Basic

Multiples x 10, 24

- x2 → 20 ✗
- x3 → 30 ✗
- x4 → 40 ✗
- 50 ✗
- ⋮
- 120 ✓

Efficient

iterations

$LCM \times gcd = a \times b$

gcd ↑ log(A)

$LCM = \frac{a \times b}{gcd}$ ✓

Trailing zeroes

N = 5

N! = 120 ← 1 zero

Hint: 10 2 8 0 0 ← 2 zeroes

1028 x 10 x 10 (2x5, 2 x 5)

No of 2's and 5's pairs in N!

N = 100

100! = 1080020 0 0 0 0 0 ...

2018 0 0 0 0 0 int

100! = (1 x 2 x 3 x 4 x 5 x 6 x 7 x 8 ... 10 ... 15 ... 20 ... 25 ... 50 ... 75 x 95 x 96 x 97 x 98 x 99 x 100)

(2, 2x2, 2x3, 2x2x2 above 2, 4, 6, 8; 5 below 5, 10, 15, 20; 5x5, 5x5x2, 5x5x3 above 25, 50, 75; 2x above 96, 98, 100)

- higher ← Multiples of 2 : 50 $\left(\frac{100}{2}\right)$ 1—100
- lower ← Multiples of 5 : 20 ← $\left(\frac{100}{5}\right)$ 1—100 → once
- — of 5x5 : 4 ← $\left(\frac{100}{25}\right)$

10 → 5, 2

No of zeroes = No of ~~zero~~ times 5 is multiplied in N!

— of 5x5x5 : 125 0 ← $\left(\frac{100}{125}\right)$

$$\text{Zeroes} = \left\lfloor \frac{N}{5} \right\rfloor + \left\lfloor \frac{N}{5^2} \right\rfloor + \left\lfloor \frac{N}{5^3} \right\rfloor + \ldots + 0$$

(1st, 25, 35)

$$100! = \frac{100}{5} + \frac{100}{25} + \frac{100}{125}$$

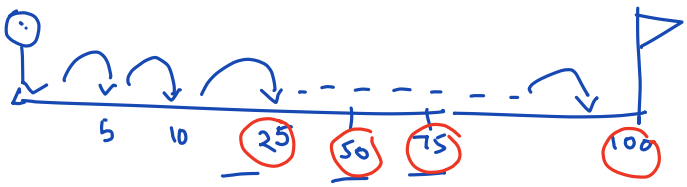
$$= 20 + 4 + 0 = 24$$

1000! $= \left(\frac{1000}{5}\right) + \left(\frac{1000}{25}\right) + \left(\frac{1000}{125}\right) + \left(\frac{1000}{625}\right) + \left(\frac{1000}{3125}\right)$ (int div)

