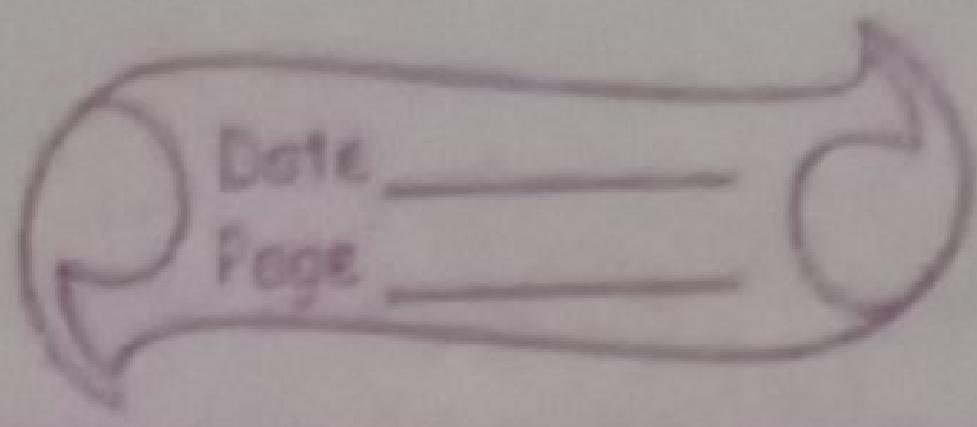


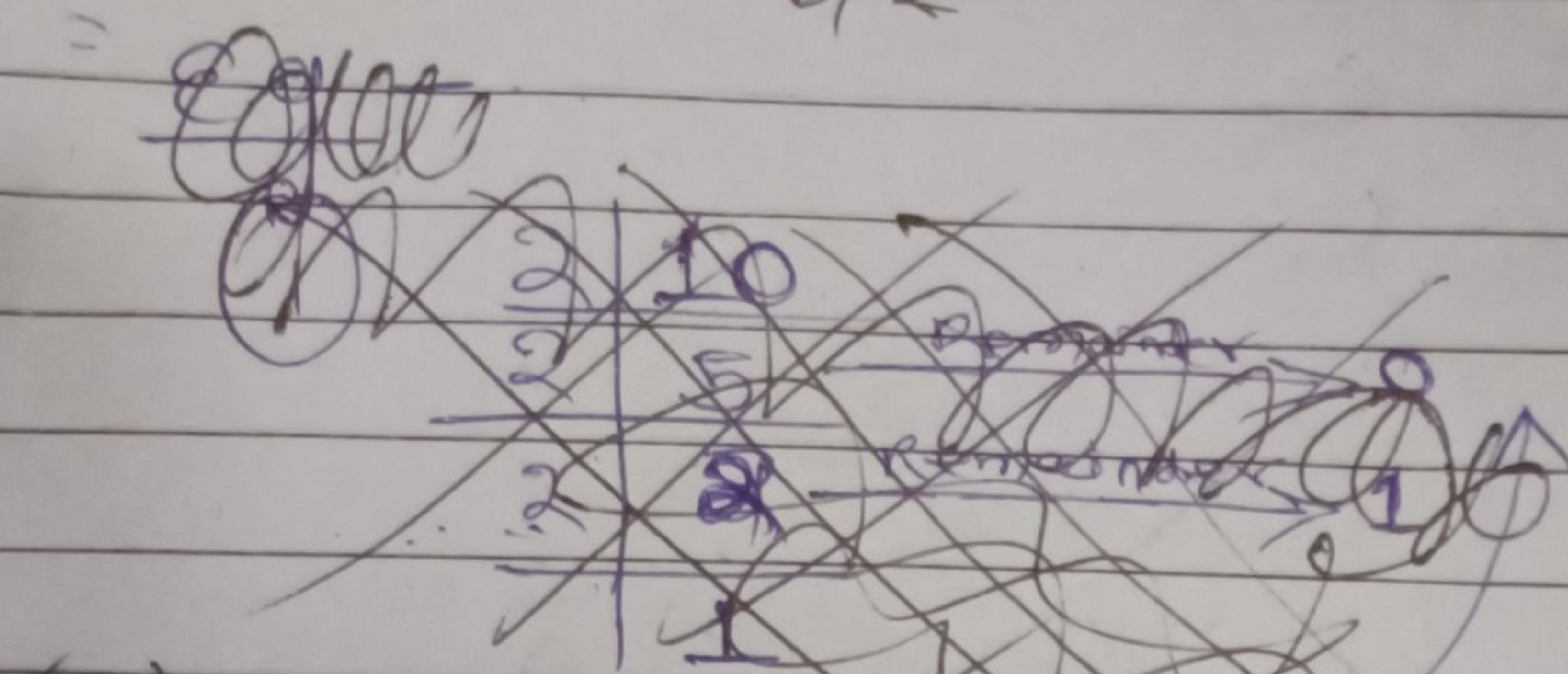
14/02/23



* BITWISE Operators

here we have to know how we can convert
digit to binary and binary to digit.

divide by 2



$$\begin{array}{r} 1010 \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ 2^3 \quad 2^2 \quad 2^1 \quad 2^0 \\ \hline 1 & 0 & 1 & 0 \end{array}$$
$$1010 \rightarrow 2^0 \times 1 + 2^1 \times 0 + 2^2 \times 1 + 2^3 \times 0$$
$$+ 2^0 \times 0 + 2^1 \times 1 + 2^2 \times 0 + 2^3 \times 1$$
$$\Rightarrow 0 + 2 + 0 + 8$$
$$\Rightarrow \underline{\underline{10}}$$

