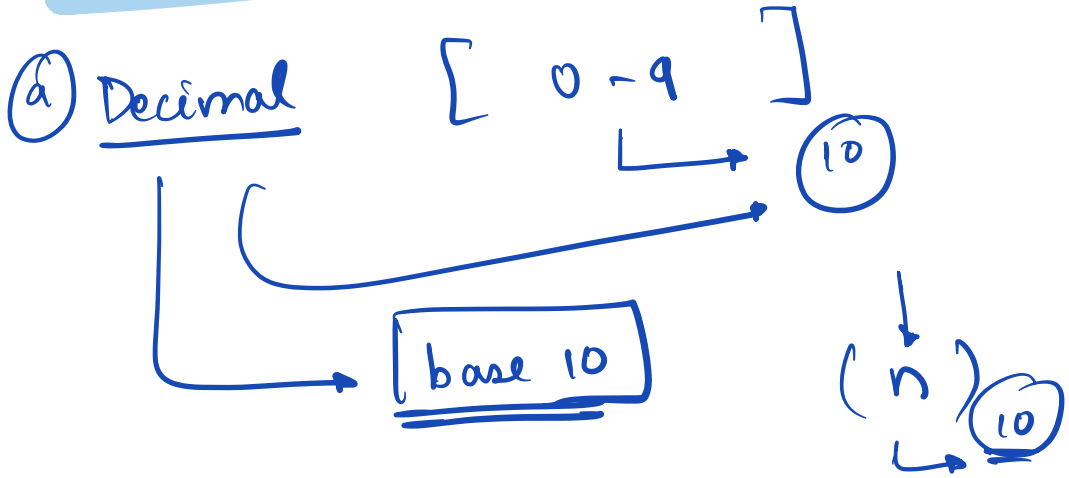
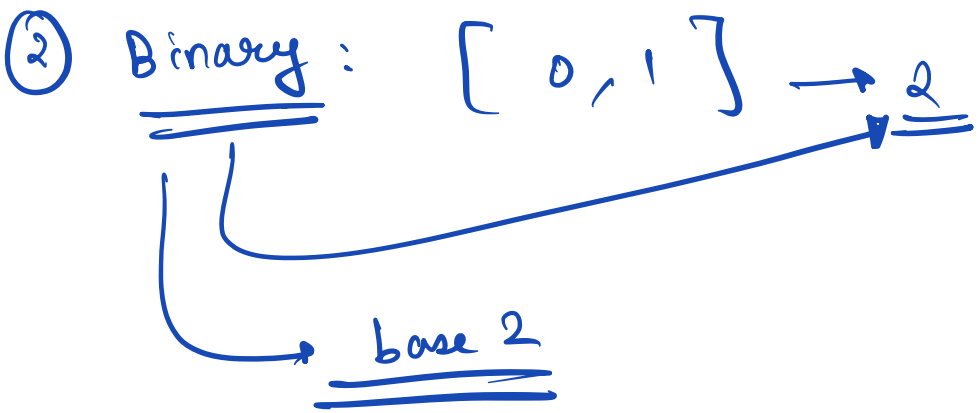
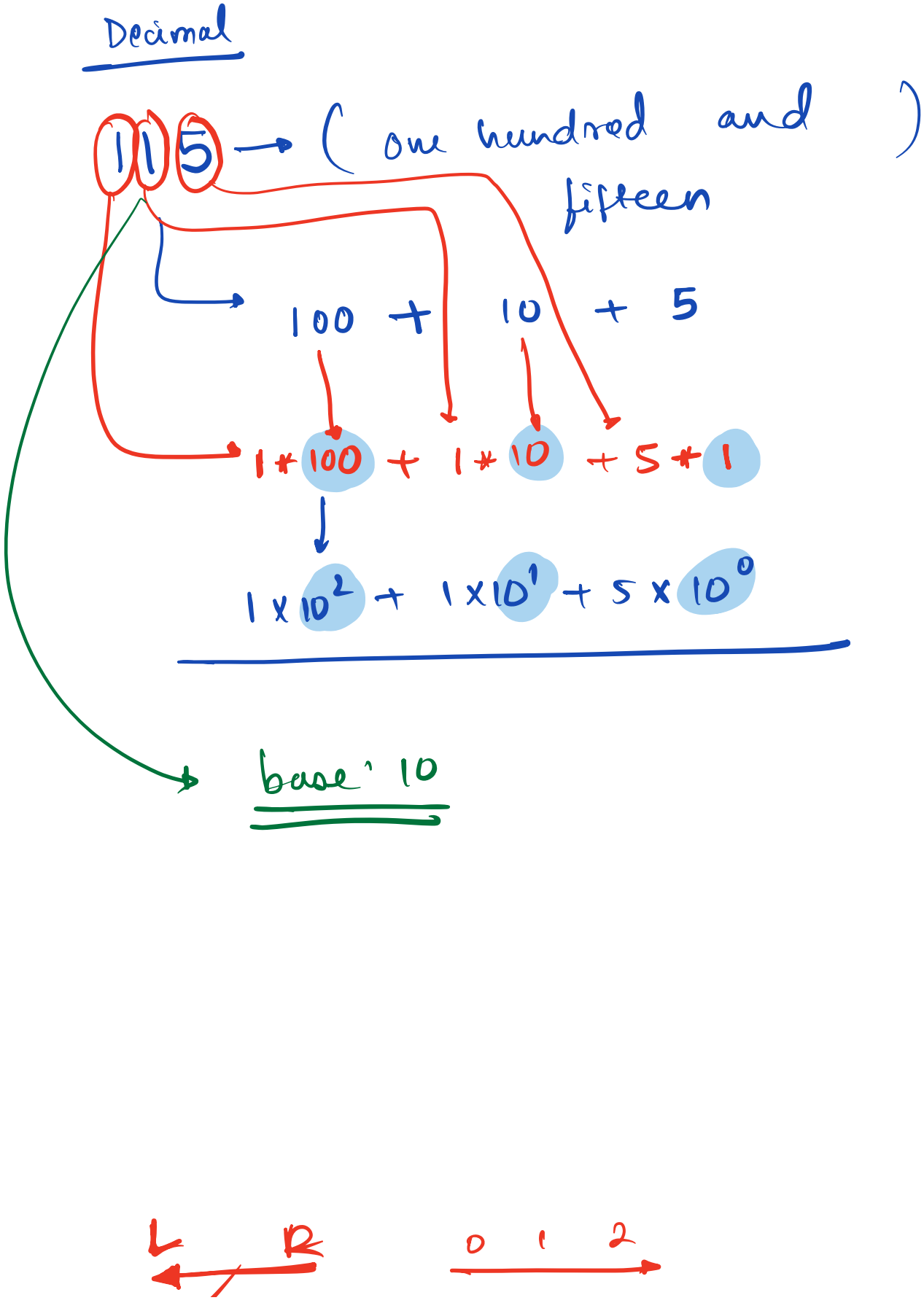
"Hello Everyone!"

