- variables
- operators
- conditionals
- looping

Agenda

- Solve problem
- complete few basic Lazyen constructs

Q) You are given a number x & you have to tell if it is a T-prime or not

↳ it should have exactly 3 factors

1, 2, 4 — 1, 3 — 4, 5, 6 → 1, 2, 3, 6

4 ✓ — 5 ✗ — 6 ✗

$x \leq 10^{12}$

$N \leq 10^5$

$\sqrt{x} \leq 10^6$

$10^5 \times 10^6$

$\geq 10^{11}$ ✗

We know, prime numbers have 2 unq factors

find if the number has 3 unq factors

You can code all the factors

Count == 3

→ $x = 36$ → factors

TLE

prime

x = product of power of primes ??

$x = p_1^a \times p_2^b \times p_3^c$ . . . . .

count = (count + 1)

$(36) \Rightarrow 2 \times 2 \times 3 \times 3 \Rightarrow 2^2 \times 3^2$

1 operation

→ 1 (2 — (x−1)) x

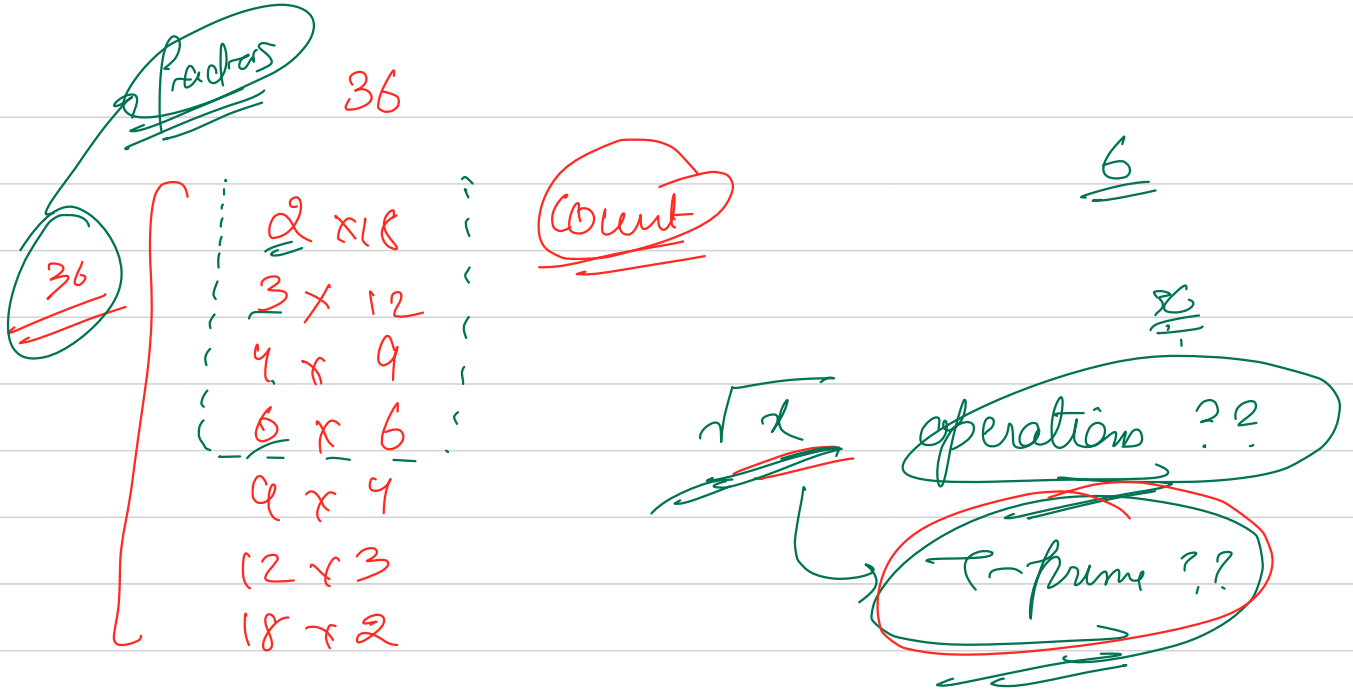
$\forall i \in [2, (x-1)]$ ✗ 2 i

(x % i == 0)

prime

T · prob

x iteration


Factors
36
36
2 x 18
3 x 12
4 x 9
6 x 6
9 x 4
12 x 3
18 x 2
Count
6
x
operations ??
Prime ??

