

Automatic

Bits

1 byte = 8 bits



↓ ↓
decimal

10

S

10
digits →

| | | | | |
|---|---|---|---|----------|
| 0 | 1 | 2 | 3 | <u>4</u> |
| 5 | 6 | 7 | 8 | <u>9</u> |

digit

49

[

binary

[0 1 1]



decimal 5

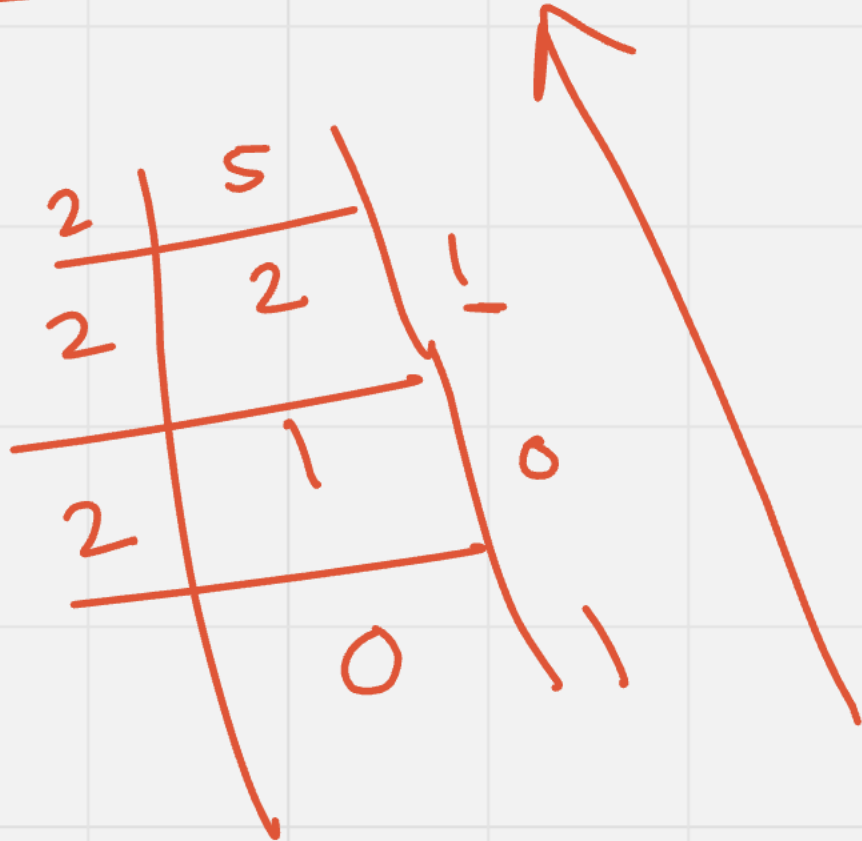
binary 101

① Division

5

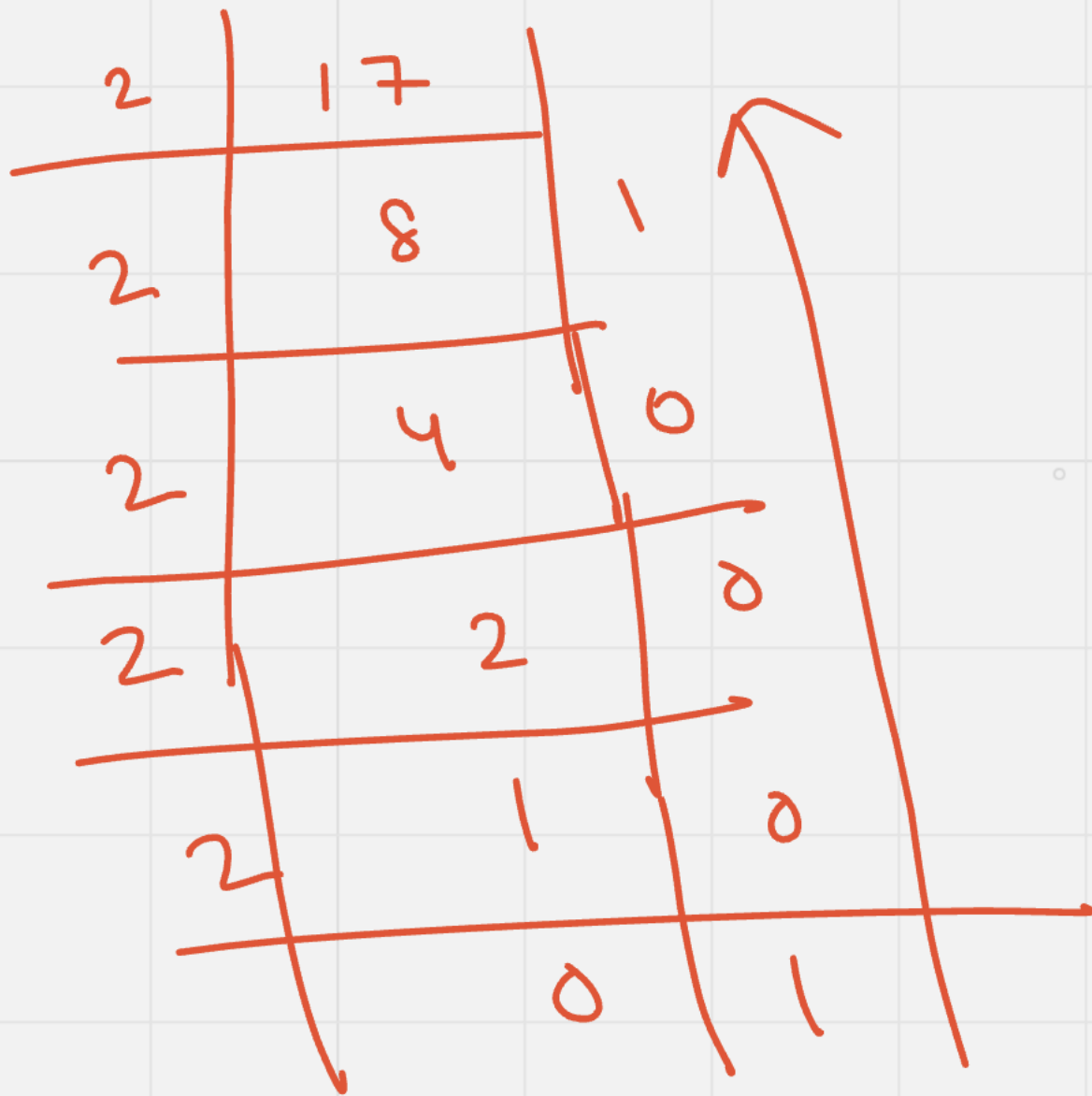
101

binary



17

10001



②

→ 5 → 101

| 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|---|----------|---|----------|
| 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 64 | 32 | 16 | 8 | <u>4</u> | 2 | <u>1</u> |

1 0 1

16 + 8 + 1 = 25

25