(i) digit to down to up
 $10 \rightarrow$ binary

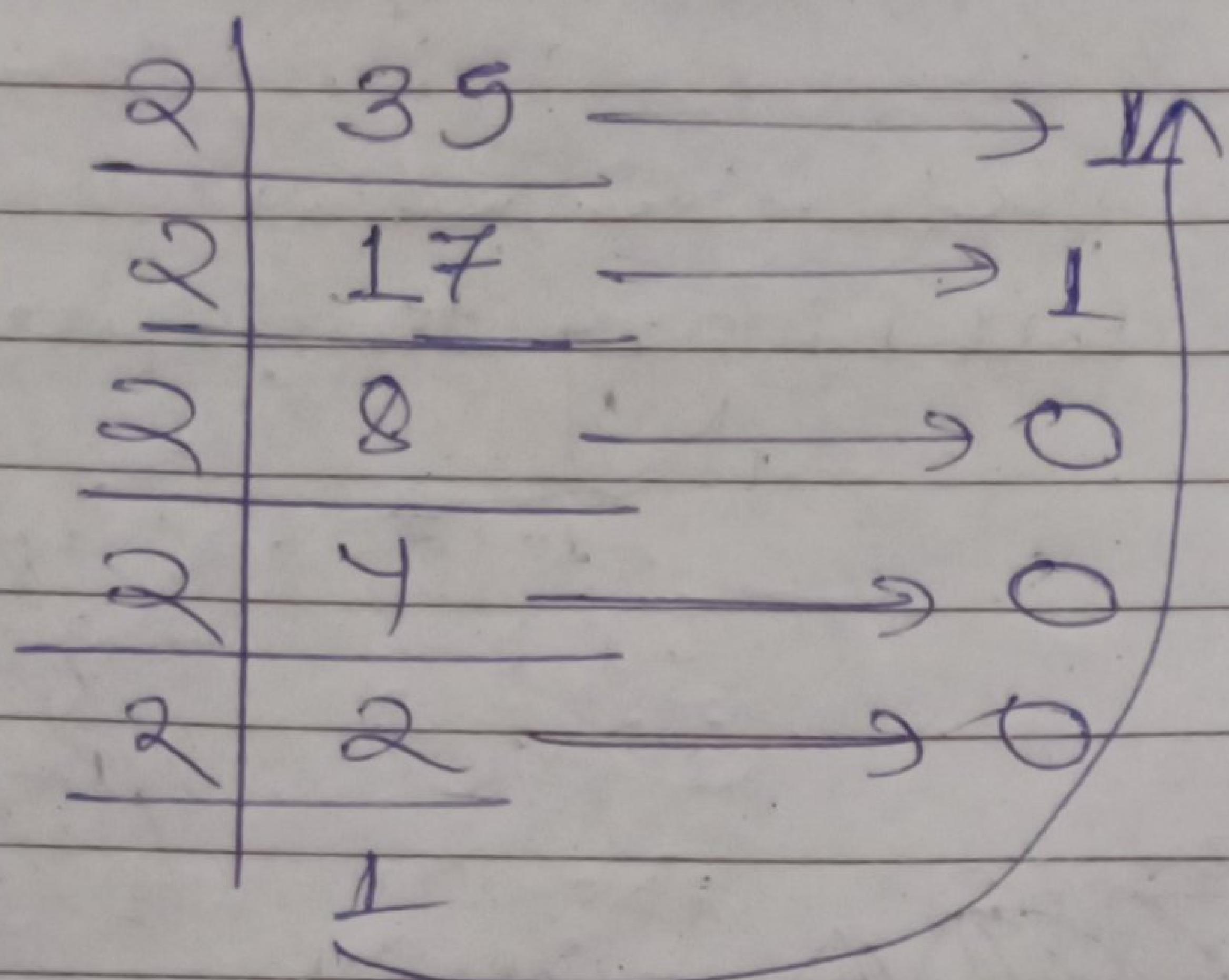
$10 \rightarrow$ binary (1010)

$$\begin{array}{r} 10 \\ \hline 2 | 5 \end{array} \xrightarrow{\text{Remainder}} 0$$
$$\begin{array}{r} 5 \\ \hline 2 | 2 \end{array} \xrightarrow{\text{}} 1$$
$$\begin{array}{r} 2 \\ \hline 1 \end{array} \xrightarrow{\text{}} 0$$