1 self

For a number to be τ-prime → 2 factor

need one more factor only → 3 factor

1, number itself

x → prime number

$x = p_1$

prime → 1, self

$x = 1$

$x = p_1^a$

X composite

$x \neq 1, x$

value of a for x to be τ prime

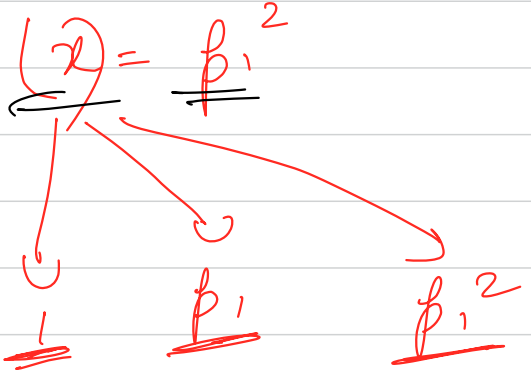
$x = p_1$

$1, p_1$

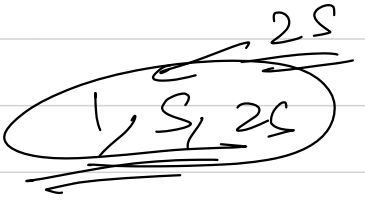
if $a = 1$

$a = 0$

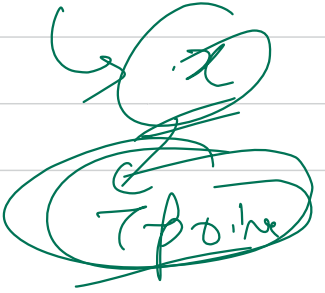
$a = 2$



[49 → 1, 7, 49]



[all the nos which are squares of prime nos are T prime]



$\sqrt{x}$ is a prime

2d ⟩ d

Really works ??

