



- o Basics of Hashing
- o Basics of HashMap
- o Basics of HashSet

Agenda

- o Easy level questions
- o Employee & Manager
- o Problem with a given diff
- o Array pair divisible by K

first Element to occur K times.

arr = { 1, 2, 1, 3, 4, 5, 2, 2, 3, 3, 2 } ^{at least} K = 3

How?
 HashMap
 Key < Integer >
 Element
 1
 2
 3
 4
 5
 freq of each Element

value < Integer >
 No. of Occ

~~2~~
 ~~2~~ 3 ✓
 ans = 2

{ store freq of each element }

Missing Numbers

- ① Extra Element in array 2
- ② Common Ele with different freq.

arr = { 1, 2, 1, 3 }

freq map

1	→	2
2	→	1
3	→	1

arr = { 4, 2, 1, 5, 3 }

freq map

4	→	1
2	→	1
5	→	1
1	→	1
3	→	1

{ 4, 5, 3 }

unique Elements
in array 2

Valid Anagrams .

What are anagrams?

String str1 = "accio"

String str2 = "ocica"

these strings are anagramic to each other .

• Sorting } same anagrams!

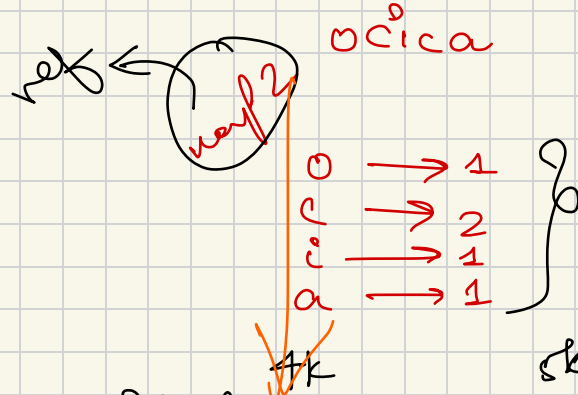
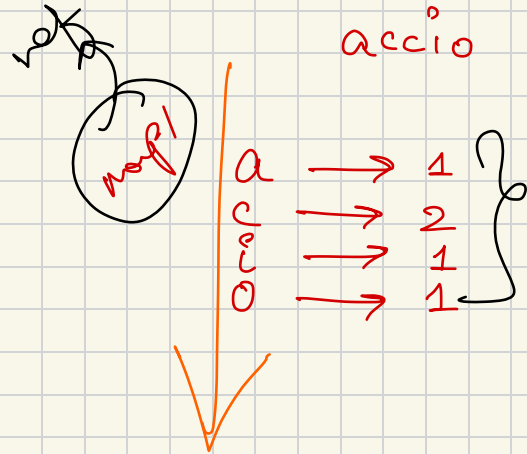
accio
accio

sort strings directly X

char[] ✓ sort

✓ Tc: $O(N \log N)$ Sc: $O(1)$

o freq map of each char.



if (map1 == map2)

↳ anagramic?

creating
TC: $O(N) + O(26) \approx O(N)$
SC: $O(26) \approx O(1)$

Better ,

map

26 freq Array

arr = [0 1 2 3 4
1 1 ~~1~~ 1
2]

0 → a
1 → b

25 → z

string = "accb d"

'b' - 'a'

ch - 'a'

relative pos

characters
are in
sorted
format

char ch = 'c'

'a' + 2

= 'a' + 2

2b

$$\left\{ \begin{aligned} \text{relative pos} &= 'c' - 'a' \\ &= (\cancel{'a'} + 2) - \cancel{'a'} \\ &= \boxed{2} \checkmark \end{aligned} \right.$$

Employee and Manager

~~o/p~~

Key(Emp)

A

B

C

D

E

F

Value(Mngr)