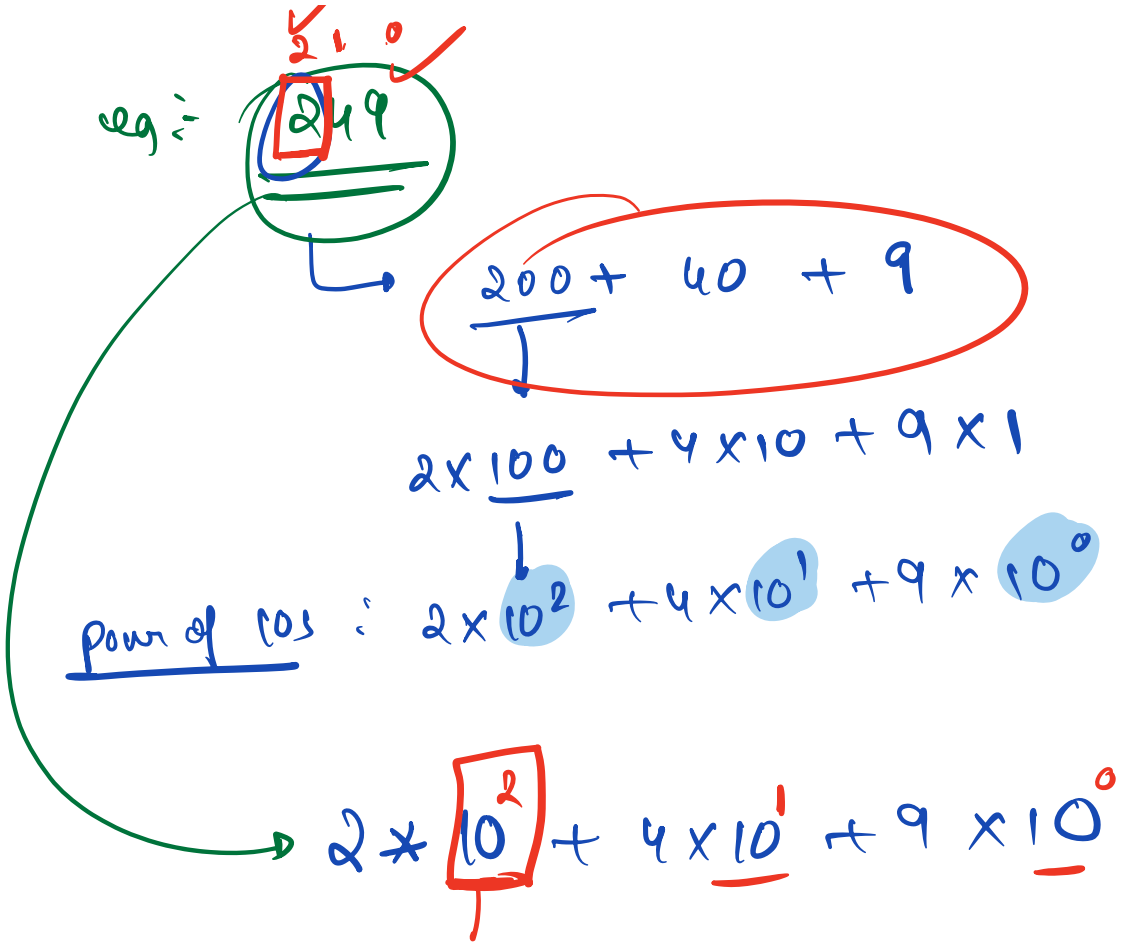
- Number Systems and Basic Maths

① Number Systems

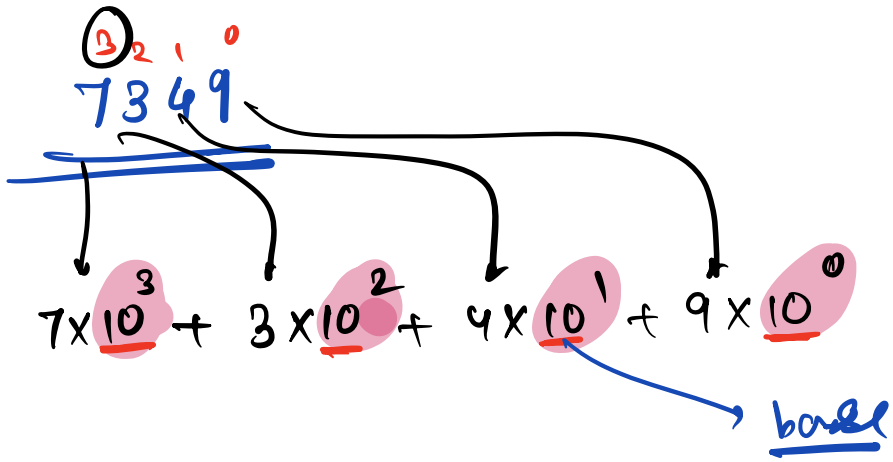





Decimal
115 → (one hundred and fifteen)
100 + 10 + 5
1*100 + 1*10 + 5*1
1 x 10^2 + 1 x 10^1 + 5 x 10^0
base 10
L R
0 1 2


eg :-
249
200 + 40 + 9
2 x 100 + 4 x 10 + 9 x 1
Power of 10s : 2 x 10^2 + 4 x 10^1 + 9 x 10^0
2 x 10^2 + 4 x 10^1 + 9 x 10^0

(3)



$(7349)_{10}$

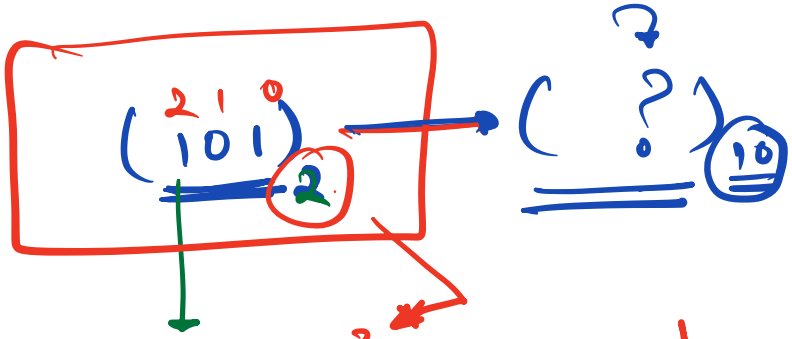
general base (b)

$7 \times (b)^2 + 2 \times (b)^1 + 1 \times (b)^0$

Converting to Decimal equivalent

( )$_b$ → base b numbers system.