⟹ if squareroot of a Number is prime

$\frac{32}{6}$ = $x \rightarrow$ 25 → 5

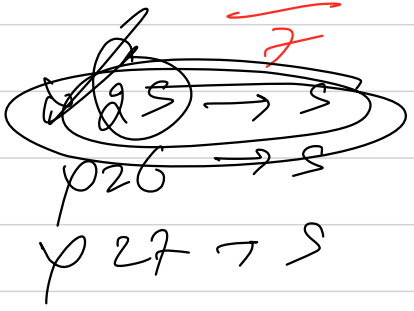
$\frac{x}{a} = a$

$\frac{26}{7}$ = 3

$\frac{26}{6} = 4$

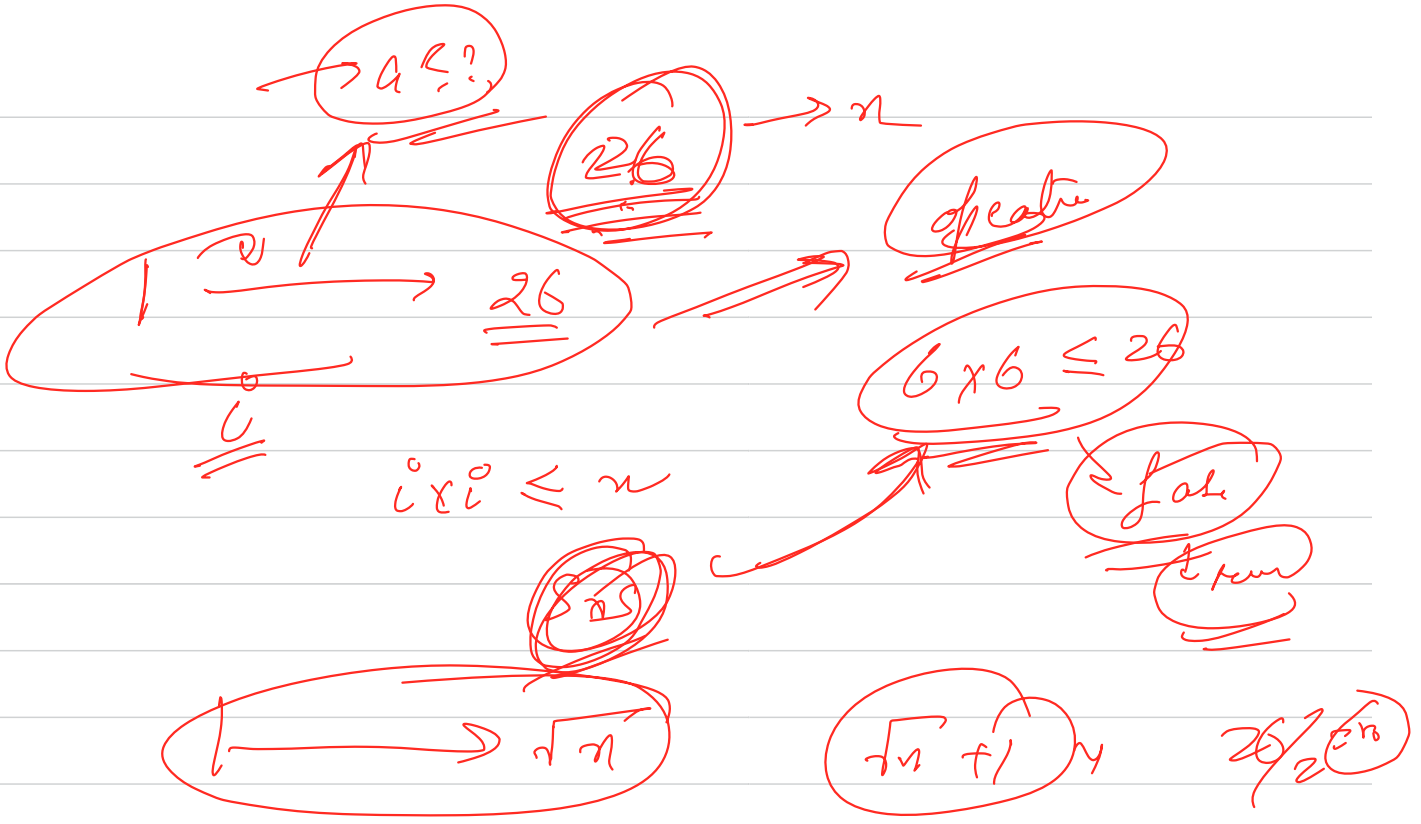
$x = a^2$

$a = \sqrt{x}$



Integer

Sqrt


a <= ?
26
n
1
26
i
i x i <= n
6 x 6 <= 26
sqrt n
sqrt n + 1
26/2

if we want to find a → $\sqrt{n}$ of each

$a = sqrt(n)$

prime — 25 → 5, 26 → 5, 27 → 5

[if a is prime and a*a == n]

