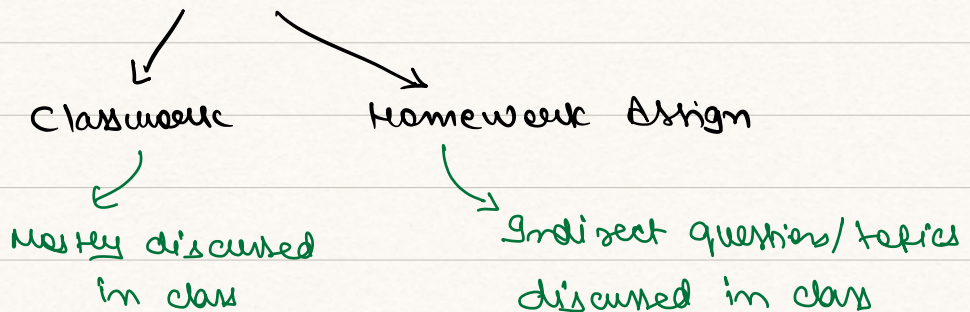
Advance

idea 2

$\{ \log_2 \text{ iterations} \}$

## Expectations :

- 1) Attend session
- 2) Revise notes
- 3) Solve assignments



## 4) Doubts



a) please ask live in class

b) Stay back & get it clarified in doubt session

a) debug in your own

b) Raise a TA request

c) Doubt session

d) Once in 2/3 weeks

Problem Solving session  
↳ recorded

non session days

→ Problems with most doubts  
↳ optional

## 5) Join on Time

6) If you miss

- watch recordings
- At least revise notes