Base 2 :- → 0 / 1



10 L
103

$= 1*(2)^2 + 0 \times (2)^1 + (1)*(2)^0$

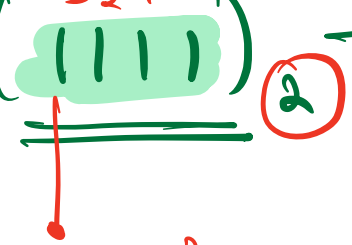
$= 1 \times 4 + 0 \times 2 + 1 \times 1$

$= 5$

$$(101)_2 = (5)_{10}$$

* Binary number System to equivalent Decimal Number System.

eg:- $(1111)_2 \longrightarrow (?)_{10}$



$= 1 \times (2)^3 + 1 \times (2)^2 + 1 \times (2)^1 + 1 \times (2)^0$

$= 8 + 4 + 2 + 1$

$= 15$

$(1111)_2 \longrightarrow (15)_{10}$

$(10)_{10} + (10)_{10} = (20)_{10}$

$(\ )_2 + (\ )_2 \longrightarrow (\text{o/p})_2$

(*) $(142)_2 \longrightarrow (\ ?\ )_{10}$

$1 \times (2)^2 + 4 \times (2)^1 + 2 \times (2)^0$

$4 + 8 + 2$

$= (14)_{10}$

$(142)_2 \longrightarrow (14)_{10}$

Reason $(142) \longrightarrow$ not a binary number.

$(\underset{5}{0}\ \underset{4}{0}\ \underset{3}{1}\ \underset{2}{1}\ \underset{1}{1}\ \underset{0}{1})_2 \longrightarrow (\ ?\ )_{10}$

$0\times(2)^5 + 0\times(2)^4 + 1\times(2)^3 + 1\times(2)^2 + 1\times(2)^1 + 1\times(2)^0$

$= 0 + 0 + 8 + 4 + 2 + 1$

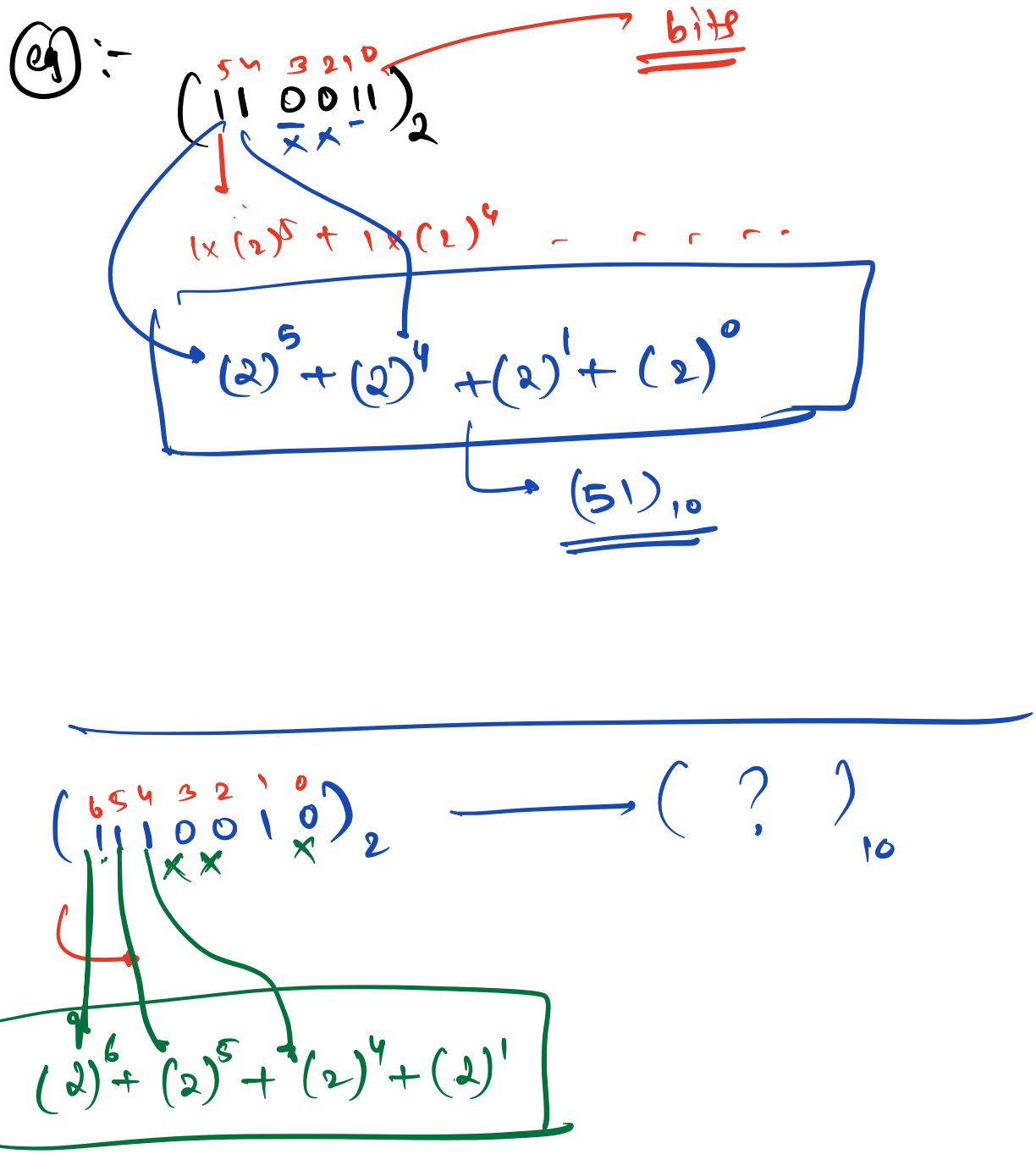
$= 15$

mm/dd/yyyy
or

$(00\,1111)_2 \longrightarrow (15)_{10}$

Obs: Leading zeroes has no significance to the value.