↳ $\sqrt{n} \to y$

2 → $\sqrt{9}$

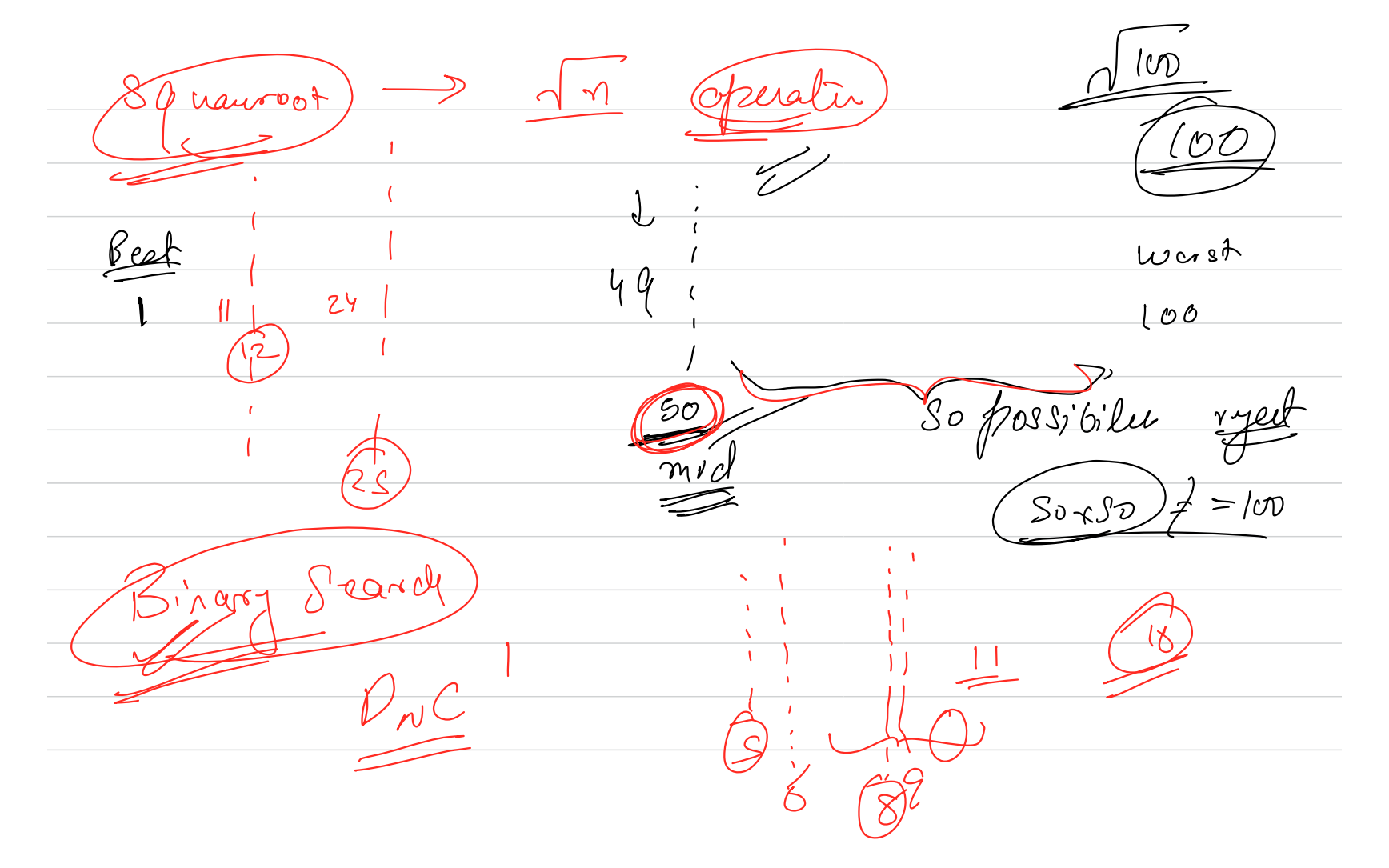
2 → $\sqrt{y}$

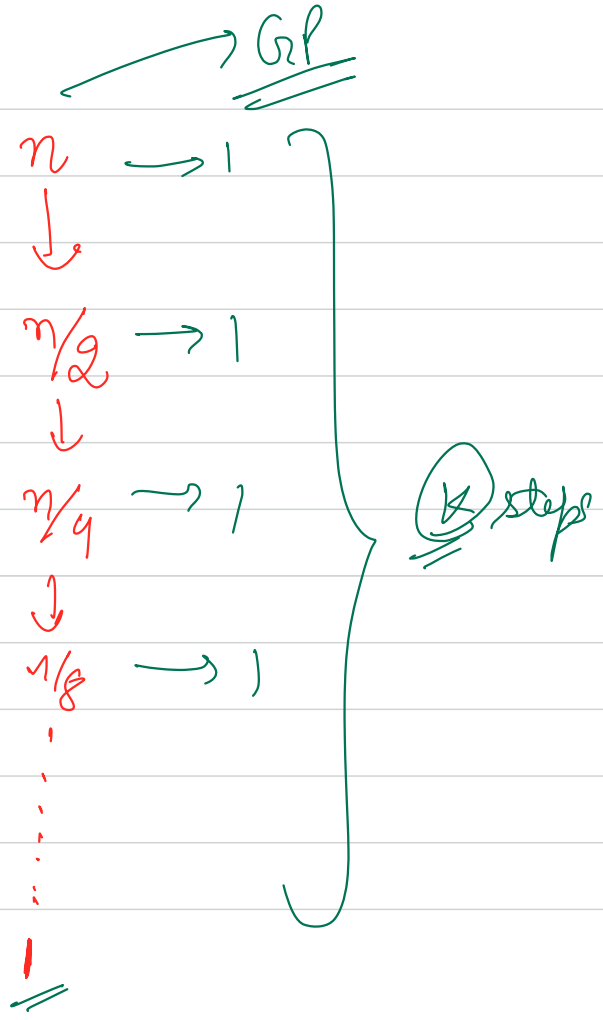
$\sqrt{n} + \sqrt[4]{n}$

$\sqrt{n}$

$10^{12} \to \sqrt{10^{12}}$

10^6


Squareroot
√n
operation
√100
100
Best
1
11
12
24
25
49
worst
100
50
mid
So possible reject
50×50 ≠ 100
Binary Search
DnC
5
6
8
9
11
18