$= 200 + 40 + 8 + 1 + 0$

$= 249$ ✓

$\frac{N}{5^p} = 0$ → Stop

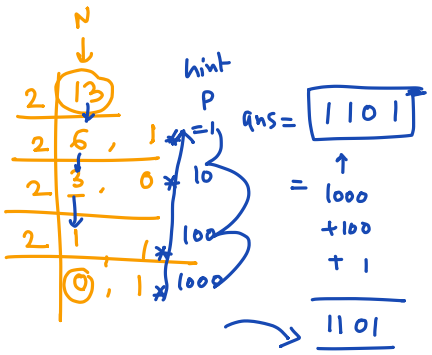


$\frac{100}{5} = 20$ coins

$\frac{100}{25} = 4$ coins

Decimal to Binary

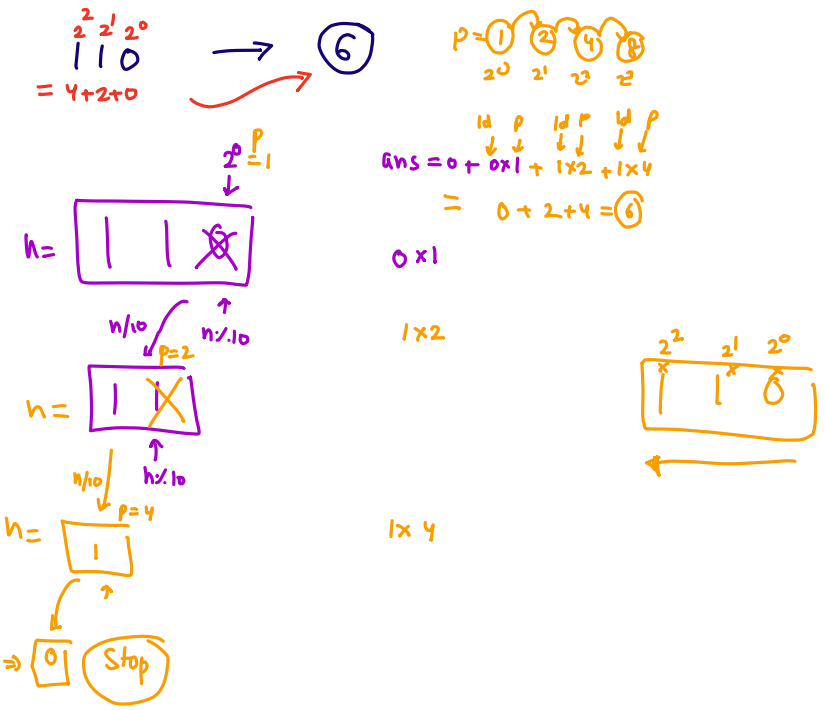
5 → 101



Binary to Decimal

110 → 6

