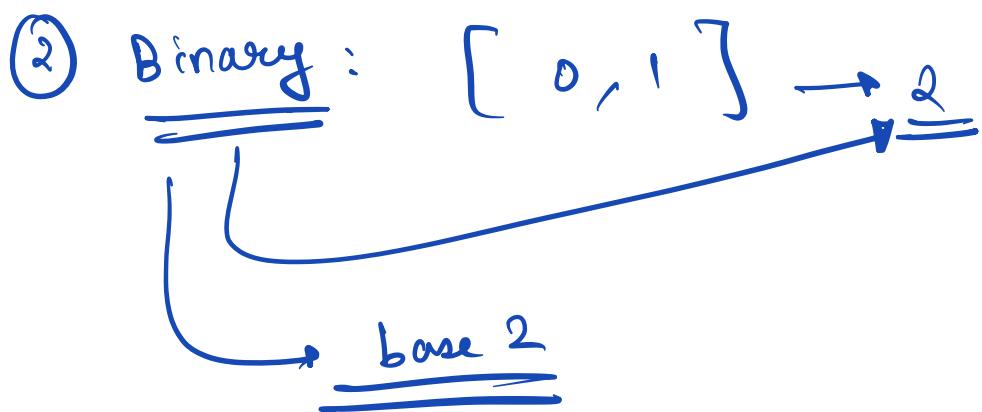
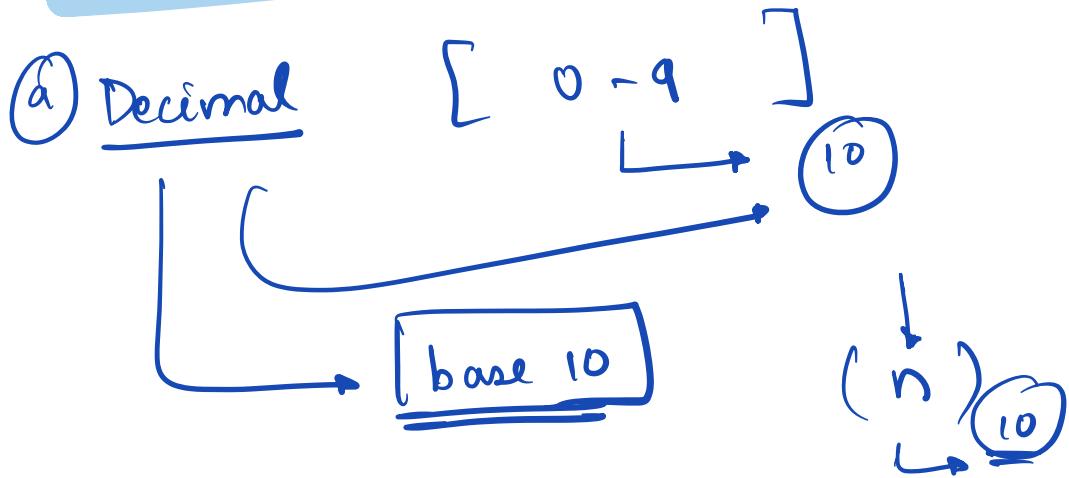


"Hello Everyone!"