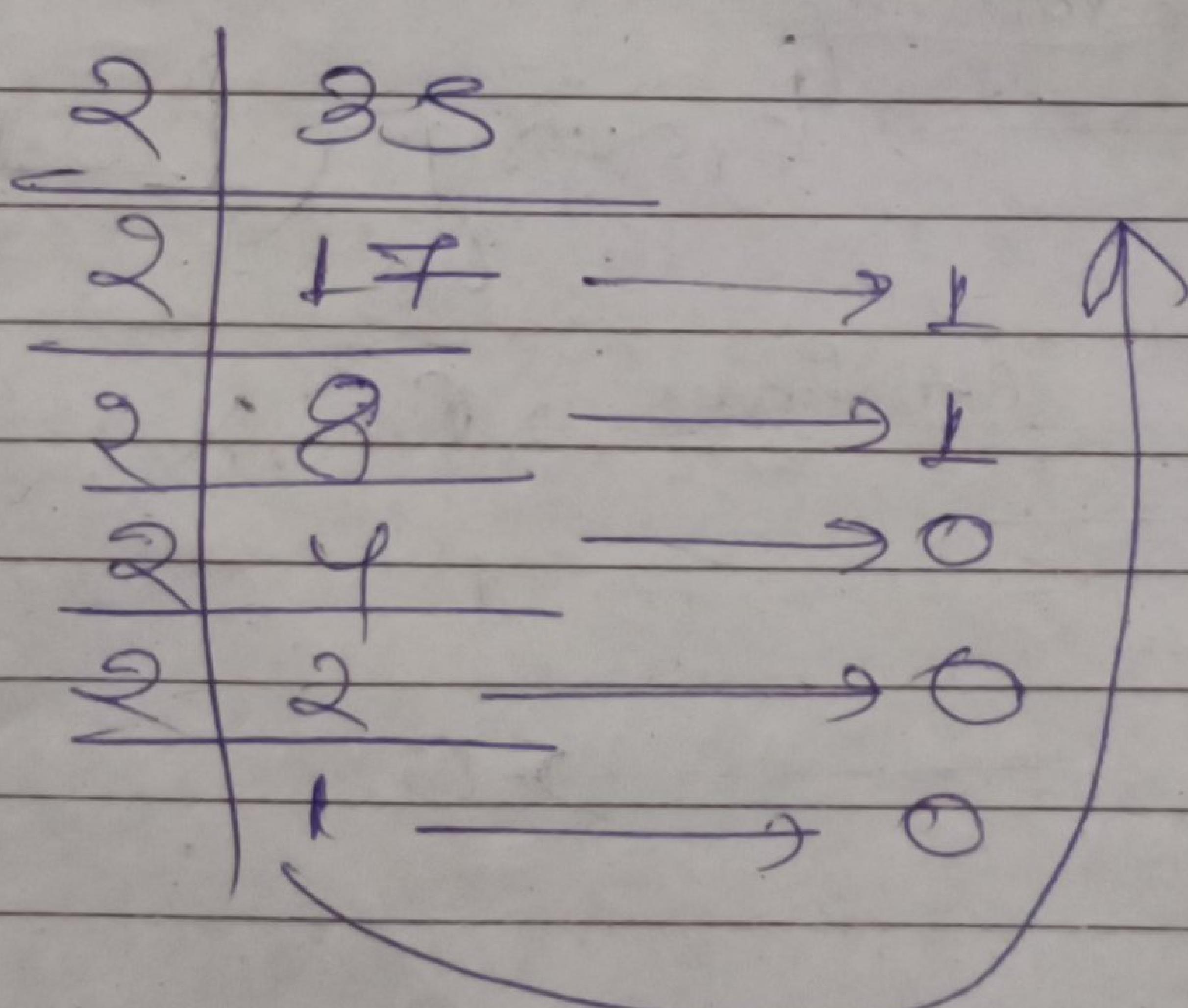
(down to up)

(2)

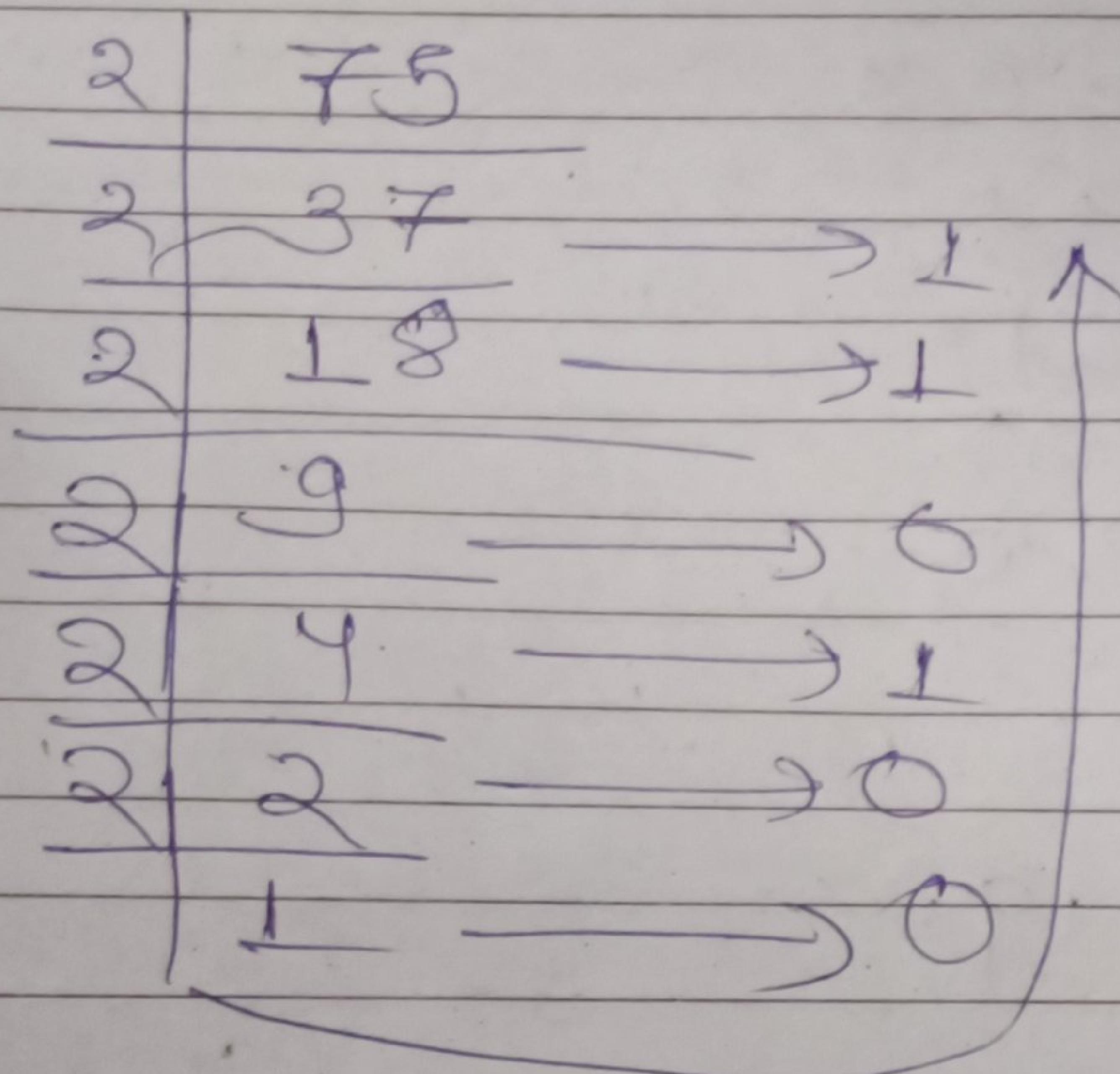
35 → binary (100011)