| | | | | | |
|----|-----------|----------|---|---|----------|
| 32 | <u>16</u> | <u>8</u> | 4 | 2 | <u>1</u> |
|----|-----------|----------|---|---|----------|

1 1 0 0 1

private

→ (11) ←

8 + 2 + 1 ✓ → 11

3 2 1 6 8 4 2 1
1 0 1 1

16 + 2 + 1 = 19

↘

19

3 2 16 8 4 2 1
1 0 0 1 1

Bit wise operators

✓ 1 8 ✓ 1 8 \Rightarrow 1 8 false

| | | | |
|----------|----------|----------|---|
| 0 | 0 | 0 | ✓ |
| 0 | 1 | 0 | ✓ |
| 1 | 0 | 0 | ✓ |
| <u>1</u> | <u>1</u> | <u>1</u> | ✓ |

int a = 5

int b = 7

int c = 5 & 7
=

5 →

7 →

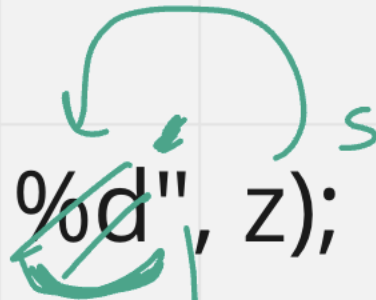
! 0 !
! ! !