$(8)_{10} \longrightarrow (08)_{10} \longrightarrow (008)_{10}$


Eg :-
5 4 3 2 1 0
(1 1 0 0 1 1)2
bits
1x(2)5 + 1x(2)4
(2)5 + (2)4 + (2)1 + (2)0
(51)10
6 5 4 3 2 1 0
(1 1 1 0 0 1 0)2
(?)10
(2)6 + (2)5 + (2)4 + (2)1

* Decimal to Binary

( )$_{10}$ ⟶ ( )$_{2}$

eg: $(22)_{10}$ ⟶ $(?)_{2}$

0/1

★

22 → Closest / nearest power of 2 less than or equal to 22

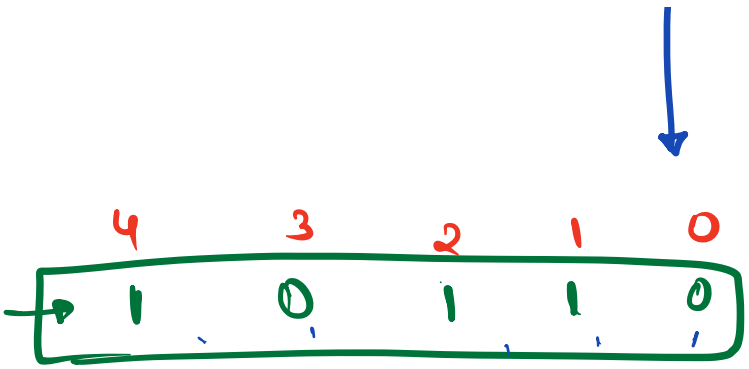
16 + 6

4 + 2

2 + 0

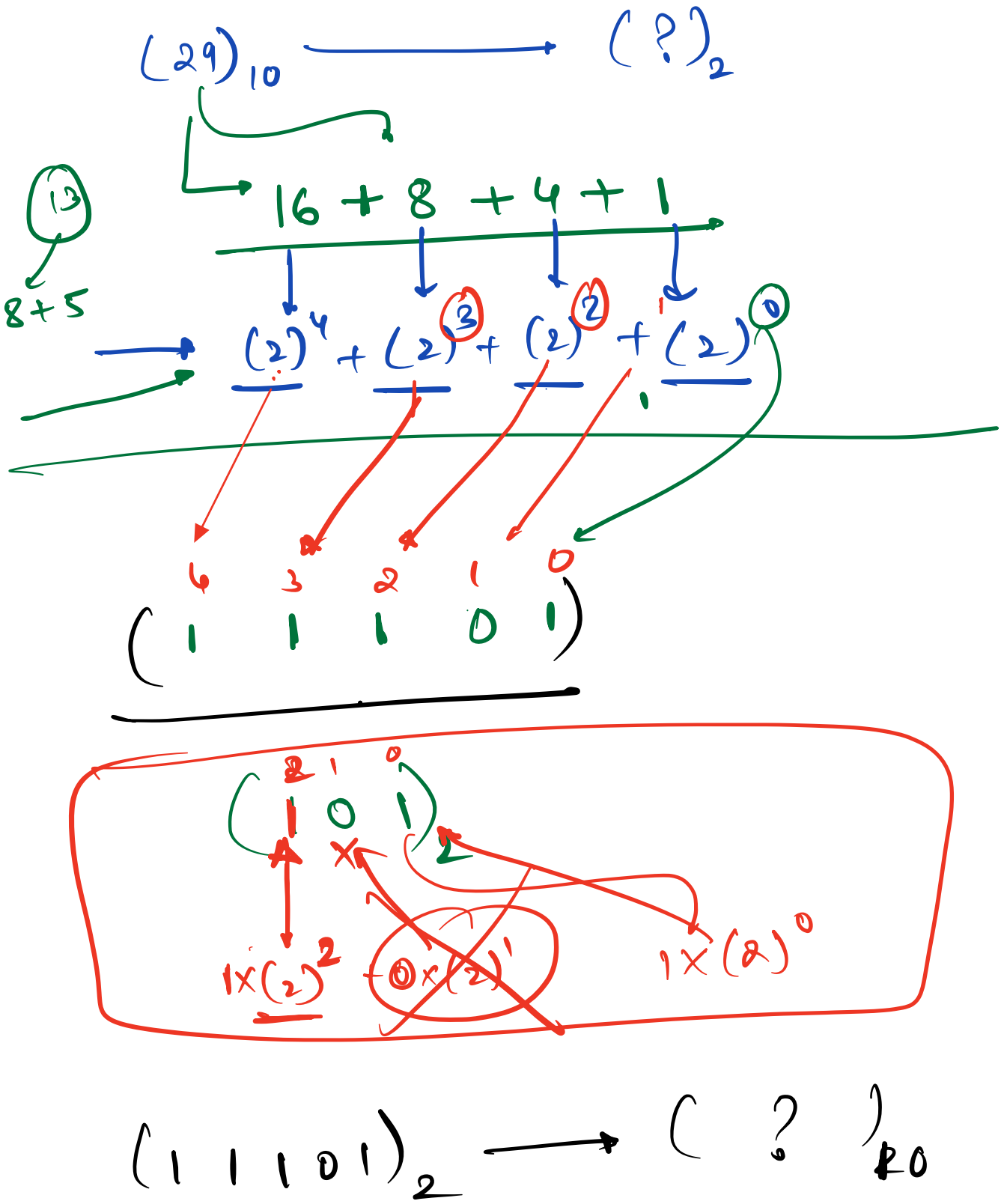
$(2)^{4} + (2)^{2} + (2)^{1}$ + 0

(write in powers of 2)



binary equivalent of $(22)_{10}$

$(22)_{10} \longrightarrow (10110)_2$


$(29)_{10}$
$(?)_2$
13
8+5
16 + 8 + 4 + 1
$(2)^4 + (2)^3 + (2)^2 + (2)^0$
4 3 2 1 0
(1 1 1 0 1)
2 1 0
1 0 1
$1\times(2)^2$
$0\times(2)^1$
$1\times(2)^0$
$(1\ 1\ 1\ 0\ 1)_2$
$(\ ?\ )_{10}$

Eg:

$(50)_{10} \longrightarrow (\ ?\ )_2$

Write 50 as a sum of numbers that are powers of 2.