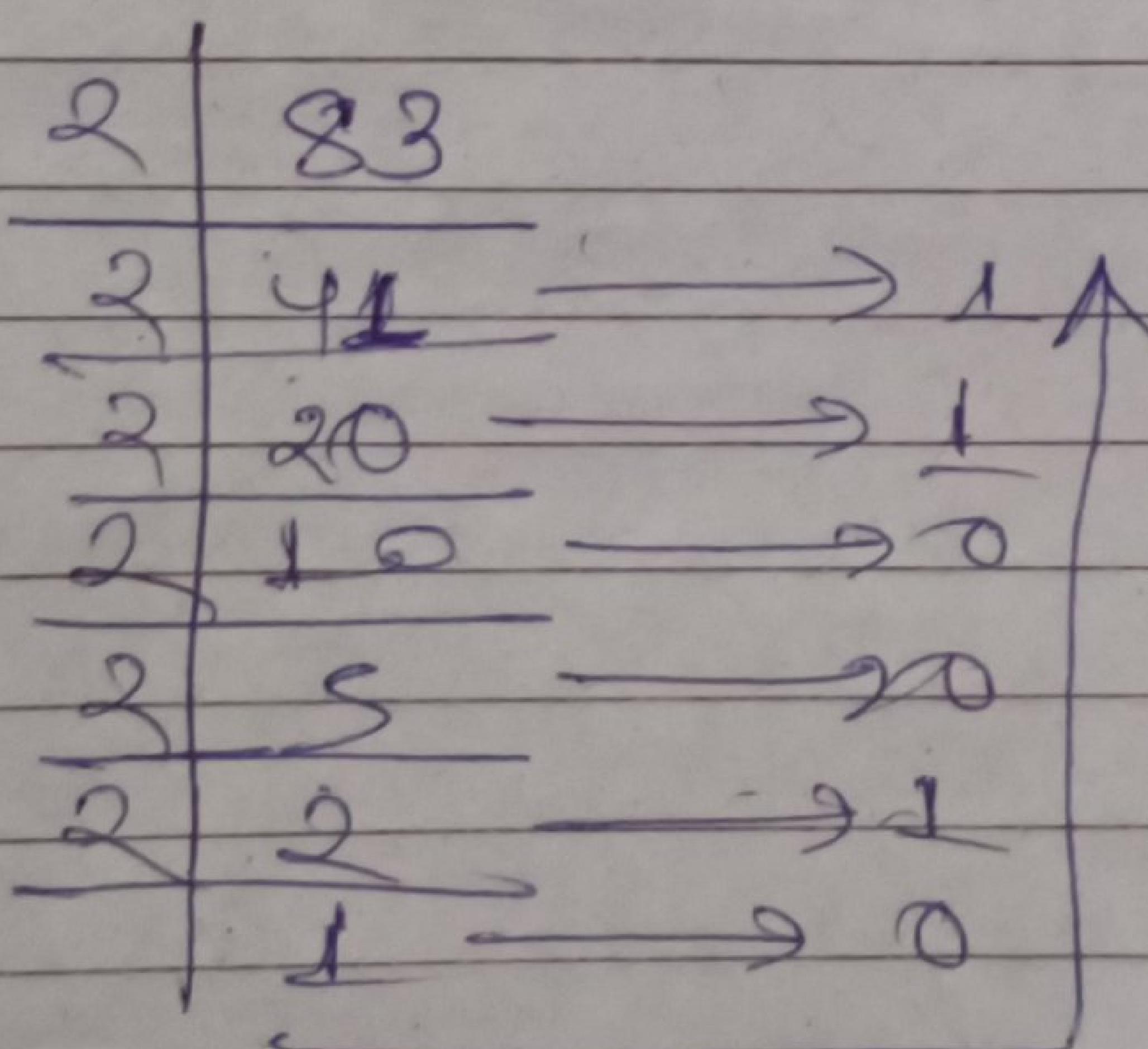
(OR) (100011)



③ 75 → binary (1001011)



