- Why problem solving is imp ?
- Key ingredients of good problem solver.
- Examples
- Ds +

ML / DS , Backend , Frontend

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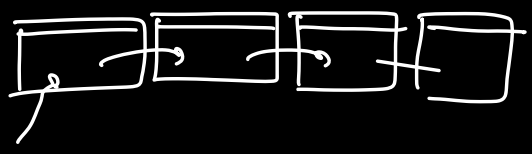
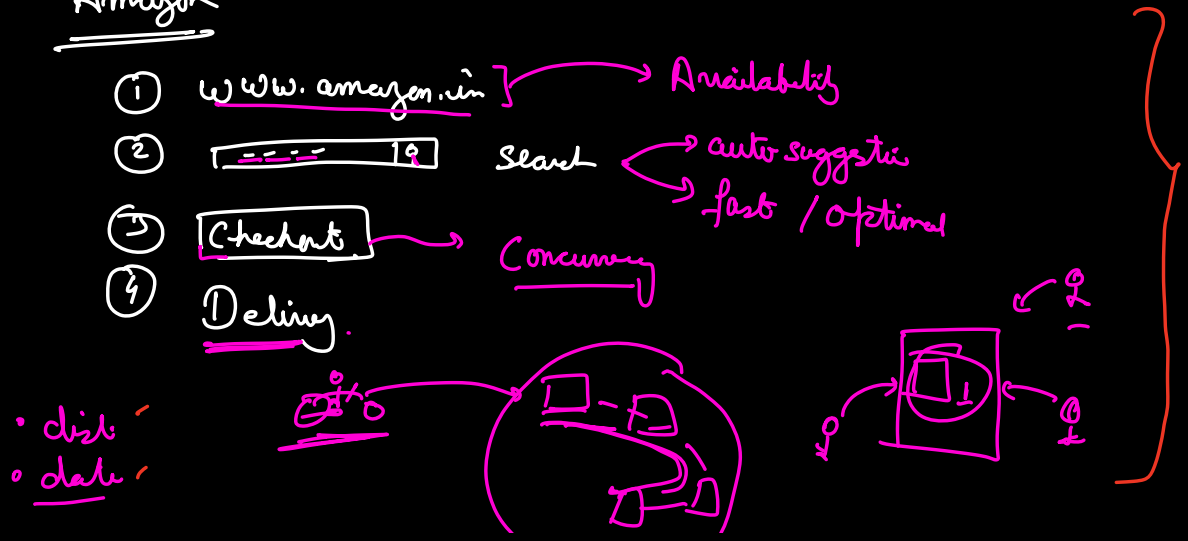
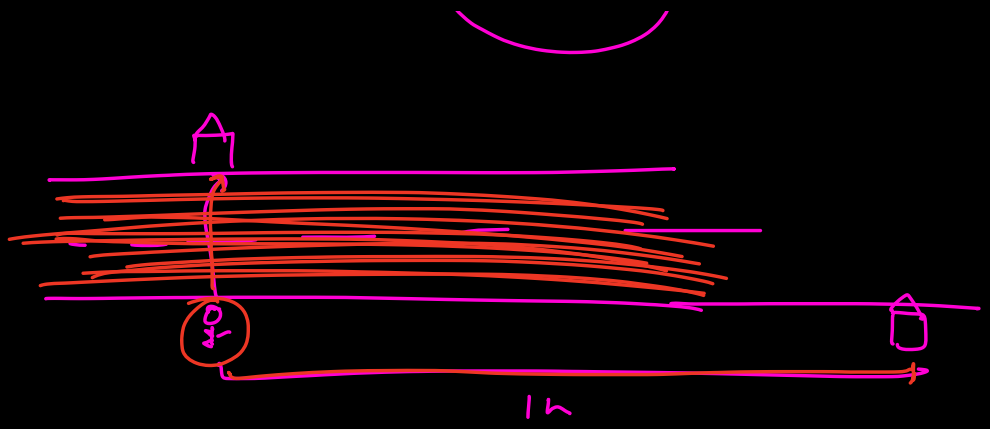
20 year



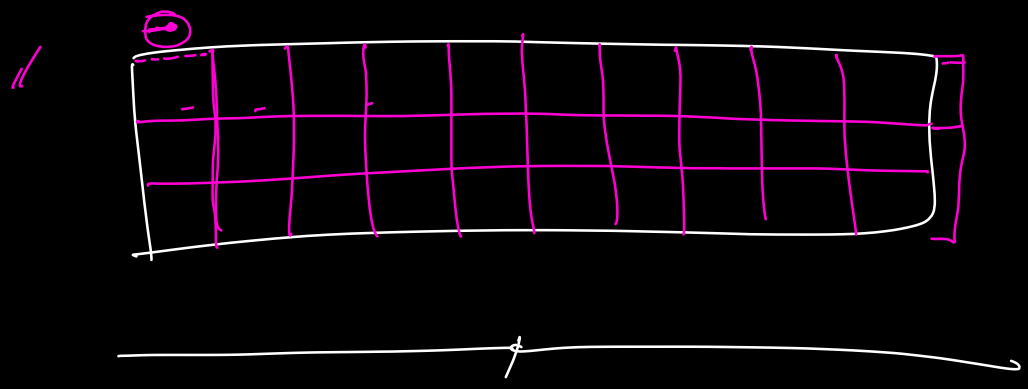
Amazon

1. www.amazon.in → Availability
2. [ ] Search → auto suggestion, fast / optimal
3. Checkout → Concurrency
4. Delivery.