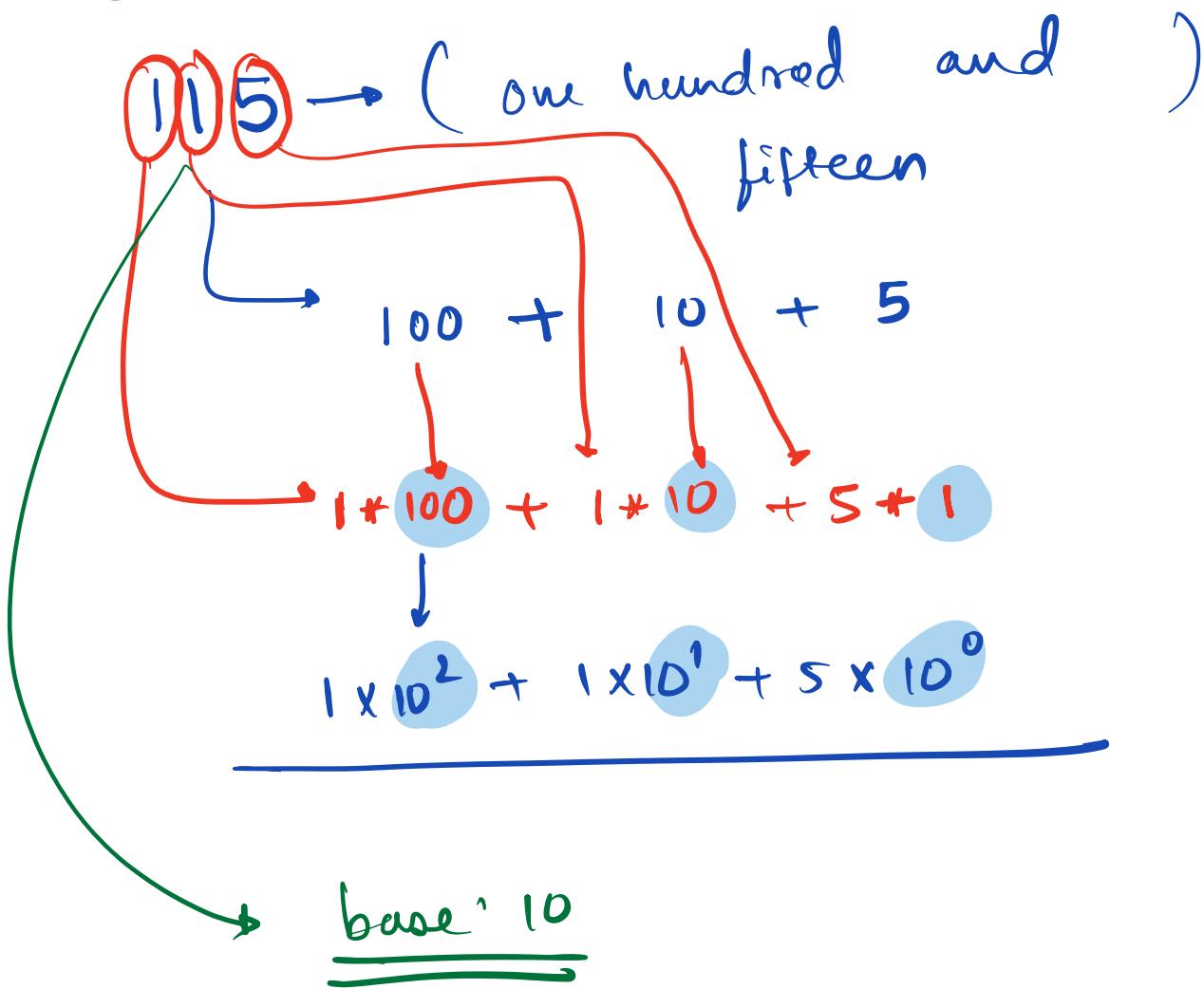
* Number Systems and
Basic Maths



① Number Systems



Decimal



L R
0 1 2

eg :-

249

5 1 0

$$200 + 40 + 9$$

$$2 \times \underline{100} + 4 \times 10 + 9 \times 1$$

Power of 10s : $2 \times 10^2 + 4 \times 10^1 + 9 \times 10^0$

$$2 \times \boxed{10^2} + 4 \times \underline{10^1} + 9 \times \underline{10^0}$$

③

$$\begin{array}{r} 7349 \\ \hline 7 \times 10^3 + 3 \times 10^2 + 4 \times 10^1 + 9 \times 10^0 \end{array}$$

based

$$(7349)_{10}$$

general base (b)

$$(721)_b$$

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

Converting to Decimal equivalent

$(\underline{\underline{b}})_b \rightarrow$ base b number system.

Base 2 :-

$$\begin{aligned}
 &= 1 * (2)^2 + 0 * (2)^1 + 1 * (2)^0 \\
 &= 1 * 4 + 0 * 2 + 1 * 1 \\
 &= 5
 \end{aligned}$$

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

* Binary number system
to
equivalent Decimal Number System.

Eg:- $(\underline{\overline{111}})^2 \rightarrow (?)_{10}$

$$\begin{aligned}
 &= 1 \times (2)^3 + 1 \times (2)^2 + 1 \times (2)^1 + 1 \times (2)^0 \\
 &= 8 + 4 + 2 + 1 \\
 &= 15
 \end{aligned}$$

$$(111)_2 \longrightarrow \underline{(15)_{10}}$$

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

$(.)_2 + (.)_2 \rightarrow (0/1)_2$

★ $(142)_{10} \rightarrow (?)_{10}$

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

$$4 + 8 + 2$$

$$= (14)_{10}$$

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

Reason $142 \rightarrow$ not a
binary number.

$$(\begin{smallmatrix} 5 & 4 \\ 0 & 0 \end{smallmatrix} \begin{smallmatrix} 3 & 2 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{smallmatrix})_2 \rightarrow (?)_{10}$$

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

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

mmldd/4444
ok

$$= 15$$

$$(\underline{\underline{00}}\underline{\underline{1111}})_2 \rightarrow (\underline{15})_{10}$$

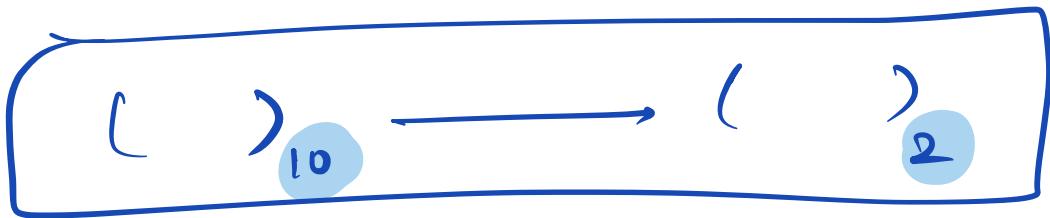
obc: Leading zeroes has no significance to the value.