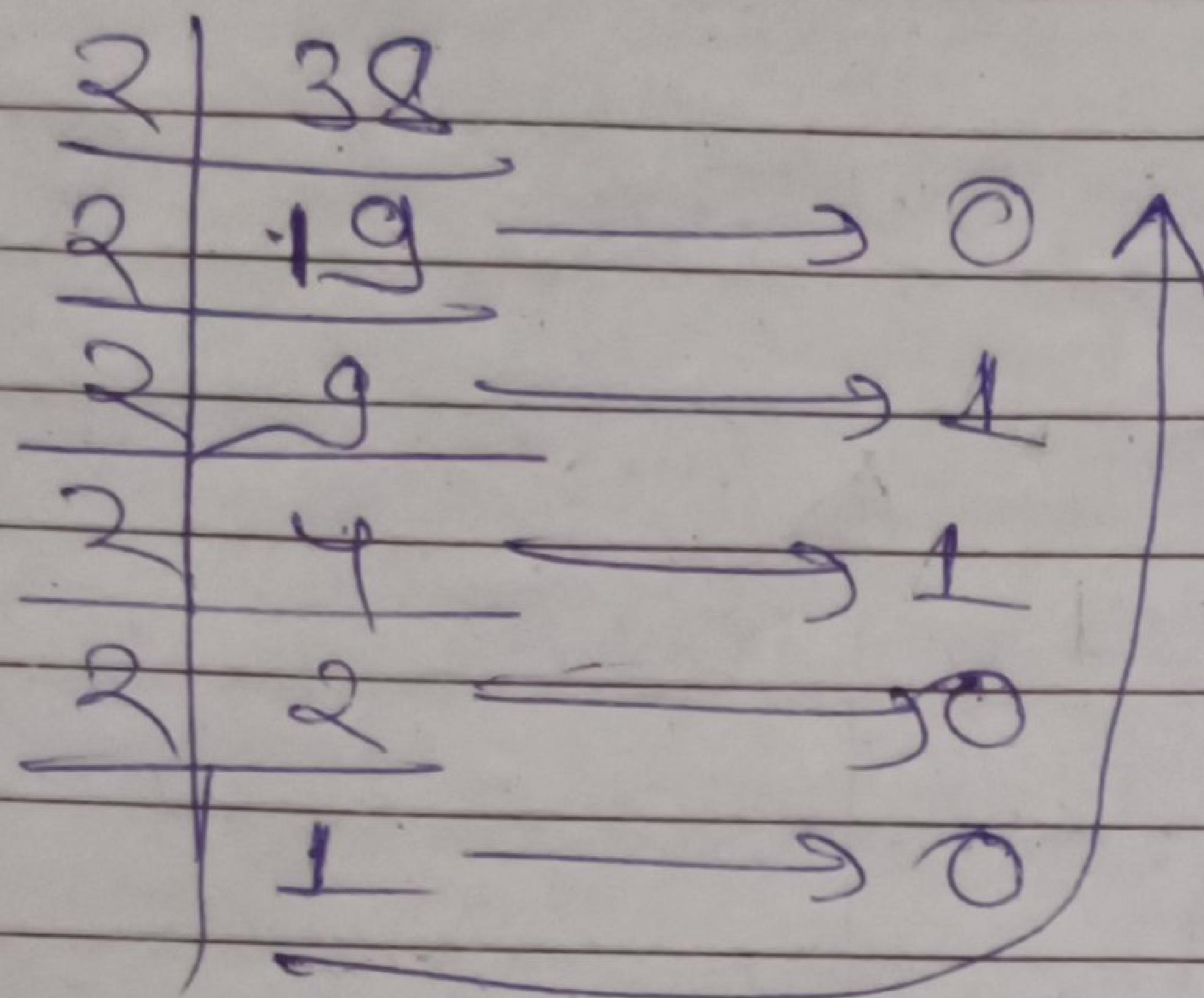
④ 83 → binary (1010011)



5)

38

→ binary(100110)



6)

75, 14, 19

(i)

$\&$ \rightarrow bitwise AND

(ii)

$|$ \rightarrow bitwise OR

	Bitwise AND		Bitwise OR	
	Bit1	Bit2	Bit1	Bit2
1	1	\rightarrow 1	1	\rightarrow 1
1	0	\rightarrow 0	1	\rightarrow 1
0	1	\rightarrow 0	0	\rightarrow 1
0	0	\rightarrow 0	0	\rightarrow 0

NOTE :-

1 \rightarrow True

0 \rightarrow False

Example :-

$$\begin{array}{r} 2 \\ + 3 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \\ \{ \\ \end{array}$$

$$\begin{array}{r} 10 \\ + 11 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \\ | \\ 3 \\ - \\ 1 \\ \hline \end{array} \rightarrow \text{or}$$

$$\begin{array}{r} 2 \\ | \\ 3 \\ - \\ 1 \\ \hline \end{array} \rightarrow 1 \uparrow$$

$$\begin{aligned} &\text{decimal} \rightarrow 2^0 \times 0 + 2^1 \times 1 \\ &\text{binary} \rightarrow 0 + 2 = 2 \\ &\rightarrow 2_{\text{base}} \end{aligned}$$

① 2 & 8

$$\begin{array}{r} 12 \\ \times 8 \\ \hline 96 \end{array}$$

10

$$\begin{array}{r} 128 \\ \times 240 \\ \hline 256 \\ 240 \\ \hline 1000 \end{array}$$

$$\begin{array}{r} 0010 \\ + 1000 \\ \hline 0000 \end{array} \rightarrow 0 \xrightarrow{\text{decimal}} 0$$