$32 + 16 + 2$

$(2)^5 + (2)^4 + (2)^1$

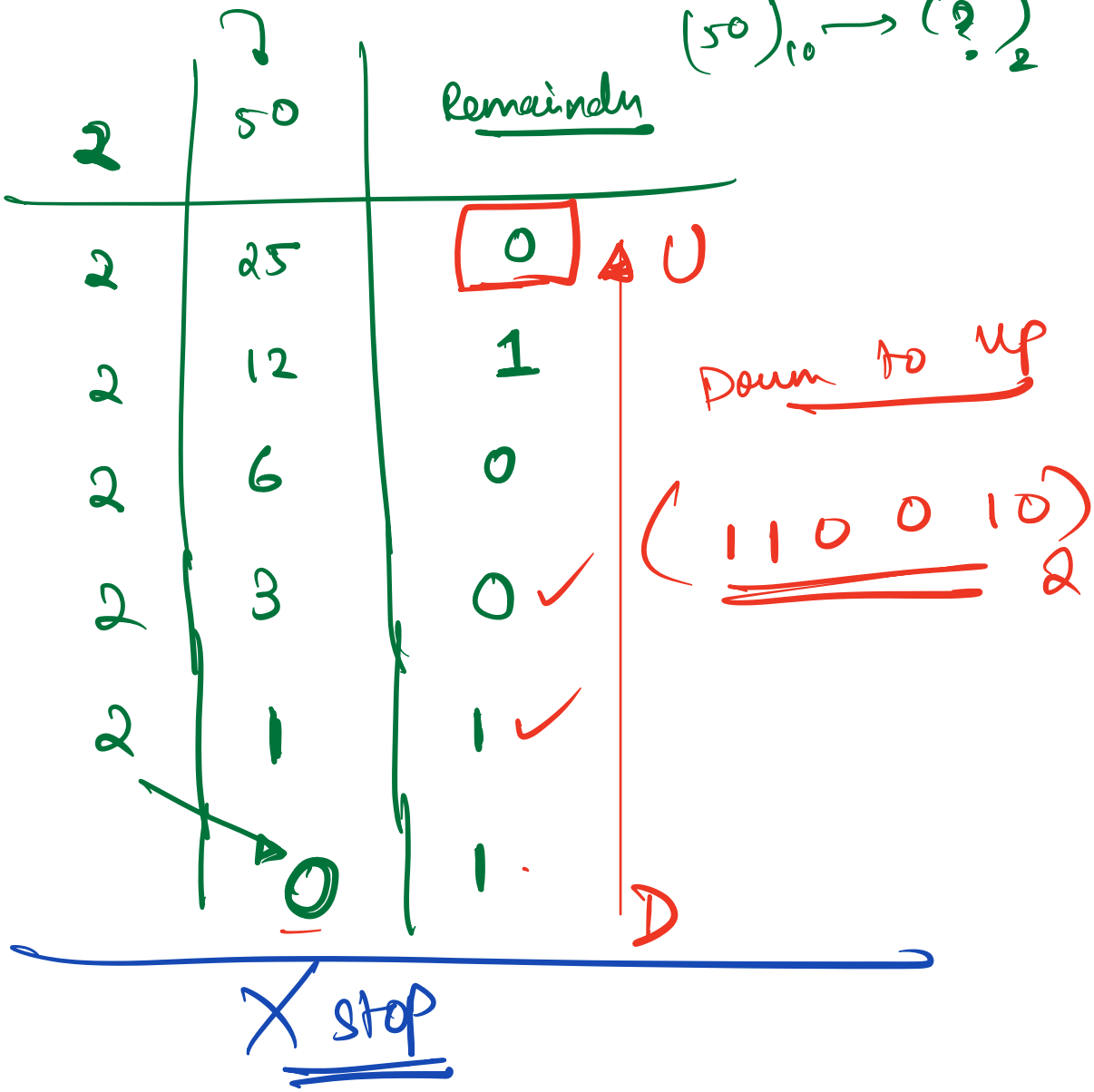
5	4	3	2	1	0
1	1	0	0	1	0

$(50)_{10} \longrightarrow (\ 1\ 1\ 0\ 0\ 1\ 0\ )_2$

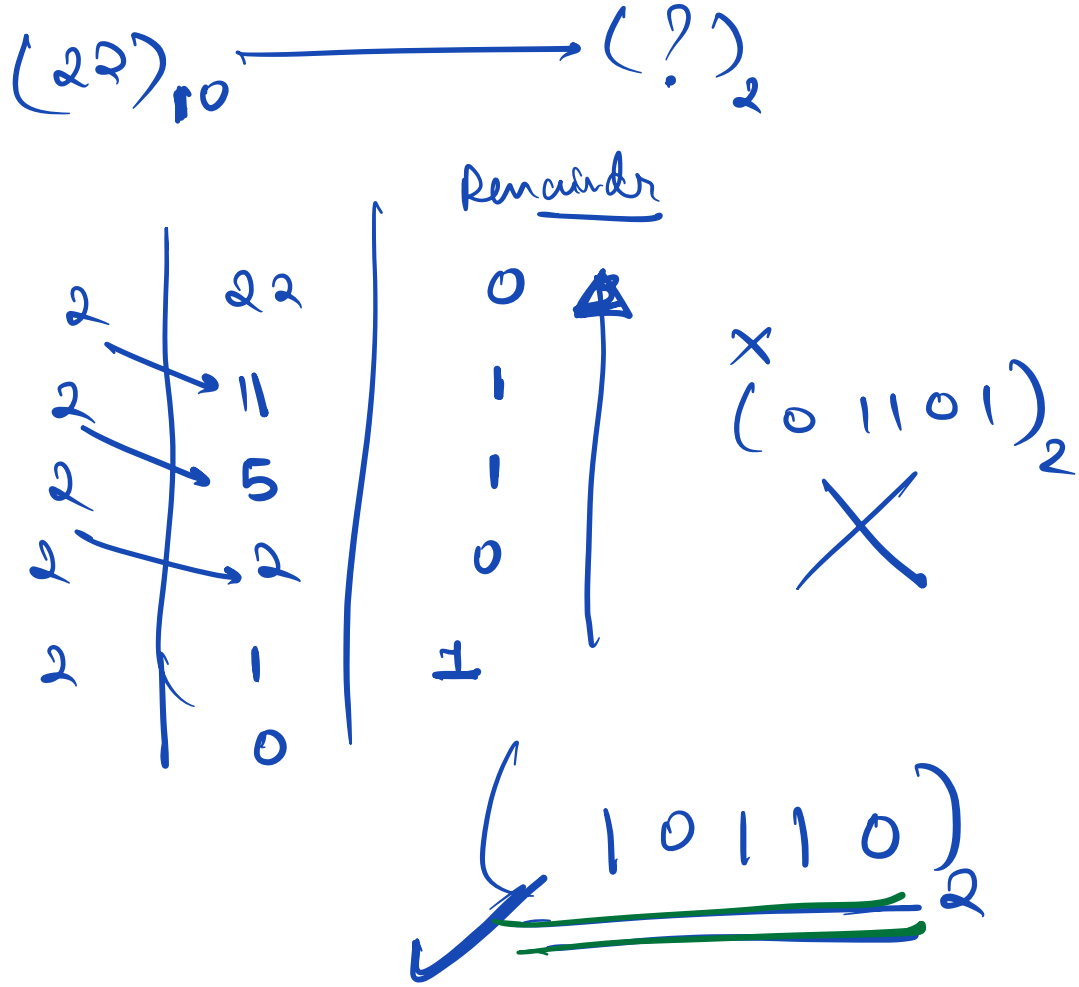

10:09

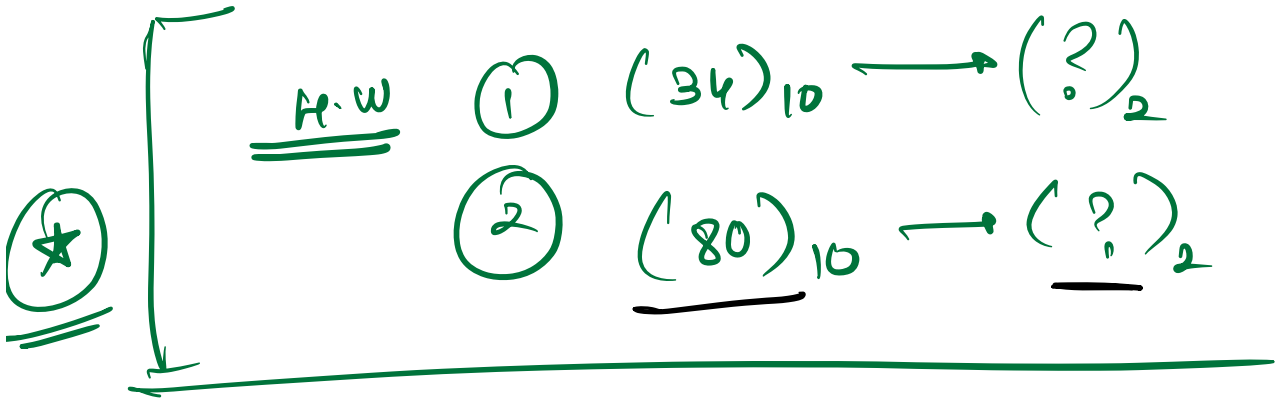
* Method 2 :- → Coding

$(50)_{10} \rightarrow (?)_2$



Logic :- Continuously divide the val by 2 and write down remainder in Bottom to Top.


(22)10 ⟶ (?)2
Remainder