1 0 1 → Ans

8 4 2 1
1 0 1

4 + 1 = 5

`printf("x & y = %d", z);`

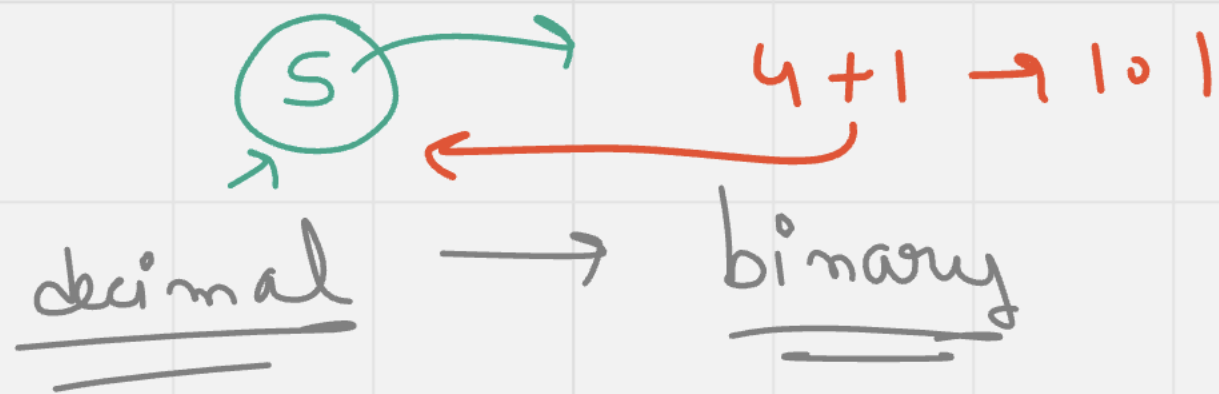


A diagram with a green arrow labeled 's' at its tail, pointing to the memory address of the format string "x & y = %d" within the printf function call. Another green arrow points from the memory address of the format string to the memory address of the variable 'z'.

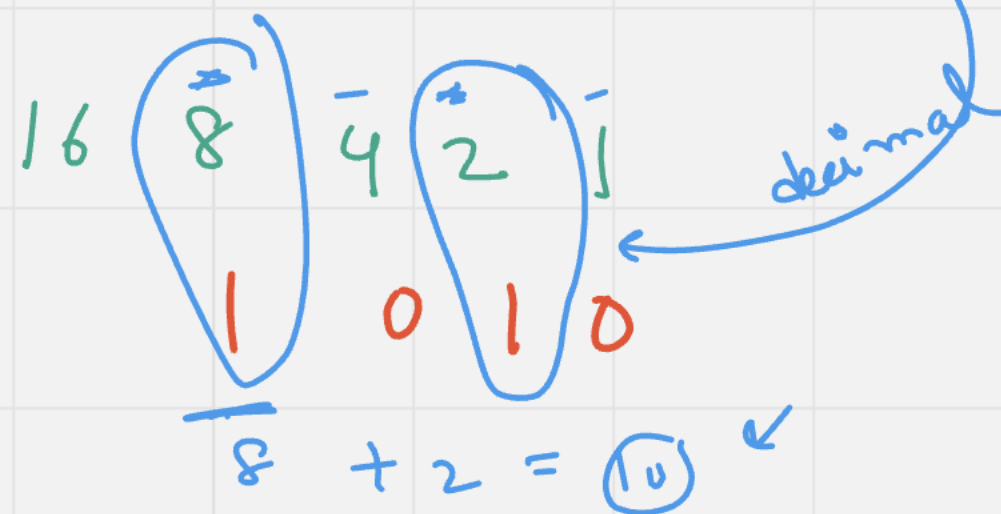
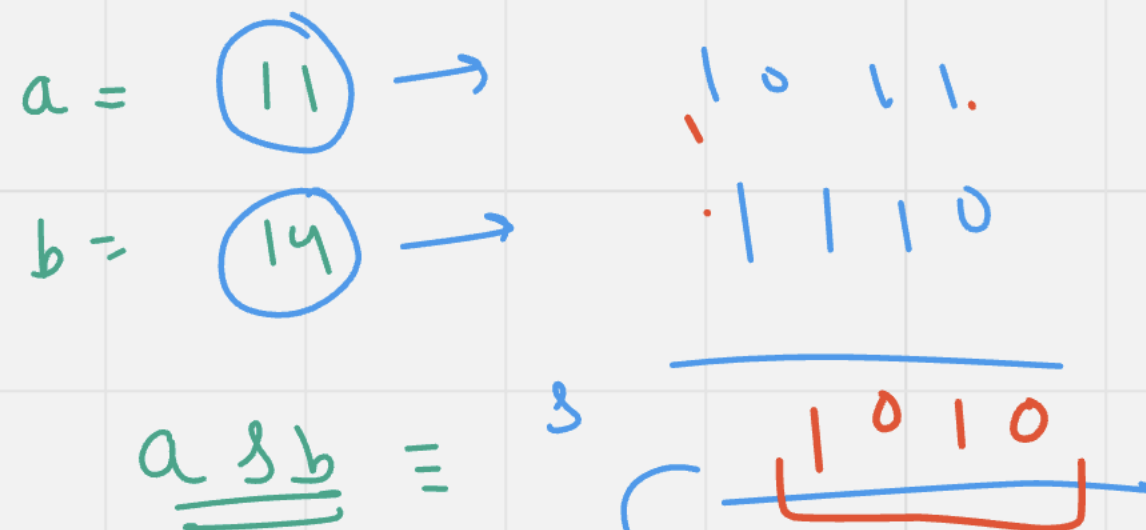
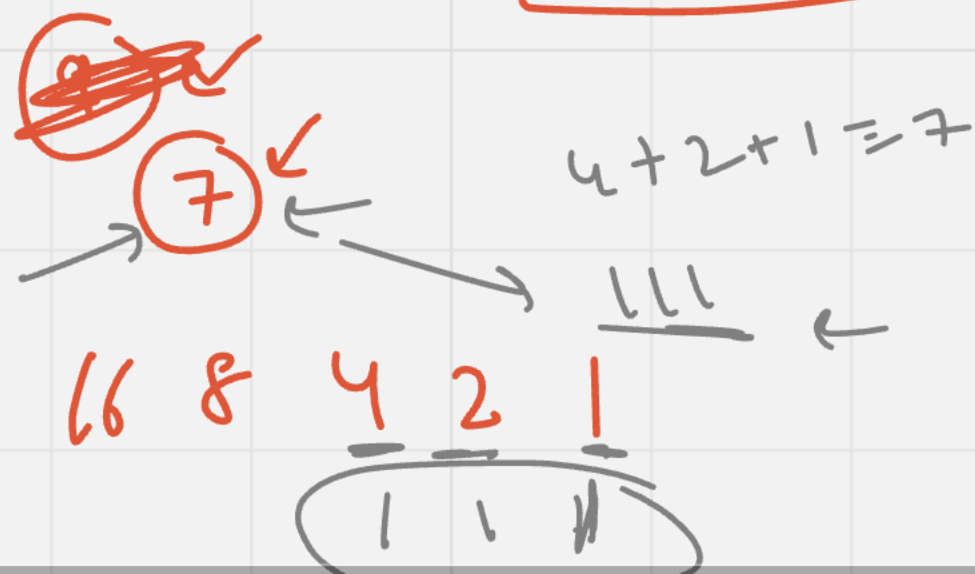
`x & y = 5`