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

$$\left(\begin{smallmatrix} 6 & 5 & 4 & 3 & 2 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 & x \end{smallmatrix} \right)_2 \longrightarrow \left(? \right)_{10}$$

Diagram illustrating the conversion of the binary number $(11001010)_2$ to its decimal equivalent. The binary digits are grouped into powers of 2: $(2)^6 + (2)^5 + (2)^4 + (2)^1$. A red arrow points from the first digit (6) to the first term. A green bracket groups the terms $(2)^6 + (2)^5 + (2)^4 + (2)^1$.

* Decimal to Binary



e.g.: (22)₁₀ → (?)₂

0/1

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

$$22 \rightarrow 16 + 6$$
$$6 \rightarrow 4 + 2$$
$$2 \rightarrow 2 + 0$$

(Write in
powers of 2)

$$\underline{(2)}^4 + \underline{(2)}^2 + \underline{(2)}^1 +$$

↓

4	3	2	1	0
1	0	1	1	0

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

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

$$(29)_{10} \rightarrow (?)_2$$

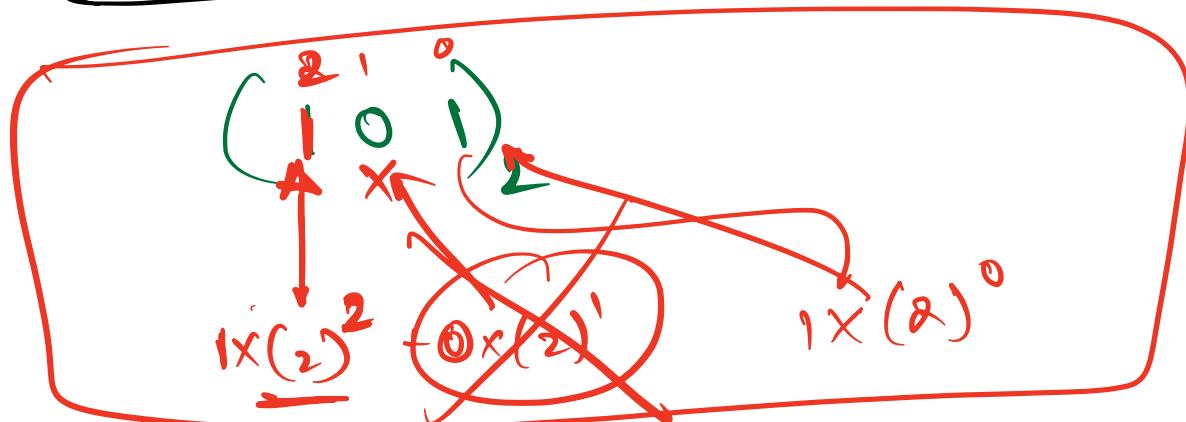
Diagram illustrating the conversion of $(29)_{10}$ to $(?)_2$.

The number 29 is shown as $16 + 8 + 4 + 1$. The sum $16 + 8$ is circled in green, labeled $8+5$, and has a green arrow pointing to it. The sum $16 + 8 + 4$ is circled in red, labeled $16+8+4$, and has a red arrow pointing to it. The sum $16 + 8 + 4 + 1$ is circled in blue, labeled $16+8+4+1$, and has a blue arrow pointing to it.

The conversion process is shown as follows:

$$16 + 8 + 4 + 1 \rightarrow (2)^4 + (2)^3 + (2)^2 + (2)^0$$

Below this, the binary representation is given as $(11101)_2$.