② 13 & 6

$$\begin{array}{r} 13 \\ \times 6 \\ \hline 78 \end{array}$$

1101

$$\begin{array}{r} 16 \\ \times 3 \\ \hline 48 \end{array}$$

110

$$\begin{array}{r} 1101 \\ \times 0100 \\ \hline 110100 \end{array}$$

$$\begin{array}{r} 110100 \\ \xrightarrow{\text{decimal}} 2^0 \times 0 + 2^1 \times 0 + 2^2 \times 1 \\ 0 + 0 + 4 \Rightarrow 4 \end{array}$$

③ 3 | 5

$$\begin{array}{r} 2 \mid 3 \\ \underline{-1} \end{array} \longrightarrow 1$$

$$\begin{array}{r} 2 \mid 5 \\ \underline{-2} \\ \underline{1} \end{array} \rightarrow 1 \uparrow \quad \begin{array}{r} 2 \mid 5 \\ \underline{-2} \\ \underline{1} \end{array} \rightarrow 0 \uparrow$$

14

101

$$\begin{array}{r} 011 \\ 101 \\ \hline 111 \end{array}$$

decimal $\rightarrow 2^0 \times 1 + 2^1 \times 1 + 2^2 \times 1$

$$1 + 2 + 4 \\ \Rightarrow 7$$

④ 3 | 7

$$\begin{array}{r} \downarrow \\ 11 \end{array}$$

$$\begin{array}{r} 3 \mid 7 \\ \underline{-3} \\ \underline{4} \end{array} \rightarrow 19$$

111

$$\begin{array}{r} 011 \\ 111 \\ \hline 111 \end{array} \rightarrow 7$$

(iii)

$\wedge \rightarrow$ bitwise XOR

Bit 1	Bit 2	\wedge
1	1	0
1	0	1
0	1	1
0	0	0

will produce ~~0~~ 1, if only one bit is 1
otherwise it will produce 0.

(iv)

$\sim \rightarrow$ bitwise NOT

|
it reverse the bit

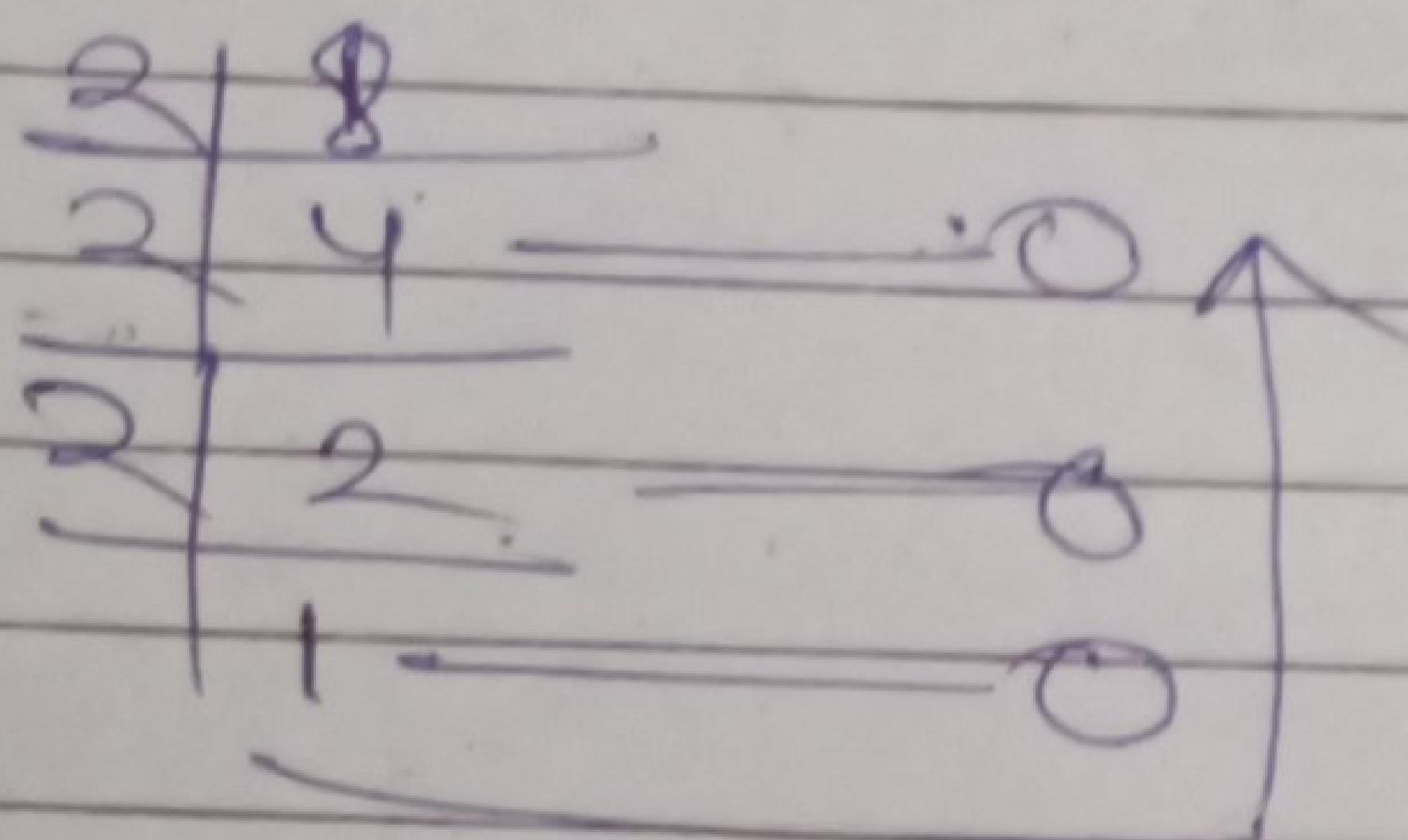
Example

$\sim 1 \rightarrow 0$

$\sim 0 \rightarrow 1$

Question

① $\sim 8 \rightarrow \sim 1000 \rightarrow 0111$



\downarrow
 \neq

② $8 \wedge 6$

\downarrow

1000

110

$$\begin{array}{r}
 1000 \\
 \wedge 0110 \\
 \hline
 1110
 \end{array}
 \rightarrow 2^0 \times 0 + 2^1 \times 1 + 2^2 \times 1 + 2^3 \times 1$$

