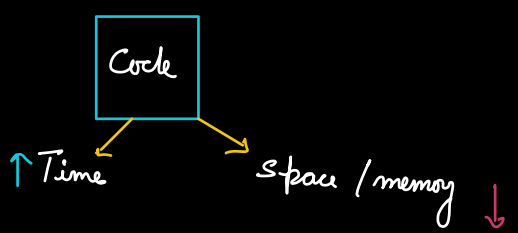
FAQs

* Notes will be in the dashboard after the class.
* Assignment will get unlocked after the session ends.
* HW has to be unlocked manually.
* No deadlines for ass or HW.
* During the doubt session, attendance will not be counted.
* Language Agnostic { Pseudo code }



Prime Numbers

Any positive number that has exactly 2 factors.

1 ⟶ Neither prime nor composite

2 ⟶ 1, 2 ⇒ 2

3 ⟶ 1, 3 ⇒ 2

10
→ 2, 5
1, 10
4 → 1, 2, 4

2, 3, 5, 7, 11, 13, 17, 19 ....

Q Given a no. Write a fn that returns true if the no. is a prime no.

To: Everyone

→ Count the no. of factors
→ if count == 2 → true
else → false.

```
boolean checkPrime (N) {
    Count = 0;
    for (i=1; i<=N; i++) {
        if (N % i == 0) {
            count++;
        }
    }
    if (count == 2)
        ret true;
    else
        ret false;
}
```

i : [1, N]

Assumption

10^8 iterations ⟶ 1 sec

$N = 10^9$ ⟶ 10^9 iterations ⟶ $\frac{10^9}{10^8}$ sec = 10 sec

$N = 10^{18}$ ⟶ 10^{18} iterations ⟶ $\frac{10^{18}}{10^8} = 10^{10}$ sec

→ 317 years

You → Kids → Grad Kids → 4th → 5th → 6th → Shoaib Malik

If a & b are two the no.

if $a \times b = N$ ⟶ a & b are factors of N

$\Rightarrow b = N/a$

$\{a, b\}$ factors of N

$\{a, N/a\}$ factor of N

If a is a factor of N

$\Rightarrow N/a$ is also a factor of N

$N = 24$

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

$N = 100$

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

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

$$\Rightarrow i \times i <= N$$

$$\Rightarrow i^2 <= N$$

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

```
boolean checkPrime (N) {
    count = 0;
    for (i=1; i<=√N; i++) {        // i*i <= N
        if (N % i == 0) {
            if (i == N/i) {
                count++;
            }
            else {
                count = count + 2;
            }
        }
    }
    if (count == 2)
        ret true;
    else
        ret false;
}
```

$i : [1, \sqrt{N}]$

$\sqrt{N}$ iterations

$N = 10^{18} \longrightarrow \sqrt{10^{18}}$ iterations $\longrightarrow 10^9$ iterations $\longrightarrow$ 10 sec

Carl Friedrich Gauss
(4th Grade)

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

$$+ \quad S: 100 + 99 + 98 + 97 + \cdots + 4 + 3 + 2 + 1$$

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

$$2S = 101 \times 100$$

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

$$S = 5050$$

$\log_a b$

$a^{(k)} = b$

$\log_2 32 \longrightarrow \log_2 (2^5) \longrightarrow 5$

$\log_2 16 \longrightarrow \log_2 (2^4) \longrightarrow 4$

$\log_2 18 \longrightarrow 4.\text{somethg}$

$\log_2 20 \longrightarrow 4.\text{somethg}$

$\log_2 30 \longrightarrow 4.\text{somethg}$

$\log_2 N$

$N = 1$

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

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

$N = 7 \xrightarrow{\div 2} 3 \xrightarrow{\div 2} 1$

$N = 8$

$\log_2 1 \rightarrow 0$

$\log_2 2 \rightarrow 1$

$\log_2 4 \rightarrow 2$

$\log_2 7 \rightarrow 2$

$\log_2 8 \rightarrow 3$

$N = 55 \xrightarrow{\div 2} 27 \xrightarrow{\div 2} 13 \xrightarrow{\div 2} 6 \xrightarrow{\div 2} 3 \xrightarrow{\div 2} 1$ $\quad \log_2 55 \rightarrow 5$

$N = 100 \xrightarrow{\div 2} 50 \xrightarrow{\div 2} 25 \xrightarrow{\div 2} 12 \xrightarrow{\div 2} 6 \xrightarrow{\div 2} 3 \xrightarrow{\div 2} 1 \rightarrow 6$

Amazon

Q Given a no which is a **perfect sq.** Write a fn to return the sq root of this number.