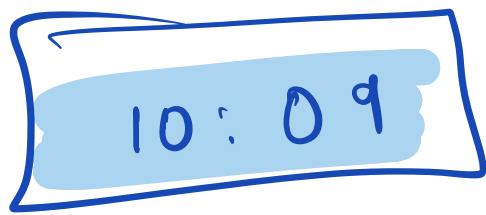
$$(11101)_2 \rightarrow (?)_{10}$$

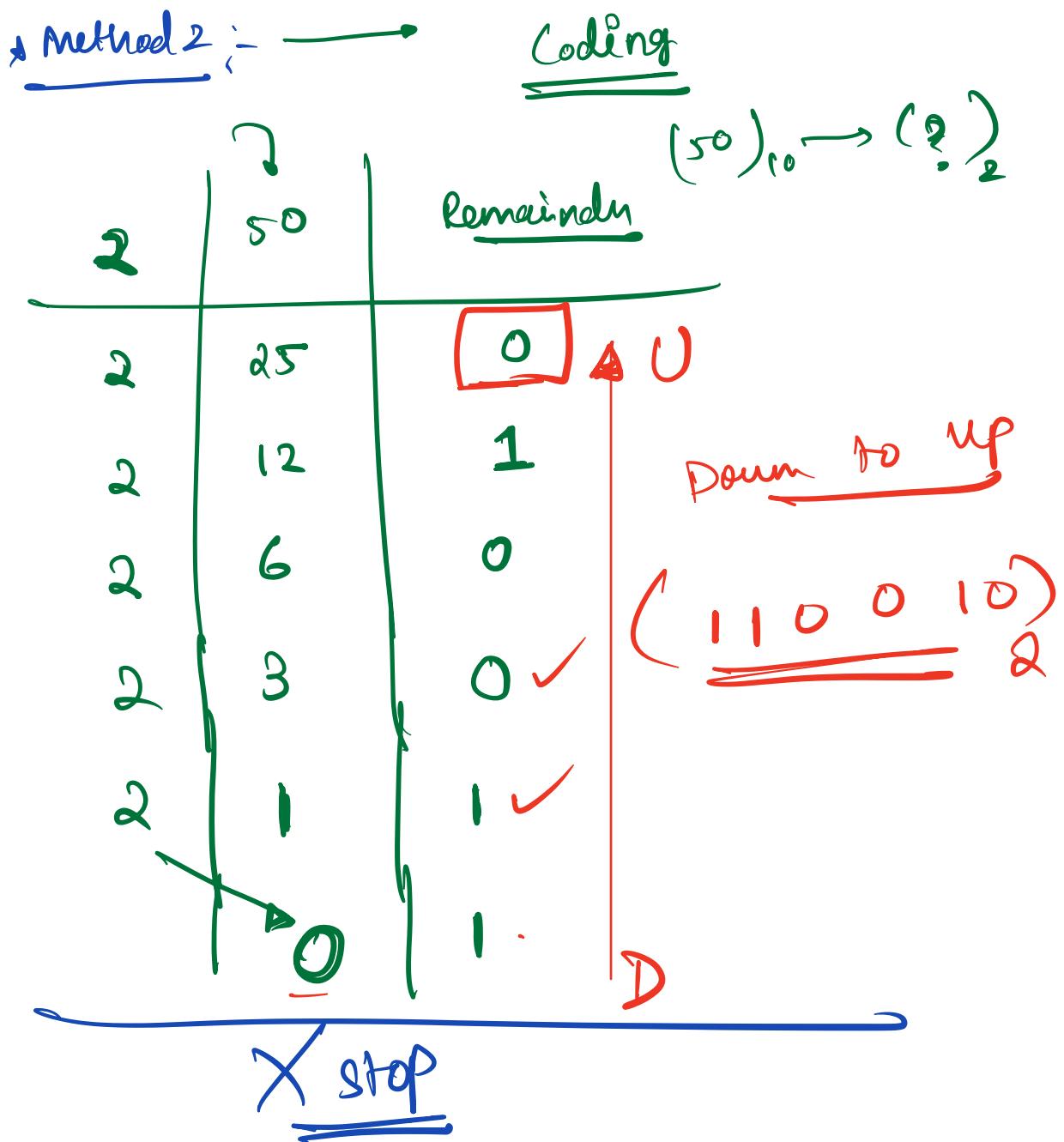
Q: $(50)_{10} \rightarrow (?)_2$

Write 50 as a sum of numbers
treat as powers of 2.

$$\begin{array}{c}
 32 + 16 + 2 \\
 \downarrow \quad \downarrow \quad \downarrow \\
 (2)^5 + (2)^4 + (2)^1 \\
 \downarrow \quad \quad \quad \downarrow \\
 5 \quad 4 \quad 3 \quad 2 \quad 1 \quad 0 \\
 1 \quad 1 \quad 0 \quad 0 \quad 1 \quad 0
 \end{array}$$