last term

$$\frac{n}{2^k} = 1$$

$$n = 2^k$$

log

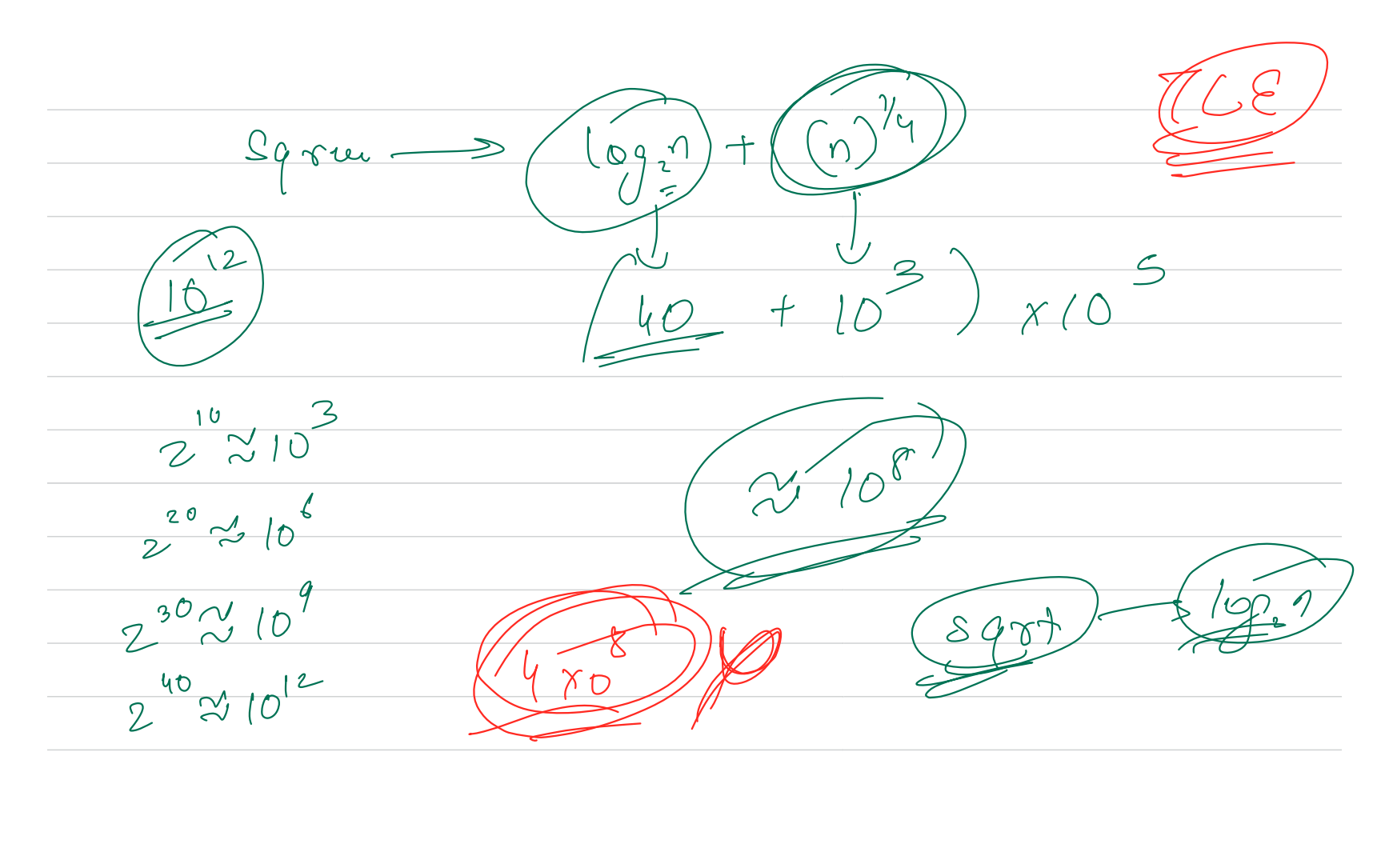
$$\log_2 n = \log_2 2^k$$

$$\log_2 n = k \log_2 2$$

$$k = \log_2 n$$

n

$\log n < \sqrt{n}$


Sqrt
$\log_2 n$ + $(n)^{1/4}$
LE
10^{12}
40 + 10^3) x 10^5
$2^{10} \approx 10^3$
$2^{20} \approx 10^6$
$2^{30} \approx 10^9$
$2^{40} \approx 10^{12}$
$\approx 10^8$
4×0^8
sqrt
$\log_2 n$

Square root

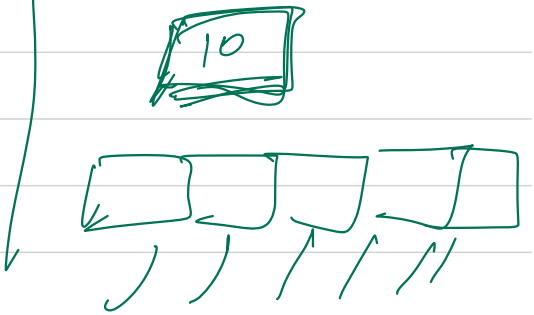
Prime @ $n^{1/4}$

↳ optimize ??