2 22 → 0
2 11 → 1
2 5 → 1
2 2 → 0
2 1 → 1
0
X
(01101)2
X
(10110)2
bin
bin(5) ⟶


H.W
1 $(34)_{10} \longrightarrow (?)_2$
2 $(80)_{10} \longrightarrow (?)_2$

★ (8) Given a number, how many times do you have to divide it by 2 to make it 1.

→ floored

eg:-

$5 \xrightarrow{//2} 2 \xrightarrow{//2} 1$

→ Ans: 2

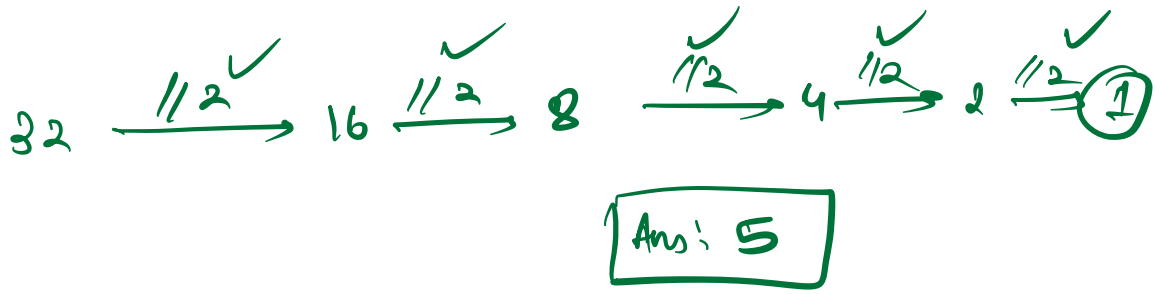
$8 \xrightarrow{//2} 4 \xrightarrow{//2} 2 \xrightarrow{//2} 1$