C

C

F

E

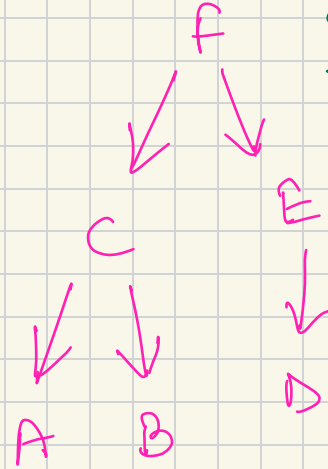
F

F

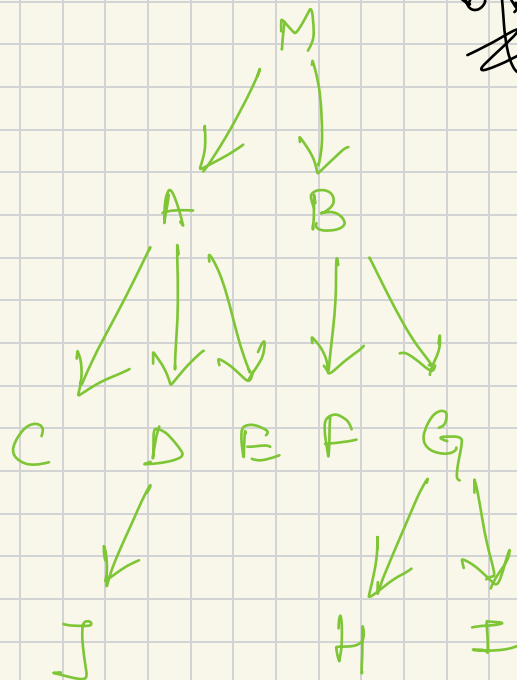
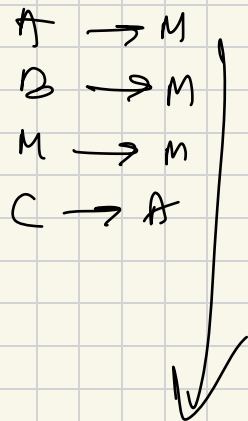
{CEO}

~~o/p~~

A	→	0
B	→	0
C	→	2
D	→	0
E	→	1
F	→	5



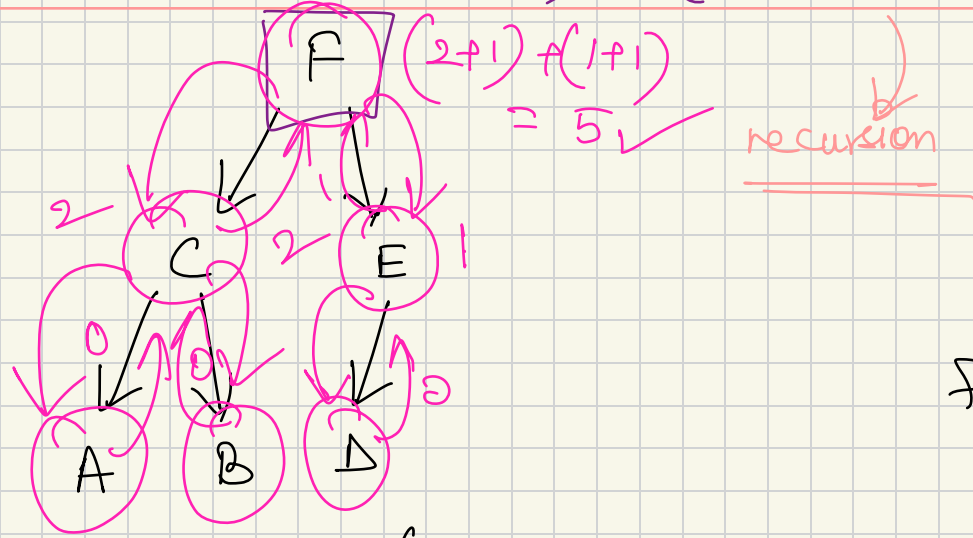
(org Chart)



~~0/P~~

J → 0
H → 0
I → 0
C → 0
D → 1
E → 0
F → 0
G → 2
B → 4
A → 4
M → 10

$$\text{total Emp}(F) = (\text{total Emp}(C) + 1) + (\text{total Emp}(E) + 1)$$



$$\text{total Emp}(f) = \sum \left(\text{total Emp}(\text{under f}) + 1 \right)$$

for itself

Direct reportee knowledge.