$$\begin{aligned}
 & \Rightarrow 0 + 2 + 4 + 8 \\
 & \Rightarrow \underline{14}
 \end{aligned}$$

③ $\sim(8 \wedge 5)$

$$\begin{array}{r} 1000 \\ \times 10 \\ \hline 10000 \end{array}$$

$$\begin{array}{r} 215 \\ 22 \longleftarrow 1 \\ 10 \end{array}$$

101

$$\begin{array}{r} 1000 \\ \times 0101 \\ \hline 1001 \end{array}$$

$$\begin{array}{r} 1001 \\ \times 1101 \\ \hline 0010 \end{array}$$

$$\begin{aligned} & 2^0 + 2^1 + 2^2 + 2^3 + 2^4 + 2^5 \\ & + 2^0 \times 1 + 2^1 \times 1 + 2^2 \times 1 + 2^3 \times 1 \\ & + 2^0 \times 0 + 2^1 \times 0 + 2^2 \times 0 + 2^3 \times 0 \\ & = 13 \end{aligned}$$

$$2^0 \times 0 + 2^1 \times 1$$

$$\Rightarrow 2$$

N

④

$\sim 8 \wedge \sim 6$

$$\begin{array}{r} 1000 \\ \times 110 \\ \hline 0111 \end{array}$$

$$110$$

$$001$$

$$\longrightarrow$$

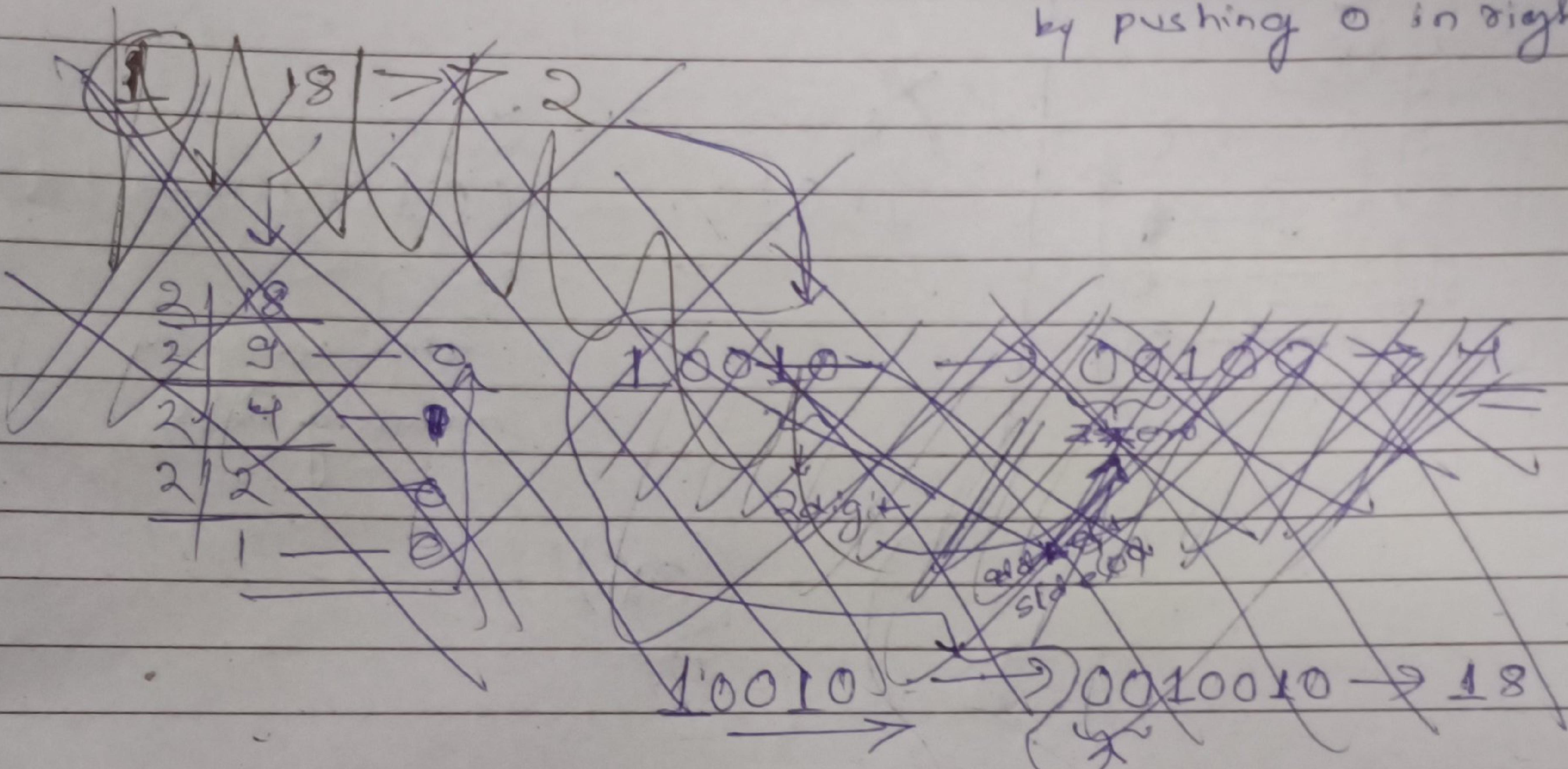
$$\begin{array}{r} 0110 \\ 0001 \\ \hline 0111 \end{array}$$

