

1. Environment = visual studio code

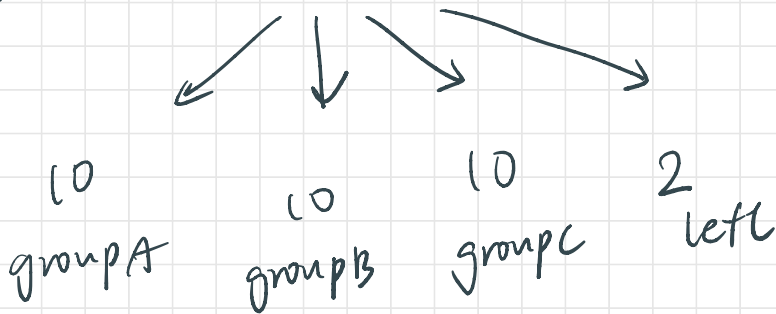
2. Divide and conquer

Divide the coin pile into three piles A, B, C

To compare :

divide all coins into 3 piles

for example 32 coins



compare A, B, C

if  $A=B=C \Rightarrow$  compare the last two coins

if there is a group weigh different

then go function recursion until find the fake coin

at level 0  $\rightarrow 3^0$  nodes

level 1  $\rightarrow 3^1$  nodes

level 2  $\rightarrow 3^2$  nodes

$\vdots$

level  $n \rightarrow 3^n$  nodes

$$3^n = n - (3^0 + 3^1 + \dots + 3^{n-1})$$

$$= n - \frac{3^n - 1}{2}$$

$$3^n = \frac{2n - 3^n + 1}{2}$$

$$2 \times 3^n = 2n - 3^n + 1$$

$$3^n = 2n + 1$$

$$n = \text{ceil}(\log_3(2n+1))$$

$$\Rightarrow O(n) = O(\log(n))$$