Ans: 3

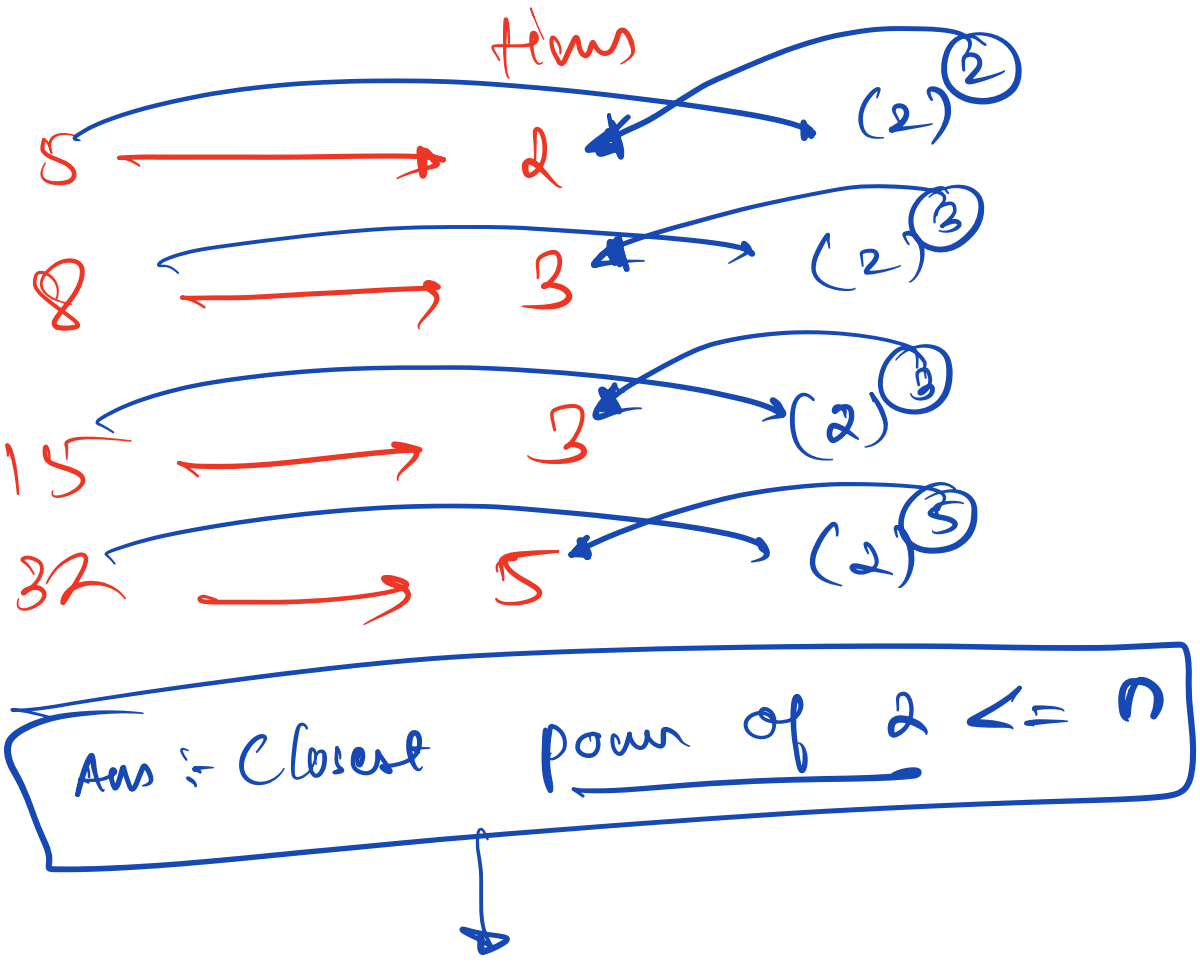
eg:-

$15 \xrightarrow{//2} 7 \xrightarrow{//2} 3 \xrightarrow{//2} 1$

Ans: 3



Ans: 5



Ans :- Closest power of 2 <= n

$\log_2(15) \simeq \lfloor 3.906 \rfloor \rightarrow 3$

$\log_2(32) \Rightarrow 5$

$\text{int}(\log_2(n))$

H.W → check out primer videos for [log]

pinned chat

$\log_b(a)$ → "log a to the base b"

if $\log_b(a) = x$

$(b)^x = a$

eg → $\log_2(64) \Rightarrow$

$(2)^x = 64$

$2^6 = 64$ ✓

$\log_2(64) = 6$

primer video

* Range

Imp

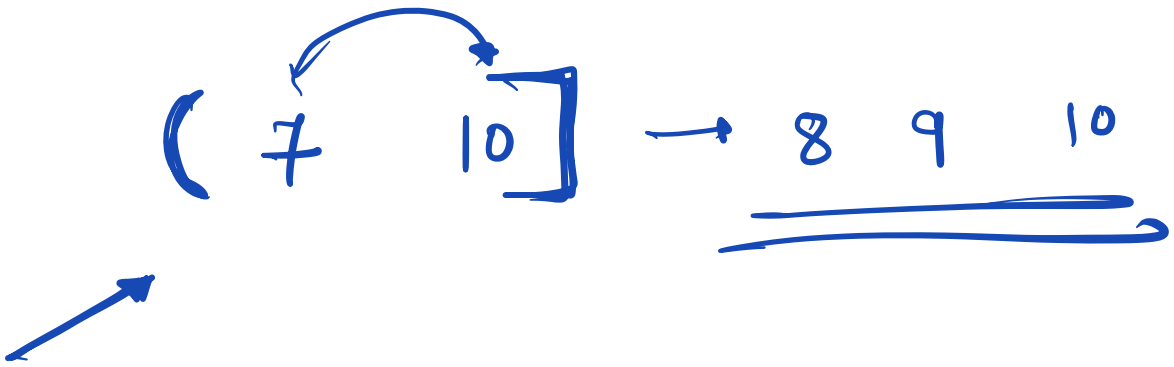
[→ included

(→ excluded

eg: [1 10] → 1 2 3 4 5 ... 10

(1 9) → 2 3 4 5 6 7 8

[5 7) → 5 6



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* no. of integers in given range

