

// $[1, 3, 5, 7, \dots]$

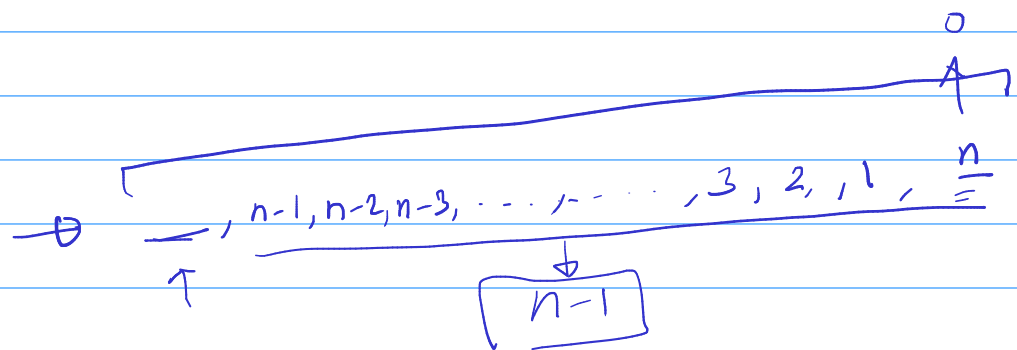
0,

$\frac{n-1}{2}$

$n=6$

1, 3, 5, 4, 2

$\rightarrow 0, 3, 1, 2, \underline{2}, 4$
 $\rightarrow \underline{1}, \textcircled{2}, \underline{3}, 4, \underline{5}, 6$
 $\rightarrow \underline{1}, \underline{3}, \underline{4}, \underline{6}, \underline{3}, \underline{2}$



$s = \text{"abcd...rphgmistbup"}$

$Q = 10^5$

L, R

Hashing

Hash Table

n of

- "ABDCFPQ" ←
- "ABDE" ←
- " " ←
- "xPQY..." ← m

" Given a set of strings, find if there are duplicates "

Trie - root

AVI -

Trie -

root

PS

ABC

Hashing: Common Data Structure

Hash tables \rightarrow ~~SP~~ DS

String \rightarrow Hash \rightarrow Number
function

```
f(string) → num = 0
for char c in string:
    num += c
return num
```

ABC

26¹⁰⁰ → one large

16¹⁸

\rightarrow

<u>A</u>	<u>B</u>	<u>C</u>
\uparrow	\uparrow	\uparrow
0	1	2
$=$		$=$

 $p = 31$
 $\frac{26}{10^5}$

\rightarrow

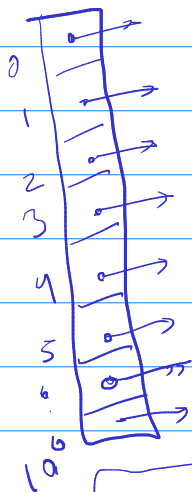
$$(65 \cdot p^0 + 66 \cdot p^1 + 67 \cdot p^2 + \dots + p^{100})$$

\rightarrow Hash \leftarrow

string \rightarrow ABC \rightarrow num

$\% \text{MOD}$
 \uparrow
 10^6

str $\xrightarrow{10^6}$



unordered map

10^6

$$p \cdot p^1 + q \cdot p^2 + R \cdot p^3 + M \cdot p^4$$

$p = 31$

\Rightarrow ABCDEPQRMXUTSY PQRM
 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

pref1

$$A \cdot p^1 + B \cdot p^2 + \dots + (P \cdot p^6 + Q \cdot p^7 + R \cdot p^8 + M \cdot p^9) \times p^{-5}$$

\uparrow

$$A \cdot p^1 + B \cdot p^2 + \dots + N \cdot p^4 + B \cdot p^5 + C \cdot p^6$$

MRQP \rightarrow

\Rightarrow MRQPYSTU XM RQPE DCBA
 pref2

$$\frac{lcm(a, b)}{gcd(a, b)} = \underline{a}$$

$$\frac{k_1 \cdot k_2 \cdot \cancel{gcd(a, b)}}{\cancel{gcd(a, b)}} = \underline{a}$$