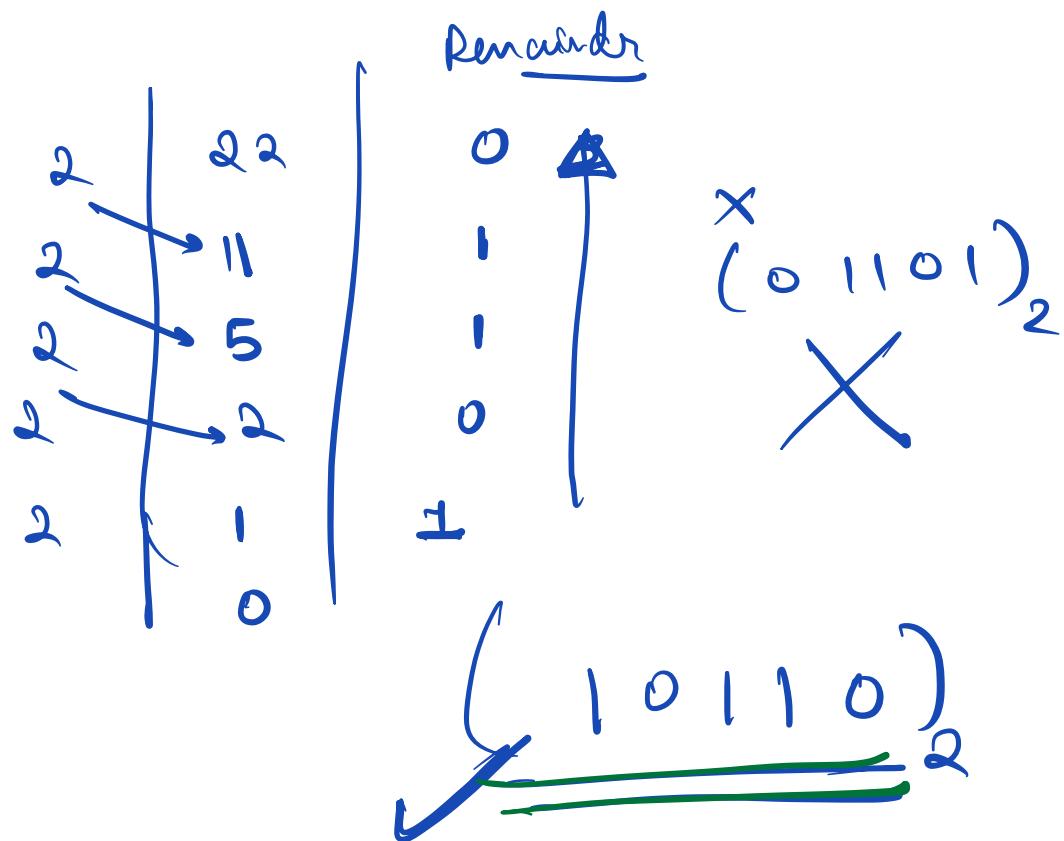
$(50)_{10} \rightarrow (110010)_2$





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

$$(22)_{10} \rightarrow (?)_2$$



bin bin(5) →

 $\stackrel{\text{H.W}}{\boxed{}}$

① $(34)_{10} \rightarrow (?)_2$

② $\underline{(80)_{10}} \rightarrow \underline{(?)_2}$

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

~~Floored~~

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

→ Ans: 2

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

Ans: 3

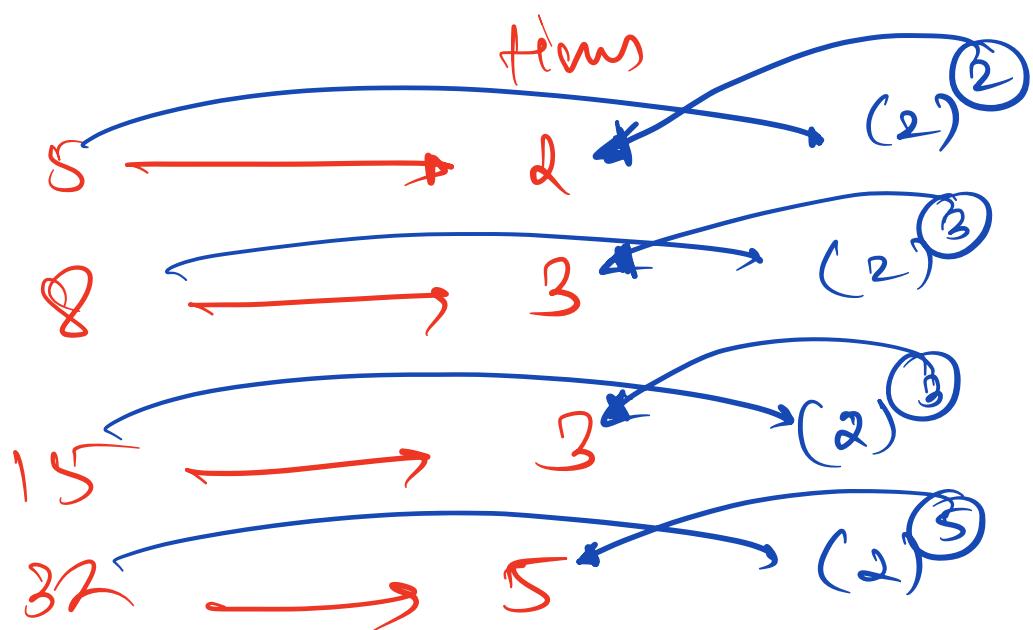
eg :-

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

Ans: 3

$$32 \xrightarrow{1/2} 16 \xrightarrow{1/2} 8 \xrightarrow{1/2} 4 \xrightarrow{1/2} 2 \xrightarrow{1/2} 1$$