A diagram with a green arrow pointing from the memory address of the variable 'z' to the memory address of the variable 'x'.



| | | | | | | | |
|-----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| ... | 2 ⁶ | 2 ⁵ | 2 ⁴ | 2 ³ | 2 ² | 2 ¹ | 2 ⁰ |
| ... | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| | | | | | 1 | 0 | 1 |



Or (1) ✓

| | | |
|----------|----------|---|
| <u>0</u> | <u>0</u> | 0 |
| 1 | 0 | 1 |
| <u>0</u> | <u>1</u> | 1 |
| <u>1</u> | <u>1</u> | 1 |

if any one

value is T

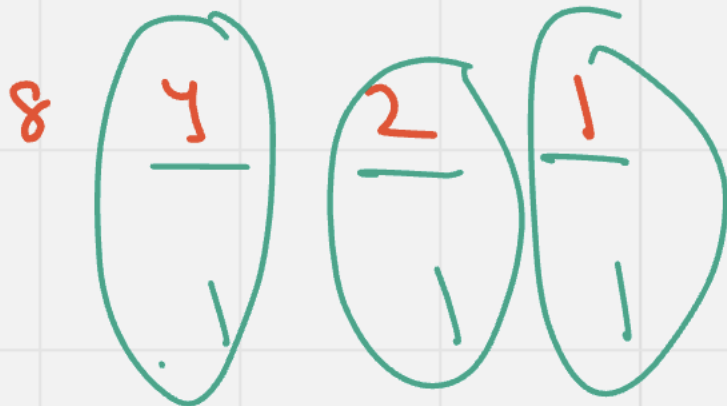
Ans is T

5 | 7

5 \rightarrow 1 0 1

7 \rightarrow 1 1 1

1 1 1



$$4 + 2 + 1 = \underline{\underline{7}}$$

$$x \rightarrow 6 \rightarrow \begin{array}{cccc} 0 & 1 & 1 & 0 \\ \hline 0 & 1 & 1 & 0 \end{array}$$

$$y \rightarrow \begin{array}{c} 12 \\ \hline \end{array}$$


$$\begin{array}{cccc} & 1 & 1 & 0 & 0 \\ \hline 1 & 1 & 1 & 1 & 0 \\ \hline \end{array}$$

$$16 \quad \begin{array}{c} 8 \\ \hline 1 \end{array} \quad \begin{array}{c} 4 \\ \hline 1 \end{array} \quad \begin{array}{c} 2 \\ \hline 1 \end{array} \quad \begin{array}{c} 1 \\ 0 \end{array}$$