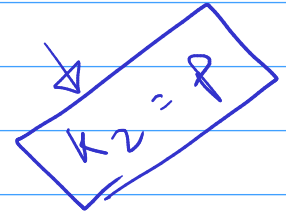
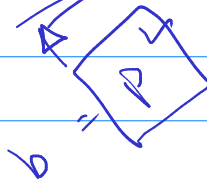
$$k_1 \cdot k_2 = \underline{a}$$

$$\frac{k_1 \cdot k_2 \cdot \cancel{p}}{\cancel{p}} = \underline{a}$$



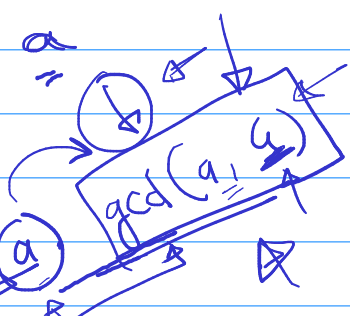
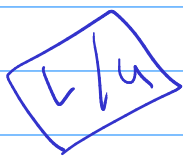
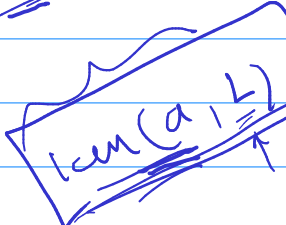
$$a = \cancel{k_1 \cdot p}$$

$$b = \cancel{k_2 \cdot p}$$



lcm

$$\left[\frac{lcm(a, \underline{L})}{gcd(a, \underline{G})} = \underline{a} \right]$$