Observation



Germany

4-5 sec

APX

$$S = 1 + 2 + 3 + 4 + \dots + 98 + 99 + 100$$
$$+\ S = 100 + 99 + 98 + 97 + \dots + 3 + 2 + 1$$
$$2S = 101 + 101 + 101 + 101 \dots + 101 + 101 + 101$$

$$2S = 101 \times 100$$

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

Prime Numbers

(Cryptography)

→ +ve number which have exactly 2 factors → 1, N

1 → (1) → Neither Prime Nor Composite

2×3 → 6

2×2 → 4

2×2×2 → 8

Q Given a +ve no. Check if it is prime or not.

```
int cnt = 0;
for (i = 1; i <= N; i++) {
    // check if i divides N
    if (N % i == 0) {
        cnt++;
    }
}
if (cnt == 2)
```

i <= N → (√N)

4 → 1, 2, 4

(N)

ret true :

else

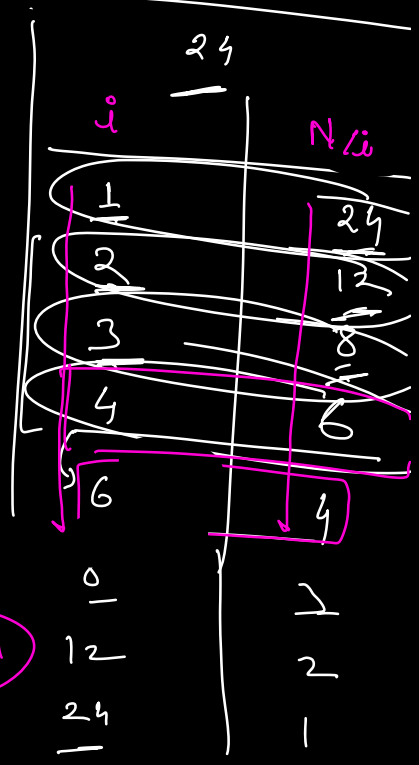
ret false ;

$a \times b = N \Rightarrow b = N/a$

(a, b) are factors of N ?

$(a, N/a)$ are factors of N ?

[if a is a factor of N,
then N/a is also a factor of N



24

i	N/i
1	24
2	12
3	8
4	6
6	4
0	3
12	2
24	1

$a <= N/a$

$c <= 25$

$\rightarrow c_{max} = 24$

$d <= 31$

$d_{max} = 31$

$i <= x$

$i_{max} = x$

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

$\Rightarrow \boxed{i \times i <= N}$

$i_m = \frac{N}{i_m} \Rightarrow i^2 = N$

$\Rightarrow i = \sqrt{N}$

N = 100

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

```
for (i=2; i*i<=N; i++){
        if (N%i == 0)   // if i divides N
            ret false;

}
ret true;
```

1 iteration ≈ 1ms

	N	$\sqrt{N}$
n = 11	11 ms	≈ 3ms
101	101 ms	≈ 10ms
10^6	10^6 ms = 1000s = 16min	$\sqrt{10^6}$ ms = 10^3ms = 1s
10^{18}	= 10^{15} sec	$\sqrt{10^{18}}$ ms = 10^9ms = 10^6s = 11 days.

316887646 years

$\log_a a^b = b$

Other → Maths for prog → log

Given N, How many times we need to divide it by 2 to make it 1.

2^1: $2 \xrightarrow{/2} 1$ (1)

2^2: $4 \xrightarrow{/2} 2 \xrightarrow{/2} 1$ (2)

2^3: $8 \xrightarrow{/2} 4 \xrightarrow{/2} 2 \xrightarrow{/2} 1$ (3)

2^4: $16 \longrightarrow 8 \longrightarrow 4 \rightarrow 2 \rightarrow 1$ (4)

$\log_2 16 = \log_2 2^4 = 4$

$\log_2 N = \log_2 2^k$

$N = 2^k$

$15 \xrightarrow{2} 7 \longrightarrow 3 \longrightarrow 1 \quad \Rightarrow 3$

$\frac{15}{2} = 7.5$

$23 \longrightarrow 11 \longrightarrow 5 \longrightarrow 2 \longrightarrow 1 \quad \Rightarrow 4$

Q Given a perfect sq. Find its sq root.

Amazon

① Private messy

② No code in CLI

$16 \longrightarrow 4$

$25 \longrightarrow 5$

49

121

$i = \sqrt{N}$

$i \times i = N$

$1 \longrightarrow N$

→ Sqrt(N) → Math

→ $i \times i == N$

→ BS

[1 — N]

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

Amazon

$\sqrt{N}$

$N = 100$

$i = 1$ ← $1 \times 1 \neq 10$

$i = 2$ ←

3 ←

⋮

$\Rightarrow i = 10 \quad 10 \times 10 == 100$

$N = \cancel{101}$

is N a perfect sq ?