Introduct array → Consecutive Block of memory
it should be homogenous

int i=10

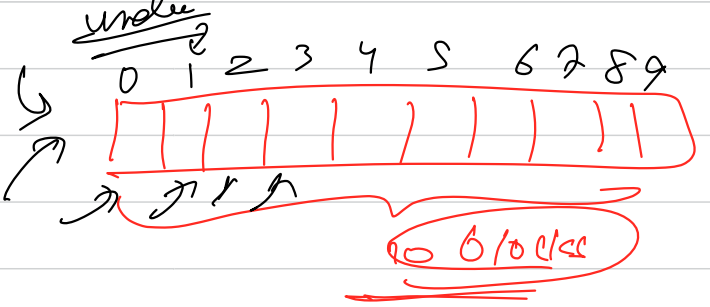
int array

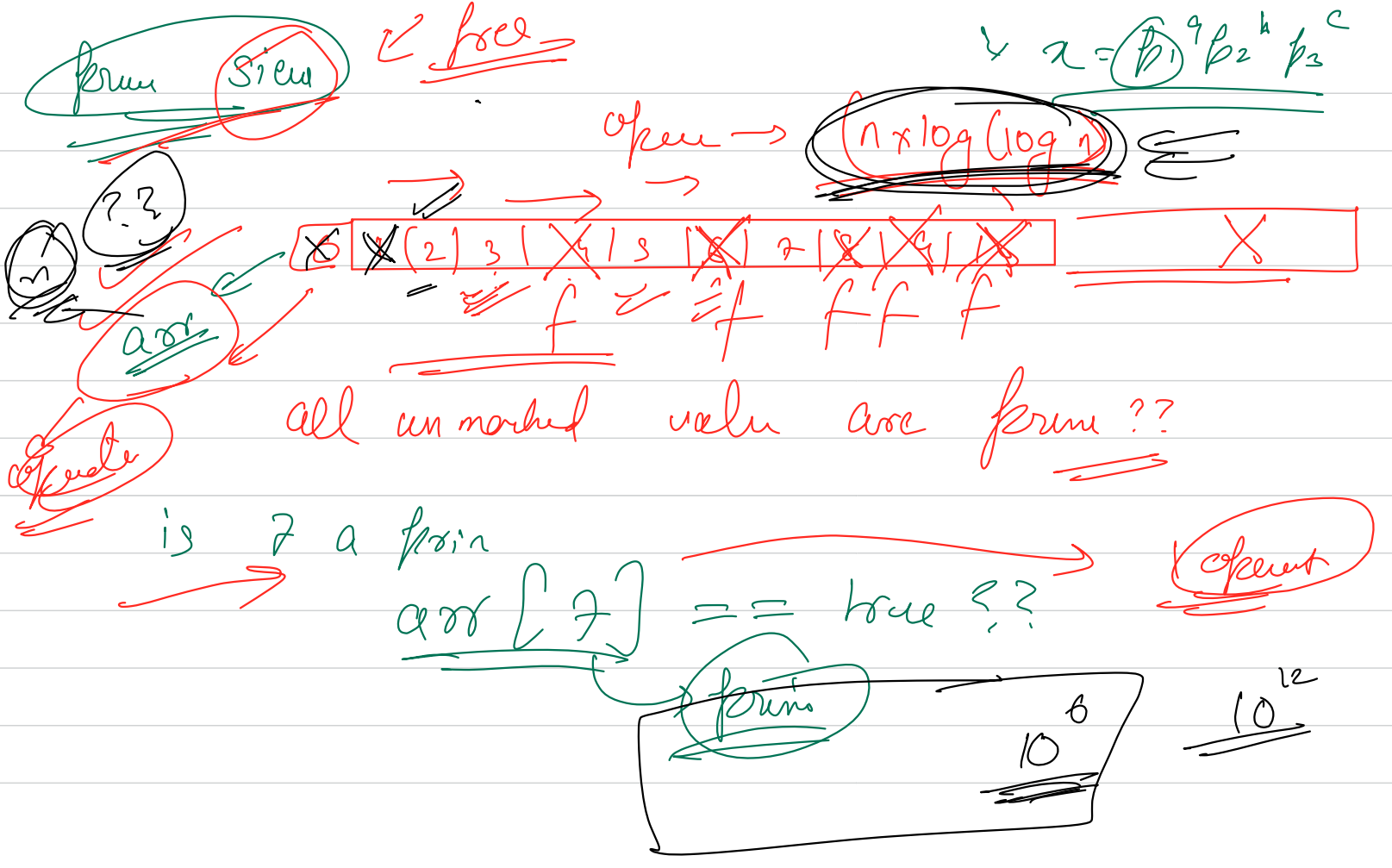


int arr[10];

arr[0]

arr[1]




prime
Sieve
free
n = p1^a p2^b p3^c
open
n x log(log n)
2 3 5 7
X
f f f f f
arr
create
all unmarked value are prime ??
is 7 a prin
arr[7] == true ??
open
prime
10^6
10^12

from sieve →

7 → 14 → 21 → 28 → 35 → 42 → 49 →

$10^6 \times \log\log 10^6$

$(10^6 \times 5) + 10^5 (40 + 1)$

$5 \times 10^6 + 4 \times 10^6$

$\approx 10^6 - 10^7$

$< 10^8$

$$m = \frac{(lo + hi)}{2}$$

$$m = \frac{lo + hi + lo - lo}{2}$$

$$m = \frac{2lo + hi - lo}{2}$$

$$m = lo + \frac{hi - lo}{2}$$

→ modified forms to calc mid