divisors

divisors

$\sqrt[3]{9} \rightarrow \text{estimated}$

A, 3

$$|a| = 4, \underline{N=3}$$

$$G = \underline{1, 2, 4}$$

$$L = \underline{4, 8, 16}$$

②

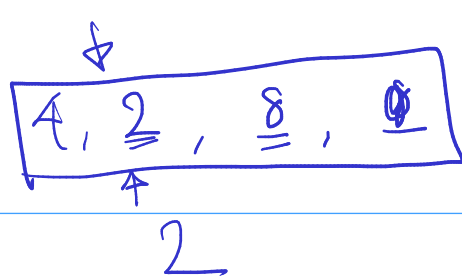
$$[4, \underline{1}, \underline{1}]$$

$$3 \cdot 2 = 6$$

$$3 \cdot 4 = 12$$

$$1, 2$$

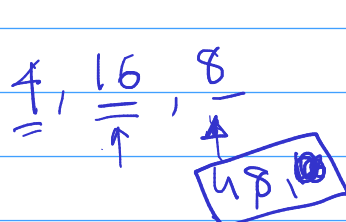
gcd = 2
lcm = 8



→ $\boxed{2, 4, 8}$
gcd = 2
lcm = 8

$\frac{2, 8}{3^2 - 2^2}$

gcd = 4
lcm = 16

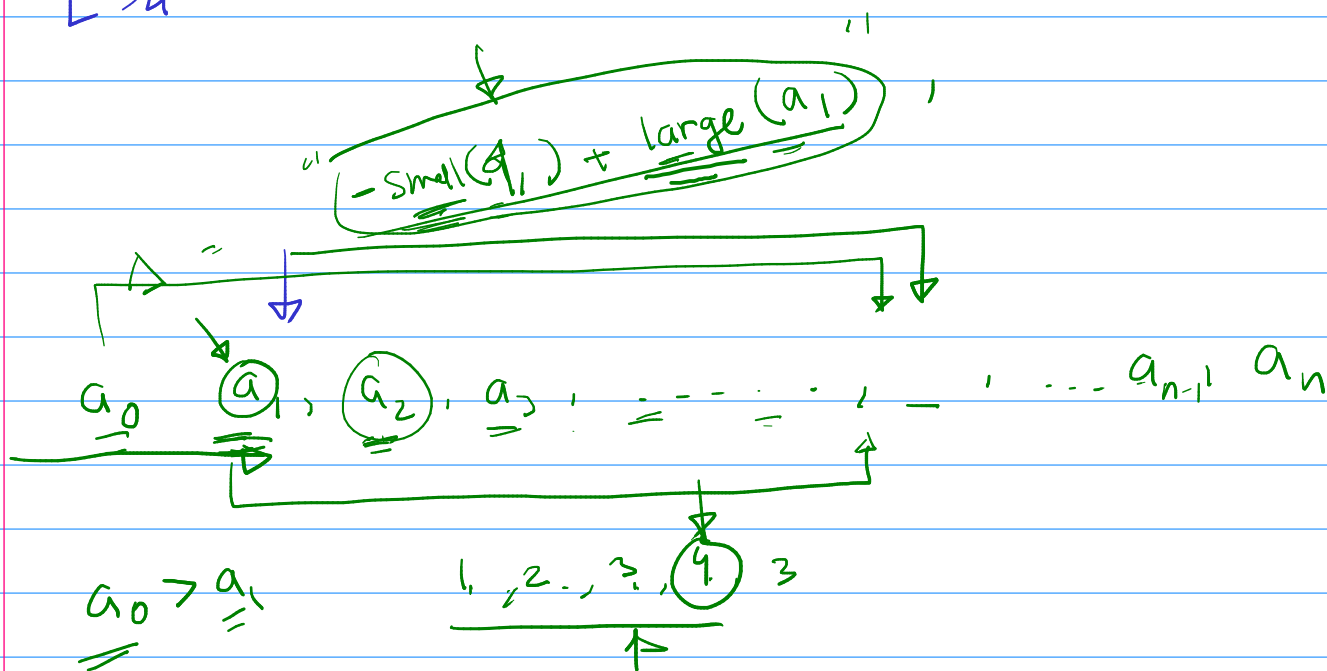
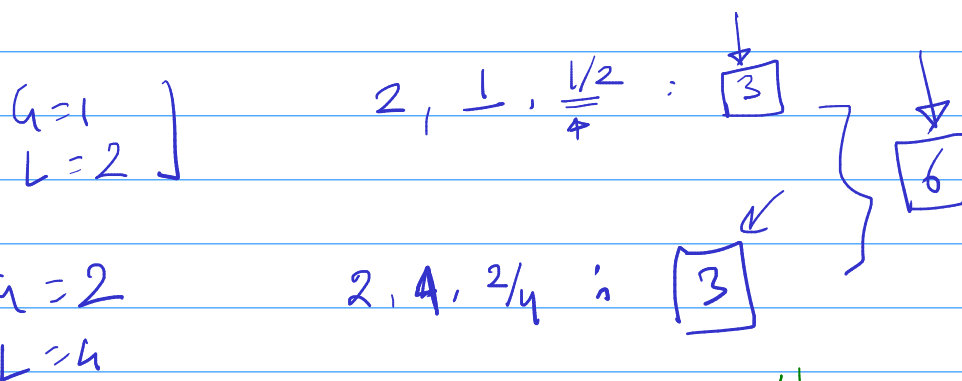