N = 100

[1 100] |100|

[1 49] |50|

[1 24] |25|

[1 11] |12|

[7, 11]

[10, 11]

mid

50 * 50 > 100 — 51, 52, 53 ...

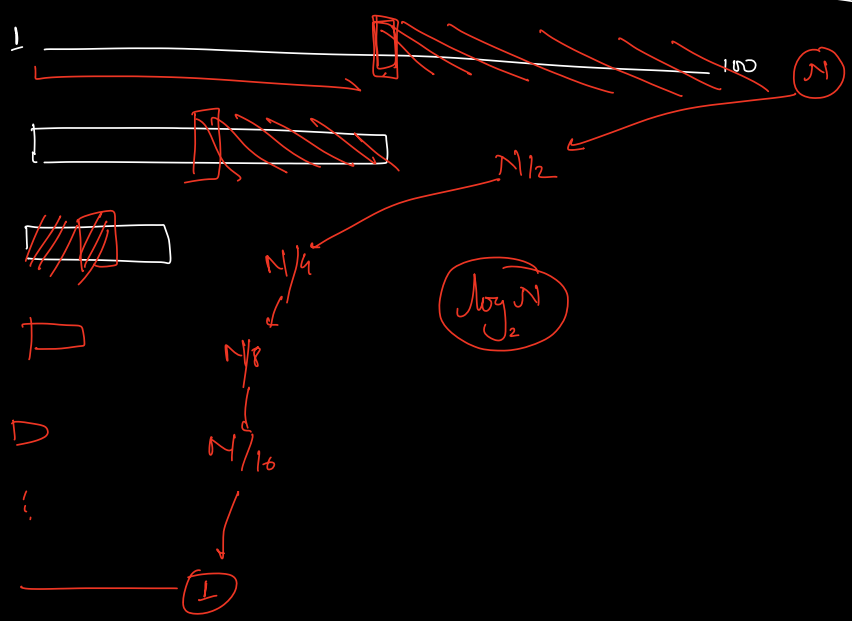
25 x 25 > 100 — 26, 27, 28 ... 49

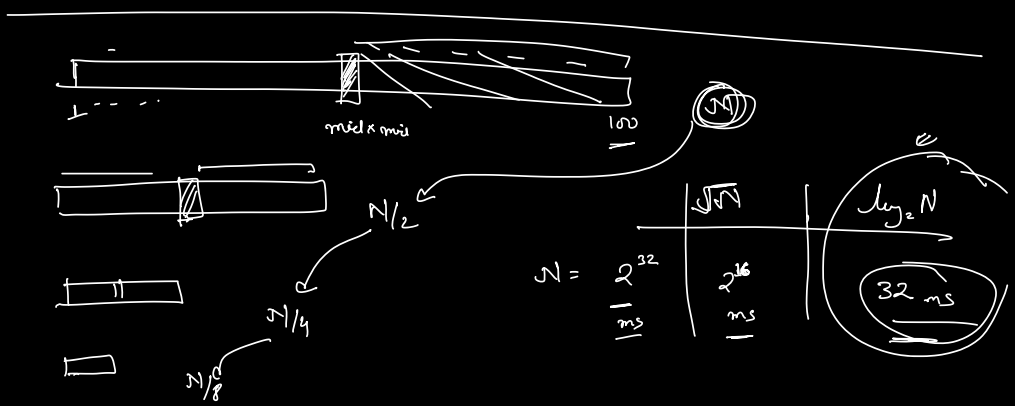
12 x 12 > 100 — 13, 14, 15 ... 24

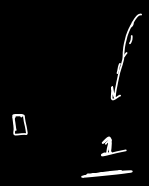
6 x 6 < 100 — 1, 2, 3, 4, 5 ✗

9 x 9 < 100 — 7, 8, 9 ✗

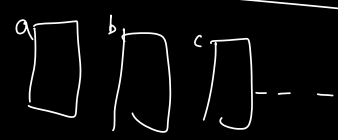
10 x 10 = = 100



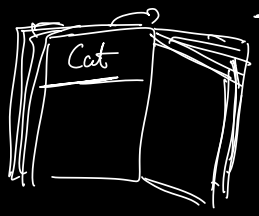




Data Structures



Dict
(to search means)



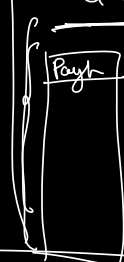
Tiger

Zeb

Elon Musk

Paypal

Glossary / Appendix



12, 100, 201

Ex Hash Map

Undo / Redo
Back button
⇒ Stack

Facebook (Mutual fn)
Google Map
⇒ Graph

Autocomplete
↳ Trie

Sql Databases
↳ Indexes
↳ Tree

DS

Steps of Cars
↳ Algo

- → Bit Manipulation → (overflow)
- → Time Complexity (TLE)
- → Arrays (observer)
- → Hash Map (Prob.; implem)
- → Sorting
- → String
- → Maths.

Intermediate