A → C

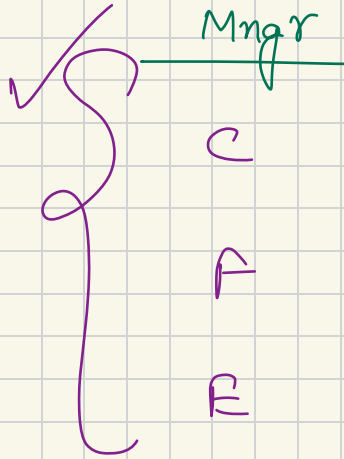
B → C

C → F

D → F

E → F

F → F



HashMap

List of Directs

{A, B}

{C, E}

{D}

CEO = F

8 steps

- Create direct reportee Hash Map
- Identify the ceo.
- recursively find the no. of Emp under Each Emp

Problem with a given difference

$\text{int}[] \text{arr} = \{ 5, 10, 3, 2, 50, 80 \}$ $B = 78$

$\text{pair}(x, y)$

$$\left. \begin{array}{l} + x - y = B \\ \text{or } y - x = B \end{array} \right\}$$

Brute Force

↳ Nested loop ($O(n^2)$ SC: $O(1)$)

$$arr = \{2, 3, 5, 10, 50, 80\}$$

$$B = 45$$

↓
Sorted

sorting will not work!

$$\text{arr} = \left\{ \overset{0}{5}, \overset{1}{10}, \overset{2}{3}, \overset{3}{2}, \overset{4}{50}, \overset{5}{80} \right\} \quad B = 78$$

TC: O(N) SC: O(N)

Pair (x, y)

$$\begin{aligned} x - y &= B \\ y - x &= B \end{aligned}$$

$$y = x - B$$

$$y = B + x$$

HashSet

5, 10,
3, 2,
50

$$x = 5$$

$$y = -73$$

$$y = 83$$

$$x = 10$$

$$y = -68$$

$$y = 88$$

$$\begin{aligned} x &= 3 \\ y &= -75 \\ y &= 81 \end{aligned}$$

$$\begin{aligned} x &= 2 \\ y &= -76 \\ y &= 80 \end{aligned}$$

$$\begin{aligned} x &= 50 \\ y &= -28 \\ y &= 128 \end{aligned}$$

$$x = 80$$

$$y = 2$$

found!

Array Pair Divisible By K

int[] arr = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} k = 5

return true / false

$(N/2)$ such pairs where sum of each pair is divisible by k .

NOTE ' you can use each ele only once.

(1, 9), (2, 8), (3, 7), (4, 6), (5, 10)

↓ ↓ ↓ ↓ ↓

10 15 10 15 15

$$\text{int[]} \text{arr} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \quad k=5$$

$$(x, y) \in (x+y) \text{ divisible by } k$$

$$x + y = a * k$$

{ some multiple of k }

$$\{q_1 * k + r_1\}$$

$$+ \{q_2 * k + r_2\}$$

$$= a * k$$

$$\begin{array}{c} \textcircled{k} \overline{x(a)} \\ \downarrow \\ \hline r \end{array}$$

$$\underline{\underline{r < k}}$$

$$\underline{\underline{x = q * k + r}}$$

$$K * (q_1 + q_2) + \underline{\underline{(r_1 + r_2)}} = a * K$$

multiple of K

multiple of K

$$\left. \begin{array}{l} (r_1 + r_2) = 0 \\ \text{or} \\ (r_1 + r_2) = K \end{array} \right\}$$

\therefore
 (x, y) are
 divisible K

when

$$(r_1 + r_2) = \begin{matrix} 0 \\ r \\ K \end{matrix}$$

$\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$$k = 5$$

rem

1 2 3 4 0 1 2 3 4 0

$$n_1 + n_2 = 0 \text{ or } 5$$

create pairs $(n/2)$
such that
sum is divisible
by k

rem	freq
1	2
4	2
2	2
3	2
0	2

even No. }