$$\begin{aligned} & 2^0 \times 1 + 2^1 \times 1 + 2^2 \times 1 \\ & + 2^0 \times 0 + 2^1 \times 0 + 2^2 \times 0 \\ & = 5 \end{aligned}$$

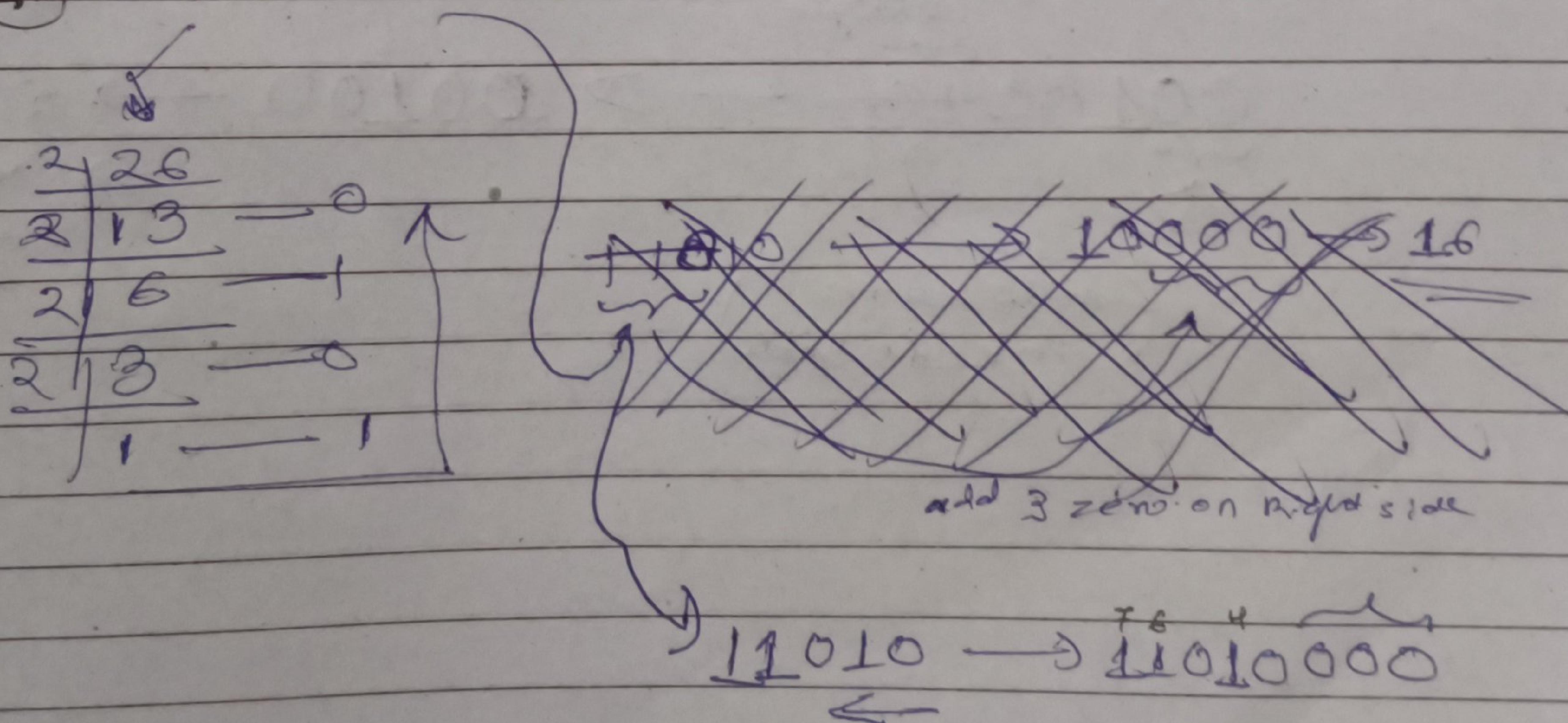
→ delete b bits from right of a and append b 0 to the left of a

(W) $a >> b \rightarrow$ right shift

$a << b \rightarrow$ left shift \rightarrow it will shift binary the number to left by pushing 0 in right



(1) $26 << 3$



$$\rightarrow 2^7 \times 1 + 2^6 \times 1 + 2^4 \times 1 \\ \rightarrow 128 + 64 + 16 \\ \rightarrow 208$$

Q) 18×72

$$\begin{array}{r}
 & 18 \\
 \times & 72 \\
 \hline
 & 0 \\
 & 0 \\
 & 0 \\
 & 0 \\
 \hline
 & 0
 \end{array}$$

~~X~~

$$10010 \rightarrow 0010010 \rightarrow 18$$

this way is
meaning less

(OR)

2 digit

$$0010010 \rightarrow 00100 \rightarrow 2^2 \times 4$$

$\Rightarrow 4$

Ans

Add 2 zero
in Left side