#

[1 10] → 10

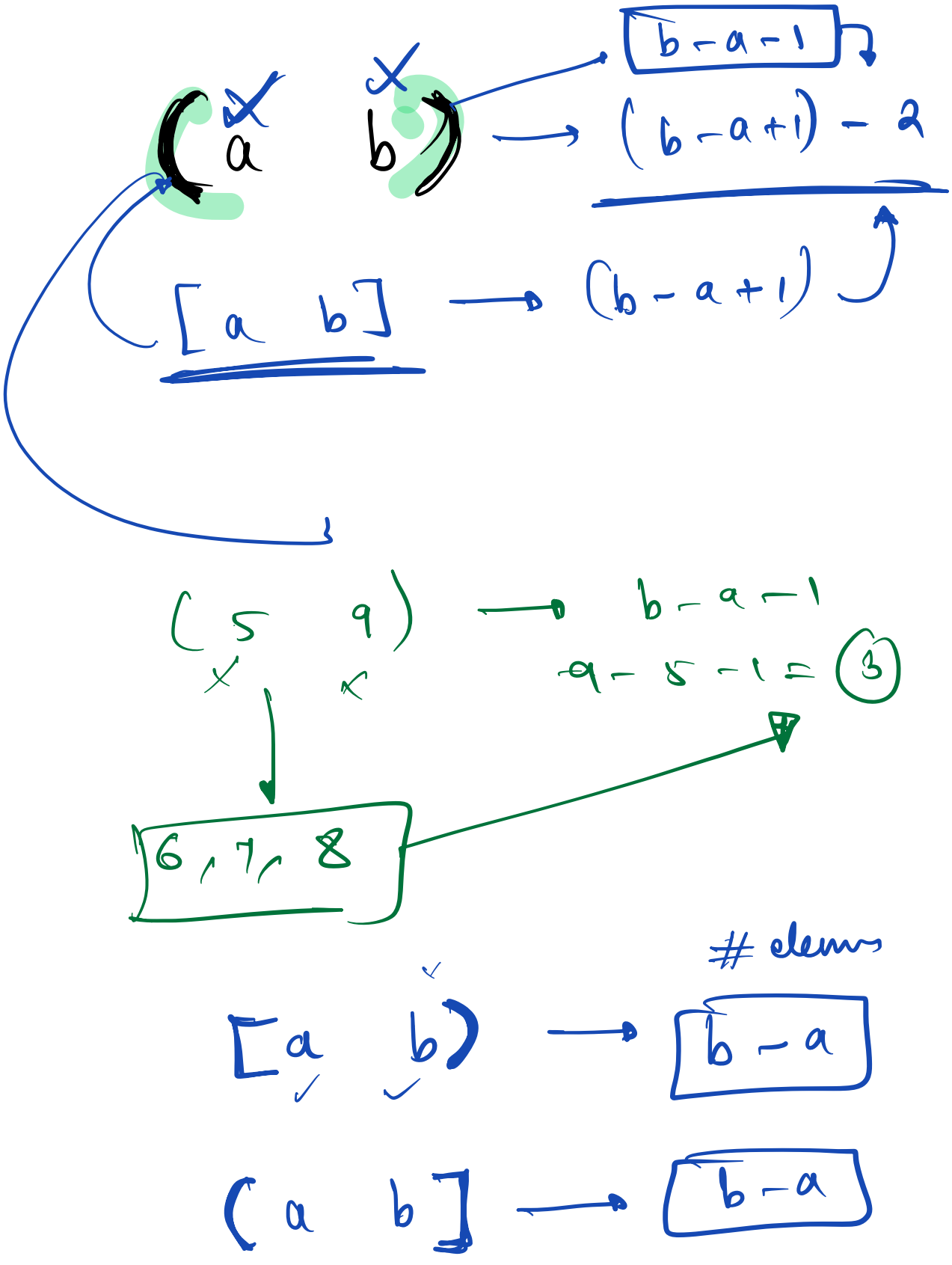
[2 8] → ~~7~~

[a b] → b − a + 1

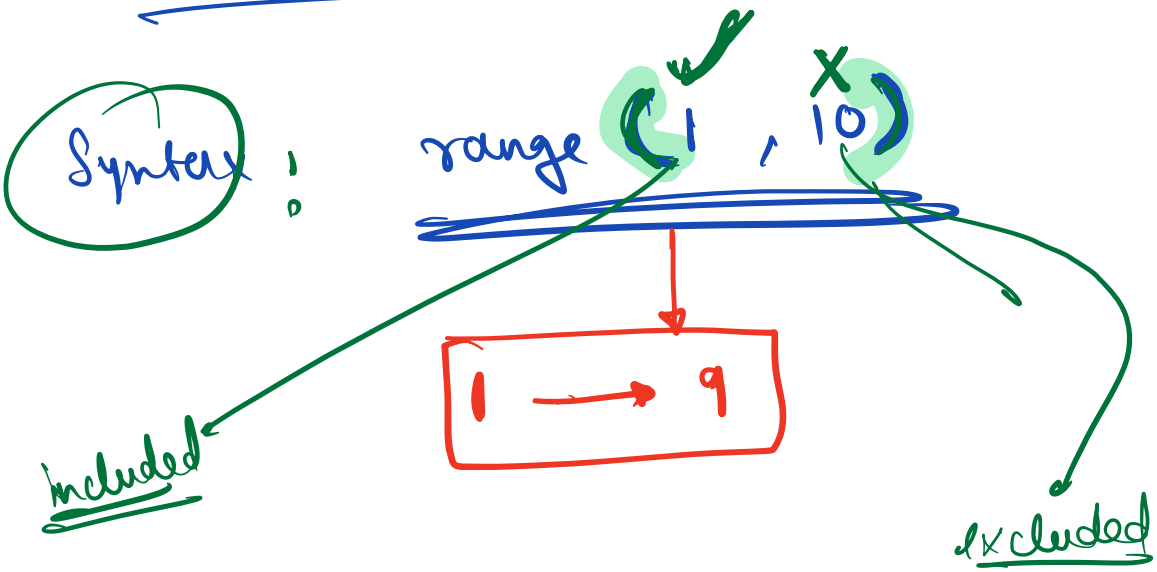
[1 10] → 10 − 1 + 1

↳ 10 ✓

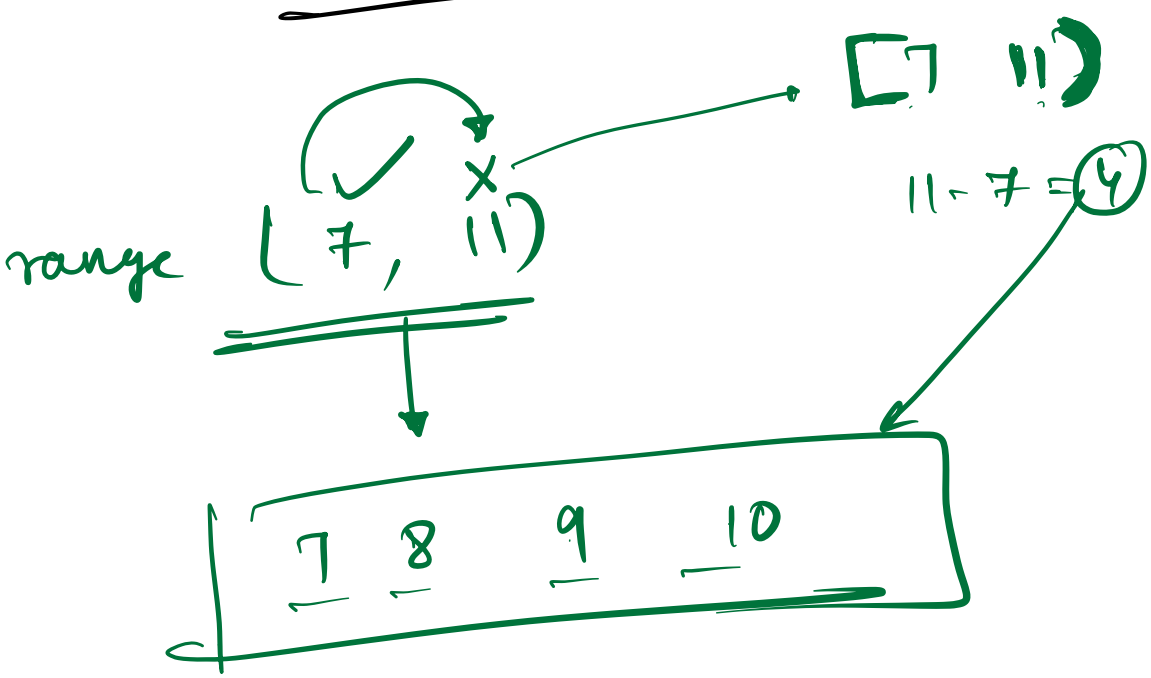
[2 8] → 8 − 2 + 1 → 7 ✓


b - a - 1
(a b) → (b - a + 1) - 2
[a b] → (b - a + 1)
(5 9) → b - a - 1
9 - 5 - 1 = 3
6, 7, 8
elems
[a b) → b - a
(a b] → b - a

* Range method in Python



print(" A ")



range $(2, x_3)$

2

$$\log_b(a) = x$$

$$b^x = a$$

Doubts :-