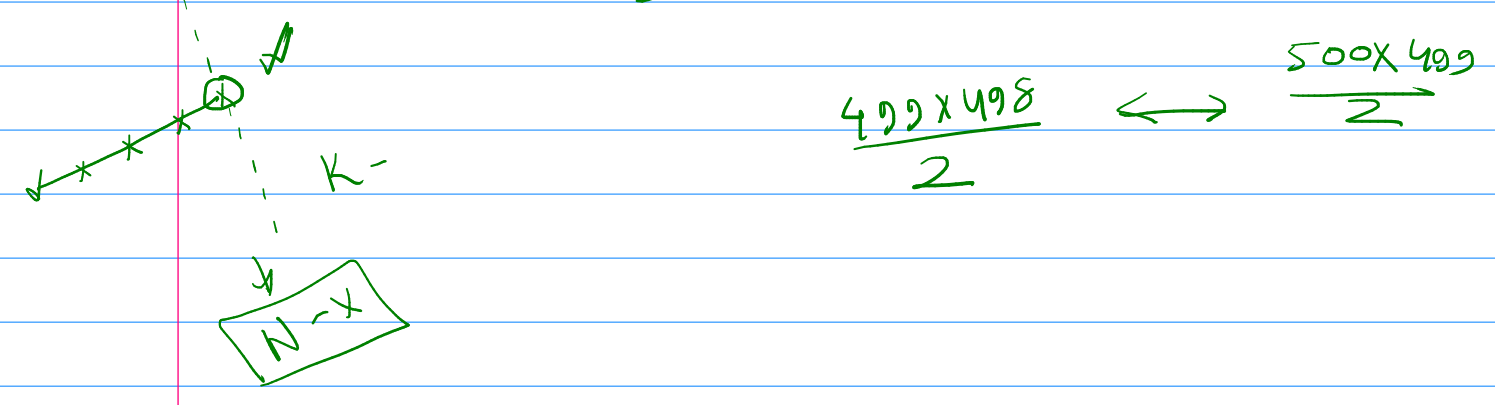
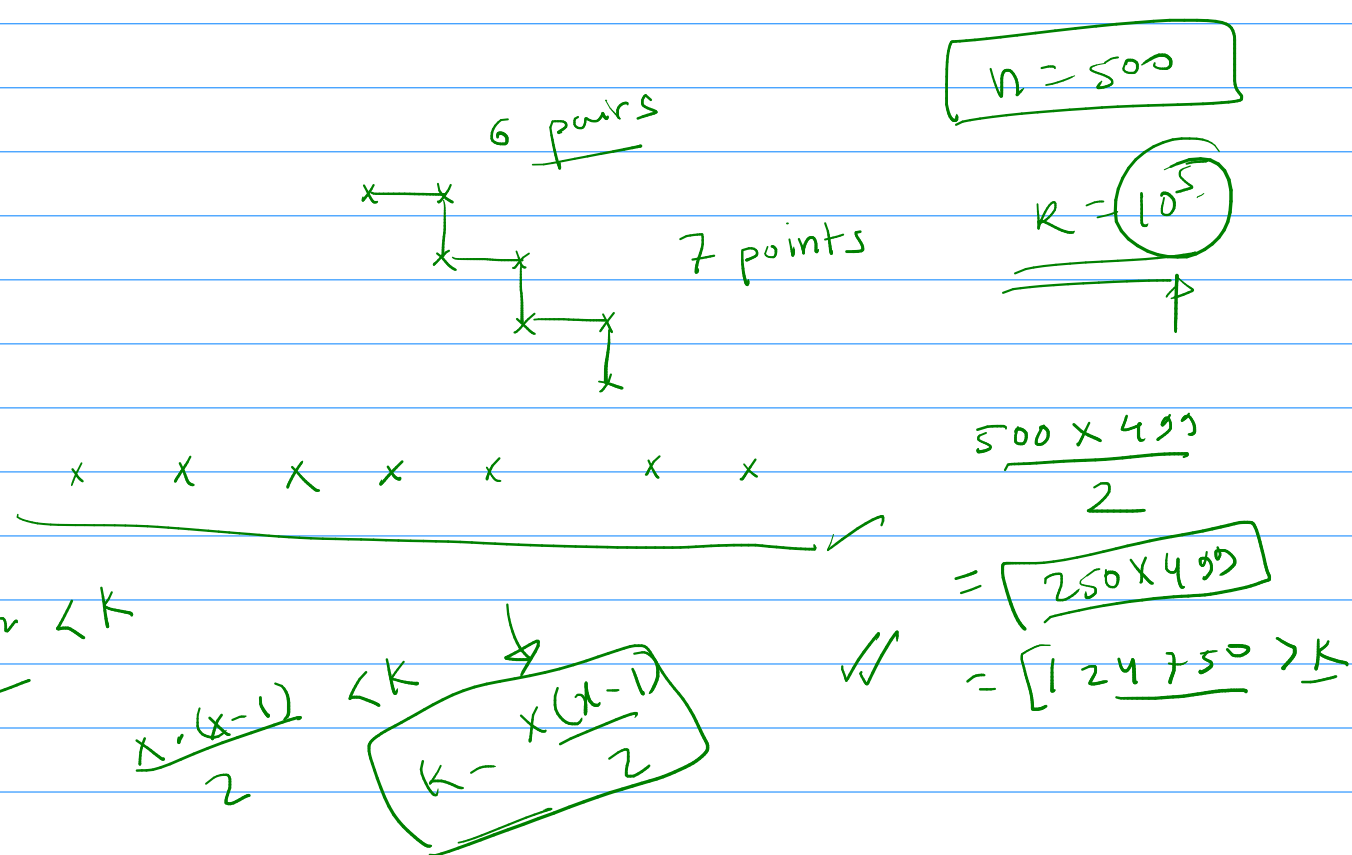
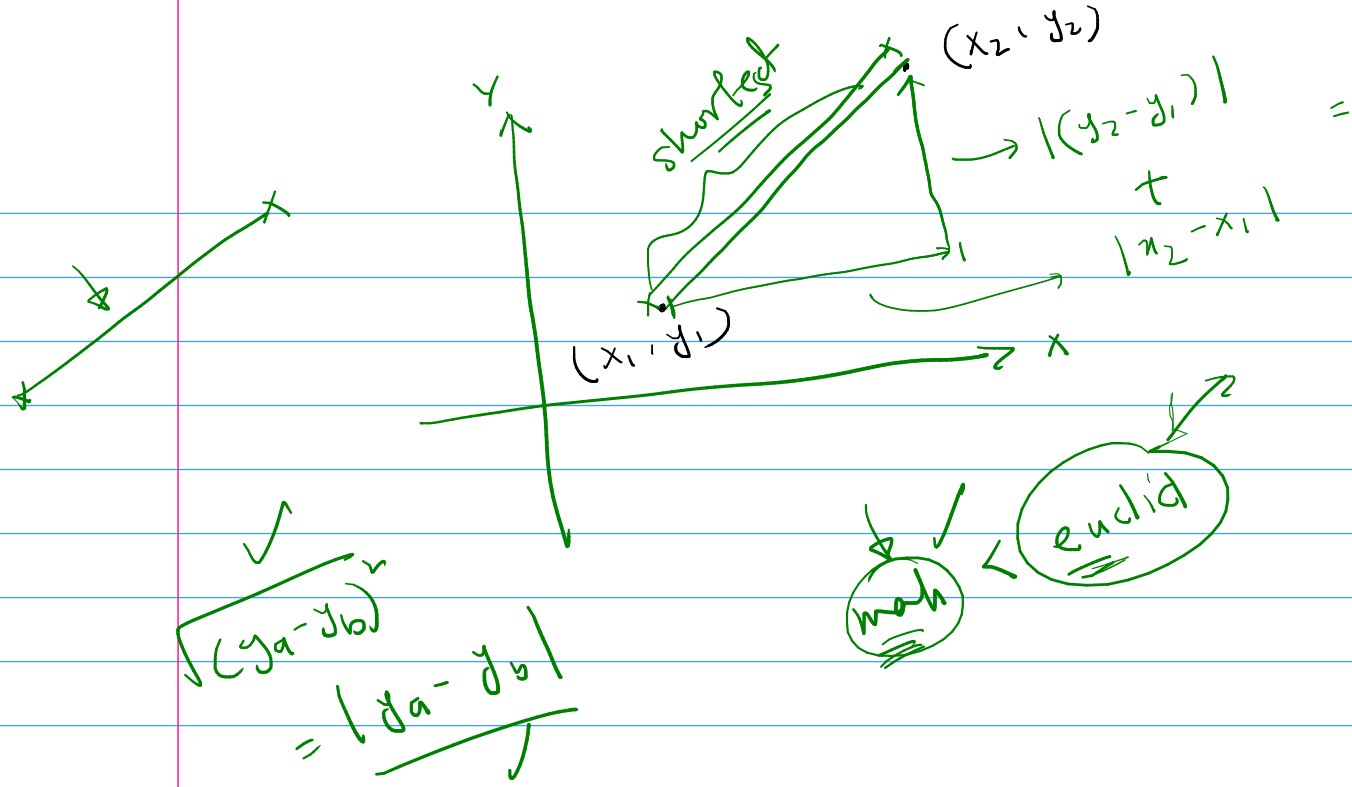
→ 4, 16, 8
→ 4, 16, 4
→ 4, 16, 4
→ 4, 4, 16
→ 4, 8, 16