$$8 + 4 + 2 = 14$$

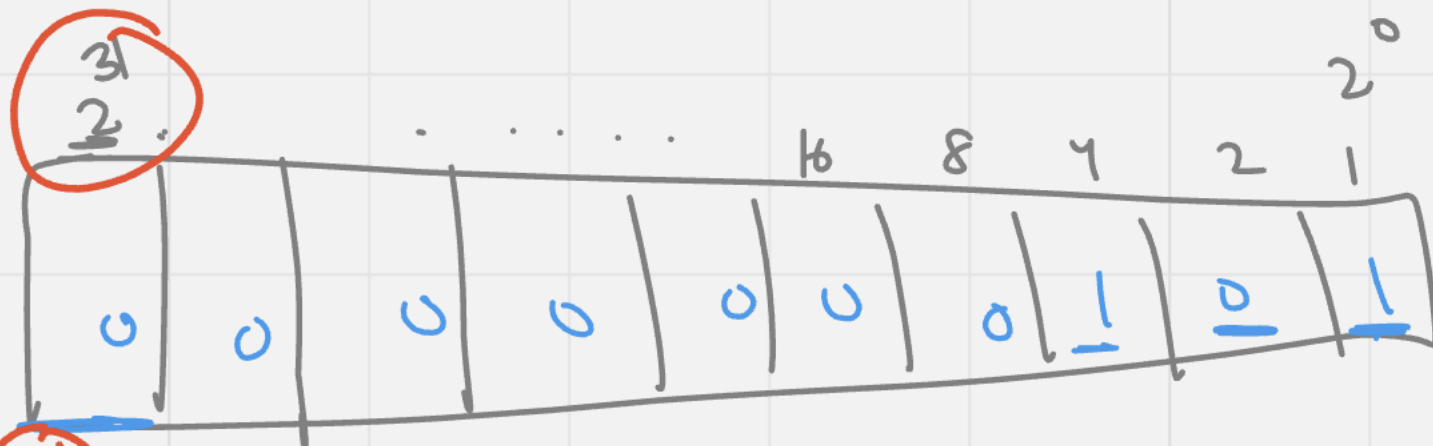
not (\sim)

| | |
|--------|---|
| \sim | |
| 1 | 0 |
| 0 | 1 |

$x \quad S$
 $\textcircled{y} = \sim S$
 $y \rightarrow$ 
 $\text{int} \rightarrow \underline{\text{bits}} \rightarrow \underline{32}$

$$5 \rightarrow \underline{101}$$

$$\underline{2} \quad \underline{5}$$



31
2

31
2

+ve

-ve

Mod

-ve

2's Complement

→ 2^{13} Complement

→ 1^1_3
 ↓
 → 2^{13}

Change bit $1 \rightarrow 0$
 $0 \rightarrow 1$

add 1 ←

(1^1_3)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |

+ ↓

2^{13}

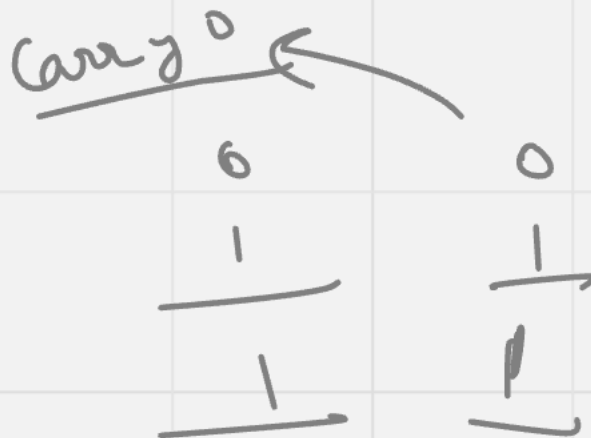
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|

Mod
 Ans

bits
add



10100



Carry = 0

Ex 1 (17) ✓

217

binary

64 32 16 8 4 2 1
0 0 0 1 0 0 0 1

Ans

+1

~~57~~

2 1 1 1 0 1 1 0

Ans

-ve ✓

mod

1 1 1 1 1 0 1 1 0
1 0 0 0 0 0 0 1 0 0 0 1

2 1 3
0 0 0 0 0 0 0 1 0
+ 1
mod

16 8 4 2 1
1 0 0 1 0
= 18
18

11
~11 →

mod

-ve

16 8 4 2 1
 0 1 0 1 1

~
 -12
12

+ 1

0 1 1 0 0 ✓
1 1 0 0 0

16 8 4 2 1
 1 1 1 0 0

(12)

XOR (^)

| | | |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 | 0 |

Same $\rightarrow 0$
diff $\rightarrow 1$

✓