10 ✗
100 ✓
121 ✓
144 ✓
1000 ✗

Perfect sq

N is a perfect sq if $\sqrt{N}$ is an integer

i.e. there must exist an integer x such that

$x \times x = N$

$x : [1, N]$

$\sqrt{N}$ ↓ $N/2$

```
fn(i=1; i<=N; i++){
    if(i*i == N){
        ret i;
    }
}
```

→ $\sqrt{N}$ iterations

N = 144

i
1
2
3
4
⋮
11
12 → 12×12 ⇒ 144 =

What if...

Don't ask anyone, until you yourself fail to find the ans.

- Write down the qns
- 30 min (with 0 help)
- Google (Stackoverflow, Git hub, medium)
- TA / Peers / Instr

$N = 2^{32}$ ⟶ 2^{16} iteration

10^8 iter ⟶ 1 sec

$2^{10} = 1024$
$\approx 10^3$

$2^{10} \longrightarrow 10^3$

$$\frac{2^{16}}{10^8} = \frac{2^{10} \times 2^6}{10^8} = \frac{10^3 \times 2^6}{10^8} = \frac{64}{10^5} \text{ sec}$$

$N = 2^{64}$ ⟶ 2^{32}

$$\frac{2^{32}}{10^8} = \frac{2^{10} \times 2^{10} \times 2^{10} \times 2^2}{10^8} \text{ sec}$$

$$= \frac{10^9 \times 2^2}{10^8}$$

$$= 40 \text{ sec}$$

$N = 100$ [1, 100]

1 x 1
2 x 2
3 x 3
4 x 4
5 x 5
:
10 x 10

N = 100

[1, 100]

50 x 50 > 100

1, 2, 3, 4, 5 ---- 49, 50, 51 ---- 99, 100

[1, 49]

25 x 25 > 100

1, 2, 3, 4 --- 23, 24, 25, 26 --- 48, 49

[1, 24]

12 x 12 > 10

1, 2, 3 --- 11, 12, 13 --- 23, 24

[1, 11]

6 x 6 < 100

1, 2, 3, --- 5, 6, 7, 8 --- 10, 11

[7, 11]

9 x 9 < 100

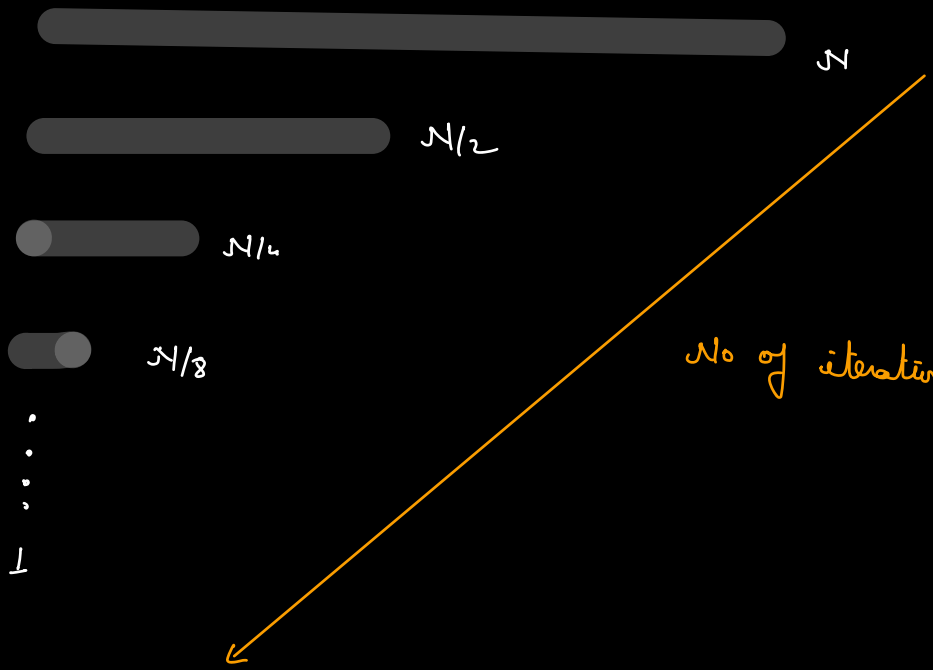
7, 8, 9, 10, 11

[10, 11]

10 x 10 == 100

10, 11

Binary Search



	$\sqrt{N}$	$\log_2 N$
$N = 1024$	$\sqrt{2^{10}} = 2^5 \rightarrow 32$	$\log_2 2^{10} \rightarrow 10$
$N = 2^{32}$	$\sqrt{2^{32}} = 2^{16}$ (65536)	$\log_2 2^{32} \rightarrow 32$
$N = 2^{64}$	$\sqrt{2^{64}} = 2^{32}$ (4,29,49,67,296)	$\log_2 2^{64} \rightarrow 64$