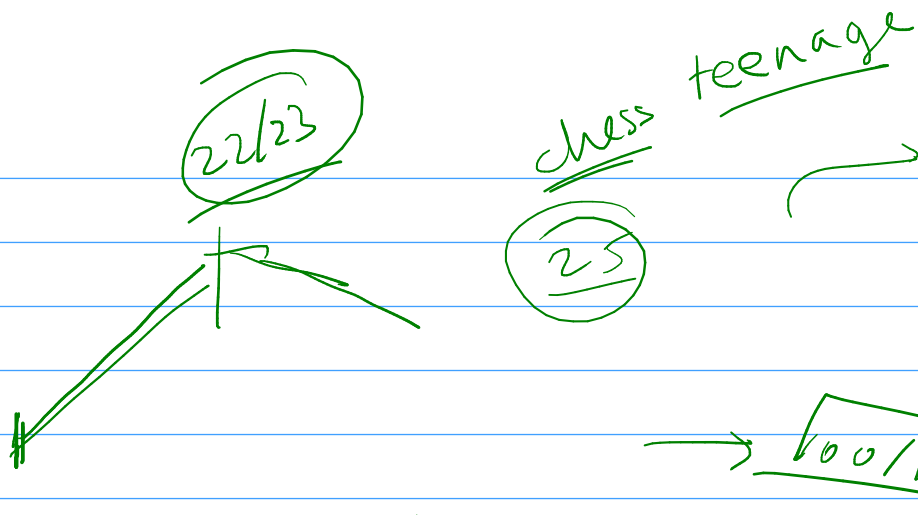
inclusion
exclusion
principle

$\frac{2, 3}{5}$

$\underline{a = 1, 2} \quad L = 2, 4$







100/150

X

$[x+100, x+200]$

Solve sort

1 hour

idea → editorial

code

1200

→

20

→

10