Ans: 5



Ans : Closest power of 2 $\leq n$

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

$$\log_2(32) \Rightarrow 5$$

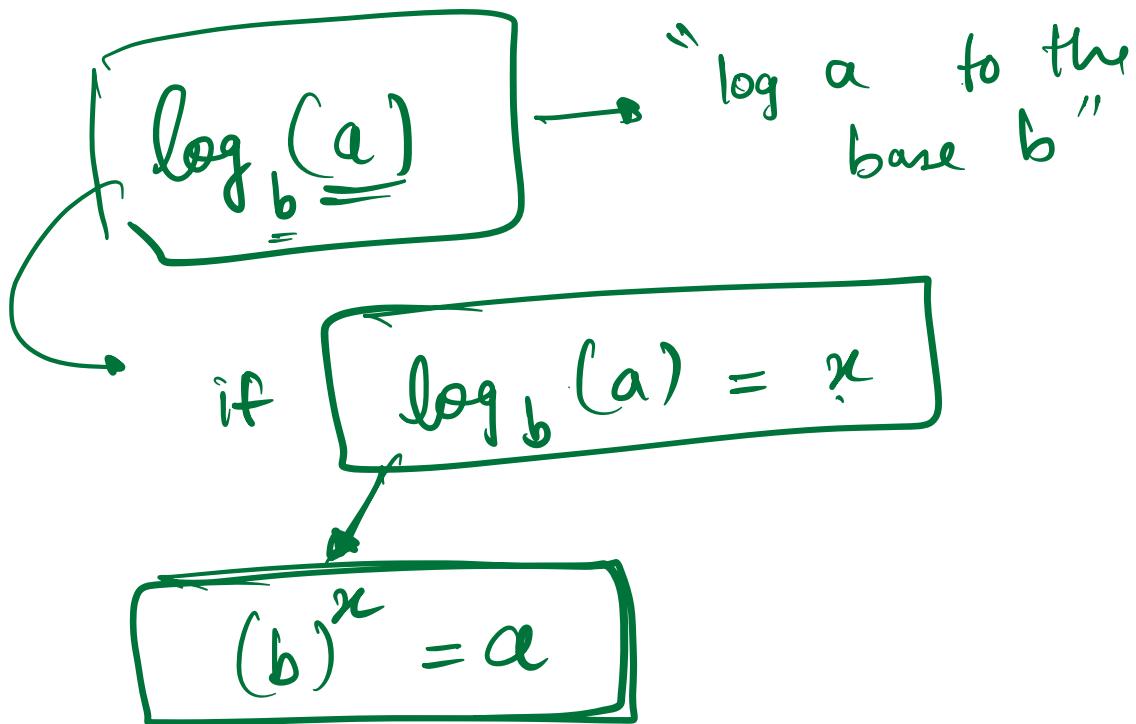
$$\text{int}(\log_2(n))$$

H.W → check out primer videos

for $\boxed{\log}$

pinned chat

→ x



$$\text{log} \rightarrow \log_{\textcircled{a}}(64) \Rightarrow$$

$$(2)^x = 64$$

$$2^6 = 64 \checkmark$$

