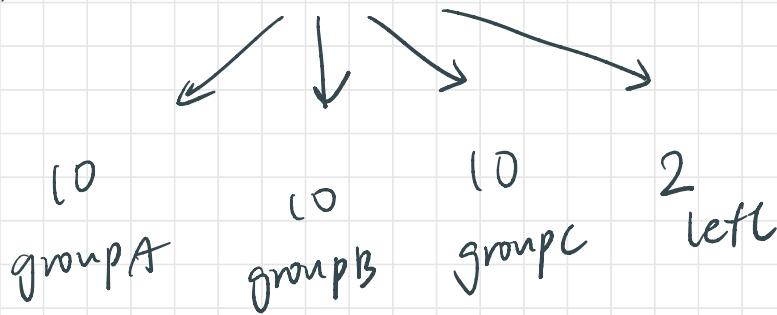


1. Environment: visual studio code
2. Divide and conquer
Divide the coin pile into three piles A, B, C
To compare :

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)

:

(level n $\rightarrow 3^n$ nodes)

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

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

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

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

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

$$n = \lceil \log_3(2n+1) \rceil$$

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