= 4+2+0



Magic No M^{th} Magic

↓

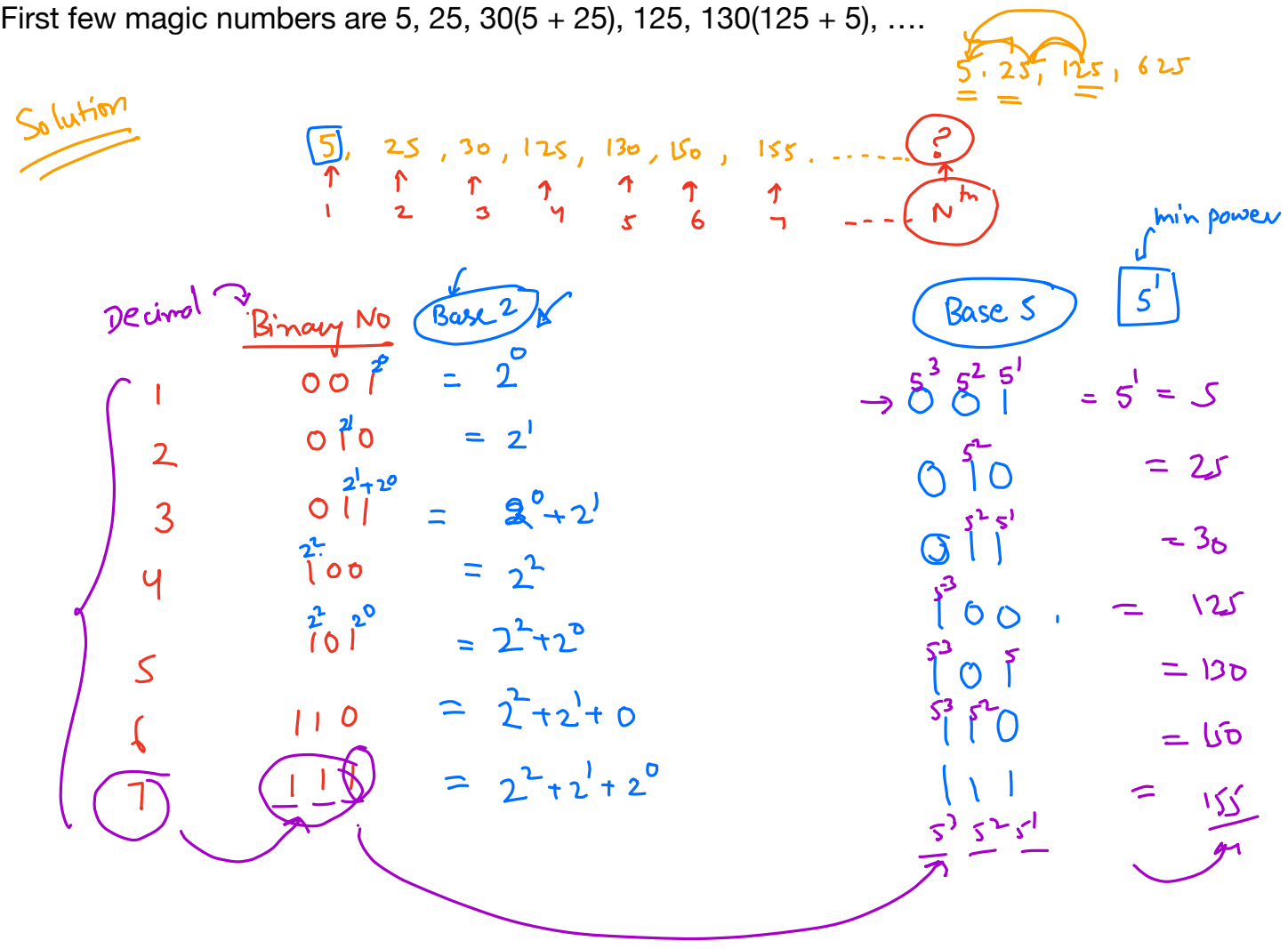
Powers of 5

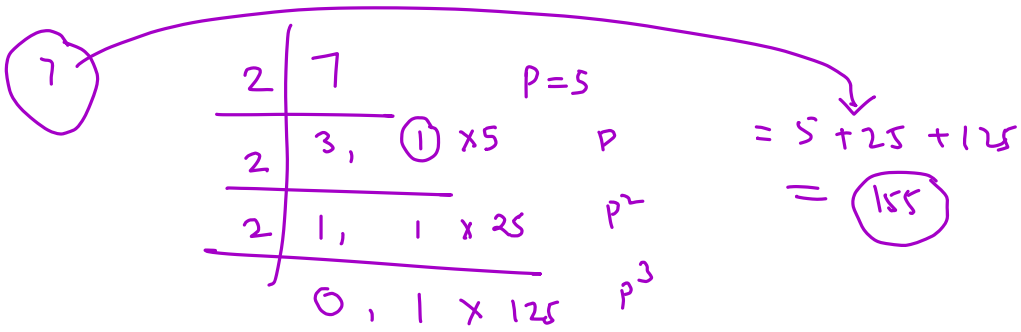
5, 25, 30, 125, 130, 155 .....

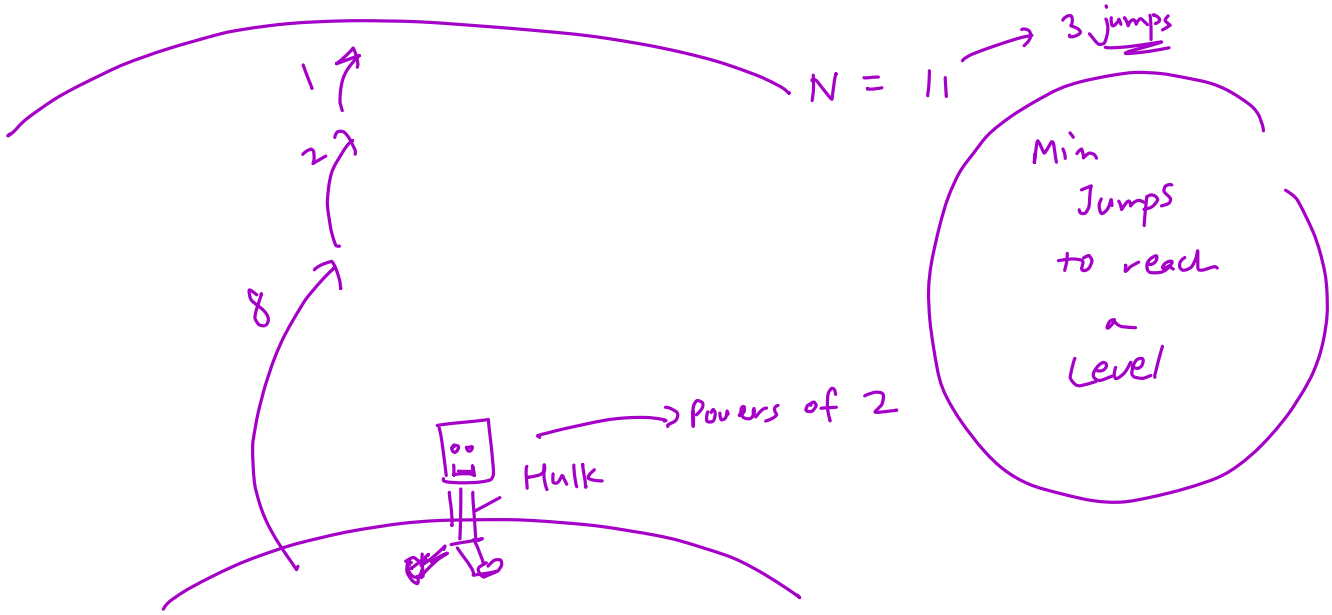
Given an integer A, find and return the Ath magic number.