$$\log_2(64) = 6$$

prime video

* Range

Imp

C

→ included

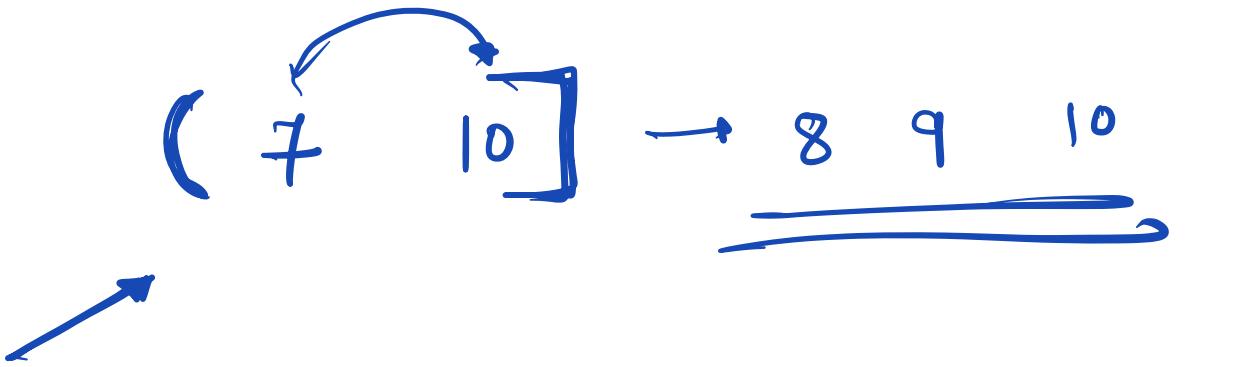
C

→ excluded

e.g.: [1 10] → ✓ 1 2 3 4 5 ... 10 ✓

(1 9) → 2 3 4 5 6 7 8

[5 7) → 5 6 ✗



* no. of integers in given range

$$[1 \quad 10] \rightarrow 10$$

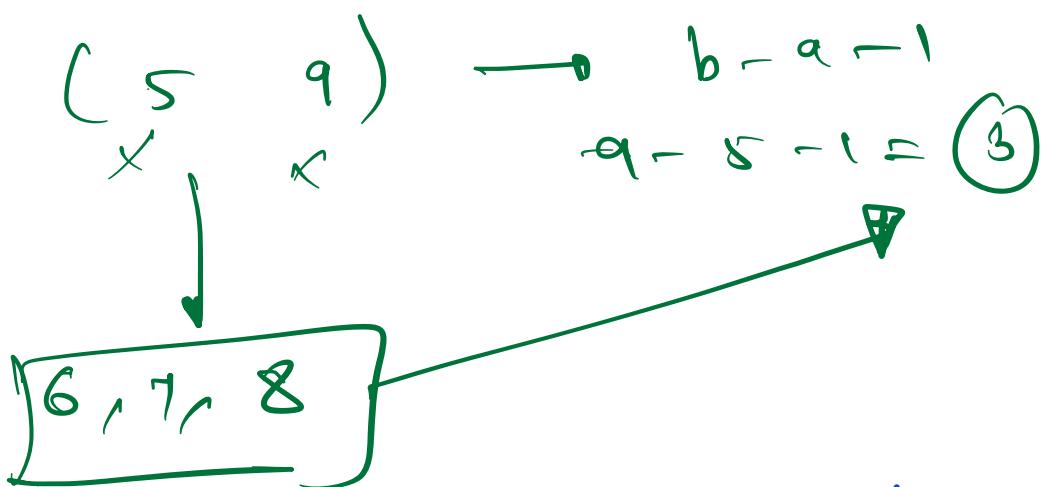
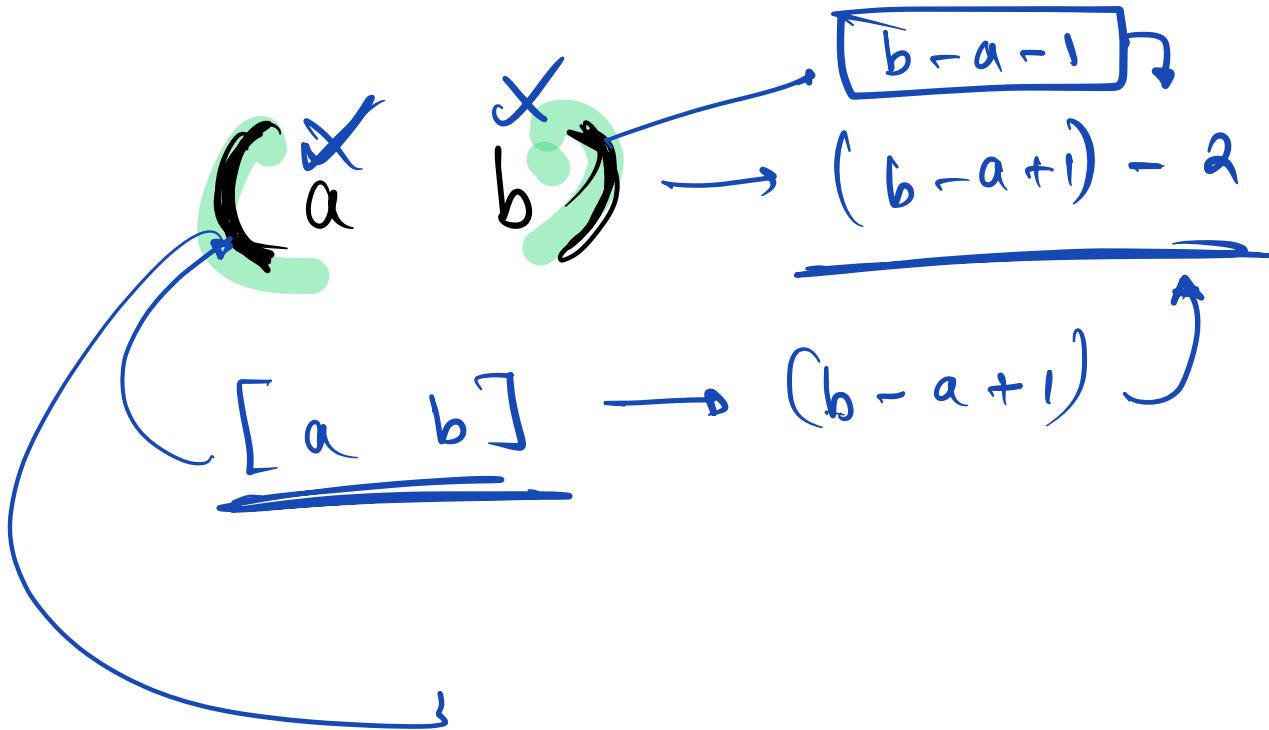
$$[2 \quad 8] \rightarrow 7$$