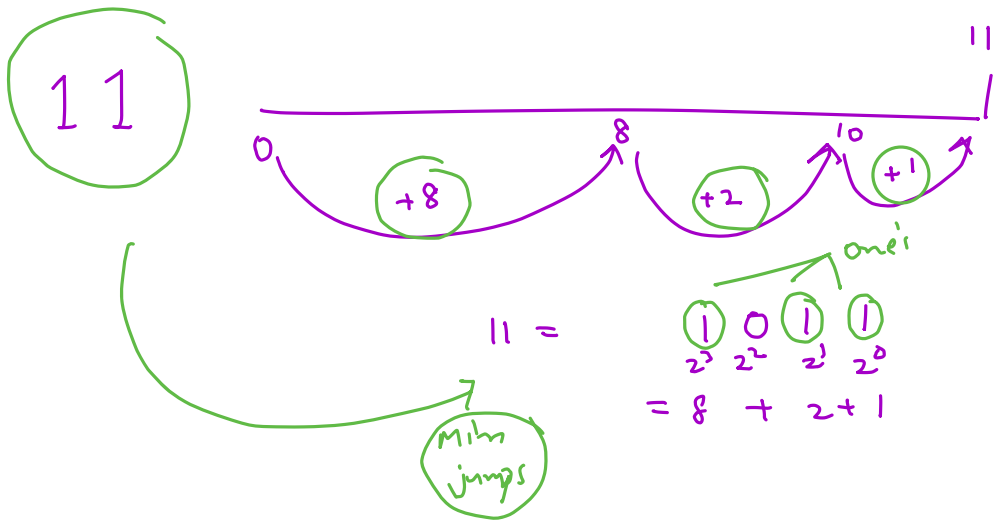
A magic number is defined as a number which can be **expressed as a power of 5 or sum of unique powers of 5.**

First few magic numbers are 5, 25, 30(5 + 25), 125, 130(125 + 5), ...




7
2 | 7
3, 1 x5
2
2 | 1, 1 x 25
0, 1 x 125
P=5
P
P²
P³
= 5 + 25 + 125
= 155


N = 11
3 jumps
1
2
8
Hulk
Powers of 2
Min Jumps to reach a Level


11
0
+8
8
+2
10
+1
11
ones
11 =
1 0 1 1
2³ 2² 2¹ 2⁰
= 8 + 2 + 1
Min jumps

Binomial Coefficient $^{N}C_{R}$

$$= \frac{N!}{(N-R)!\,R!} \quad \text{—(1)}$$

$$^{N}C_{R} = {}^{N}C_{N-R}$$

$$= \frac{N!}{(N-(N-R))!\,(N-R)!}$$

$$= \frac{N!}{R!\,(N-R)!} \quad \text{—(2)}$$

$$^{5}C_{3} = \frac{5!}{2!\,3!} = \frac{1\times2\times3\times4\times5}{1\times2\times1\times2\times3} = 10$$

$$=$$

↳ Shortcut

Num (5)

Denom (1)

$$\frac{5\times4\times3}{1\times2\times3} = 10$$

$$^{11}C_9 = \frac{11 \times 10 \times 9 \times 8 \cdots}{1 \times 2 \cdots\cdots 9}$$

$$\| $$

$$^{11}C_{11-9} = {}^{11}C_2 \Rightarrow \frac{11 \times 10 \times 9}{1 \times 2} = 55$$

Permutation

Cricket Team 11 ppl

Choose 2 ppl. for post of captain & vice captain

$^{11}C_2$ ways choosing * 2! ways of Arranging

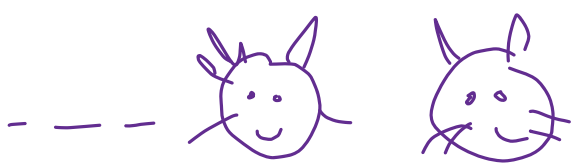
$= {}^{11}C_2 * 2!$

$= {}^{11}P_2$

- - - X - - - Y - -

(X, Y) in $^{11}C_2$ ways

Y, X



3! = 6 ways

A C B

A B C

C B A

C A B

$^5C_3 * 3!$

$= {}^5P_3$

B C A

B A C

$$^{N}P_{R} = {}^{N}C_{R} * R!$$

$$= \frac{N!}{(N-R)!} \times R!$$

$$= \frac{N!}{(N-R)!}$$

$$^{N}P_{R}$$

$$\log_{10} 1000 = 3$$

$$\log_2 64 = 6$$

$\log_b 1 = 0$

$\log_b 10^{18} = 18$