$[a \quad b] \rightarrow b - a + 1$

$$[1 \quad 10] \rightarrow 10 - 1 + 1$$

$\overbrace{10}$ ✓

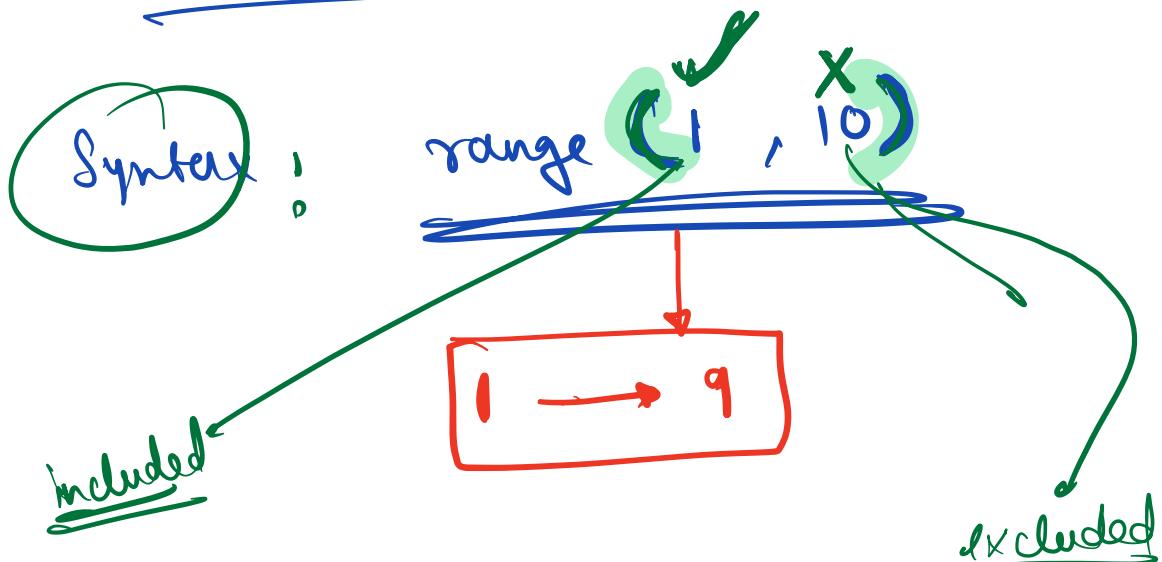
$$[2 \quad 8] \rightarrow 8 - 2 + 1 \rightarrow 7 \text{ ✓}$$



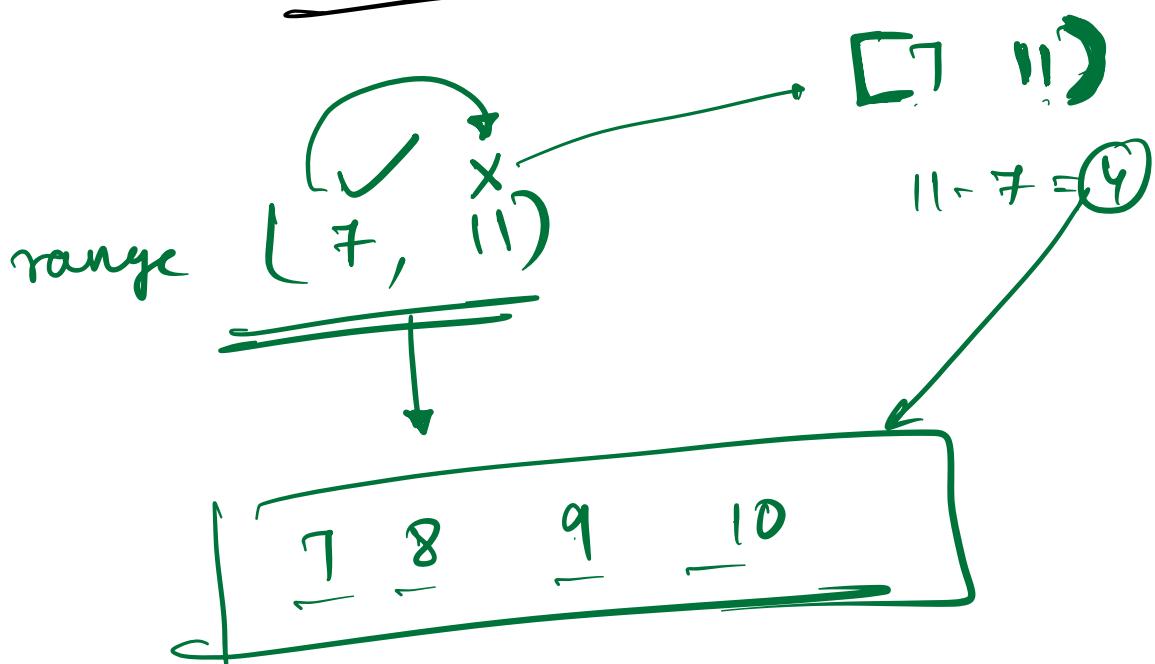
$\cancel{[a \ b]}$ \rightarrow $\boxed{b-a}$
 # elems

$(a \ b] \rightarrow \boxed{b-a}$

* Range method in Python



`print("A")`



range (x_2, x_3)

2

$$\log_b(a) = n$$
$$b^n = a$$

Doubts :-

$$\begin{array}{c} \xrightarrow{\quad} (75)_{10} \xrightarrow{\quad} \\ \downarrow \\ 64 + 8 + 2 + 1 \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ (2)^6 + (2)^3 + (2)^1 + (2)^0 \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ 6 \ 5 \ 4 \ 3 \ 2 \ 1 \ 0 \\ \hline 1 \ 0 \ 0 \ 1 \ 0 \ 1 \ 1 \end{array}$$