

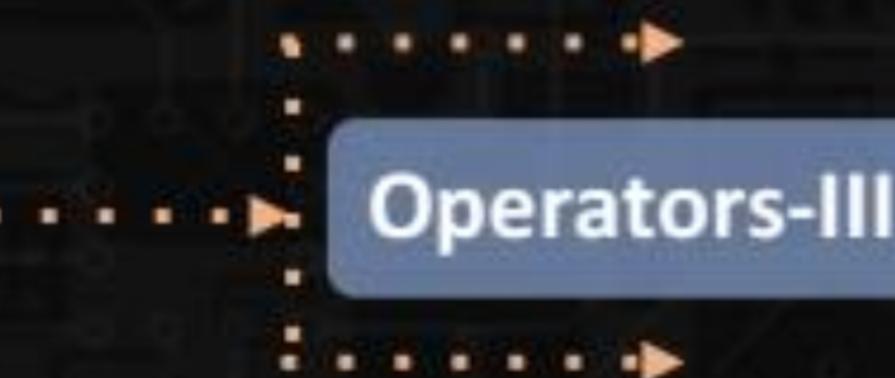
# CS & IT ENGINEERING

Programming in C  
Chapter-1  
**Data types and Operators**  
**Lec- 06**



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## TOPICS TO BE COVERED



## Hexadecimal Number System

16 Symbols

0 - 9

10 - A

11 - B

12 - C

13 - D

14 - E

15 - F

$$(83)_{10} = (53)_{16}$$

$$(83)_{10} = ( )_{16}$$

16	83	Rem
16	5	3
0		5

$$(26)_{10} = (\quad)_{16}$$

16	26	Rem
16	1	10 → A
0	1	

$$(26)_{10} = (1A)_{16}$$

10  
~~(1A)~~  
(1A)



## Bitwise Operators

- (i) Bitwise OR (|)
- (ii) Bitwise AND (&)
- (iii) Bitwise XOR (^)
- (iv) Bitwise left Shift Operator (<<)
- (v) Bitwise Right Shift operator (>>) ]
- (vi) Bitwise NOT (~)      Unary

binary

## Bitwise OR (|)

$\uparrow\uparrow\uparrow$   
16 bits

```
int a=5, b=13, c;
```

```
c = a | b; printf("%d", c);
```

a

00000000000000101

b

000000000000001101

000000000000001101

(13)

$$0|0 = 0$$

$$0|1 = 1$$

$$1|0 = 1$$

$$1|1 = 1$$

∴

```
int a=38, b=17, c;  
c = a|b;  
printf("%d", c);
```

$$\begin{array}{r} 0000\ 0000\ 00|00|10 \\ 0000\ 0000\ 00010001 \\ \hline 0000000000|10|11 \end{array}$$

55

## Bitwise AND ( $\&$ )

```
int a=5, b=19, c;  
c = a & b;  
printf("%d", c);
```

0000 0000 0000 0101  
0000 0000 0001 0011  
—————  
0000 0000 0000 0001

1       $1 \& 1 = 1 \checkmark$  (both bits are 1)  
 $1 \& 0 = 0$   
 $0 \& 0 = 0$   
 $0 \& 1 = 0$

## Bitwise XOR (^)

$$\begin{array}{l} 0 \wedge 1 = 1 \\ 1 \wedge 0 = 1 \end{array} \quad ] \text{ both bits are different}$$

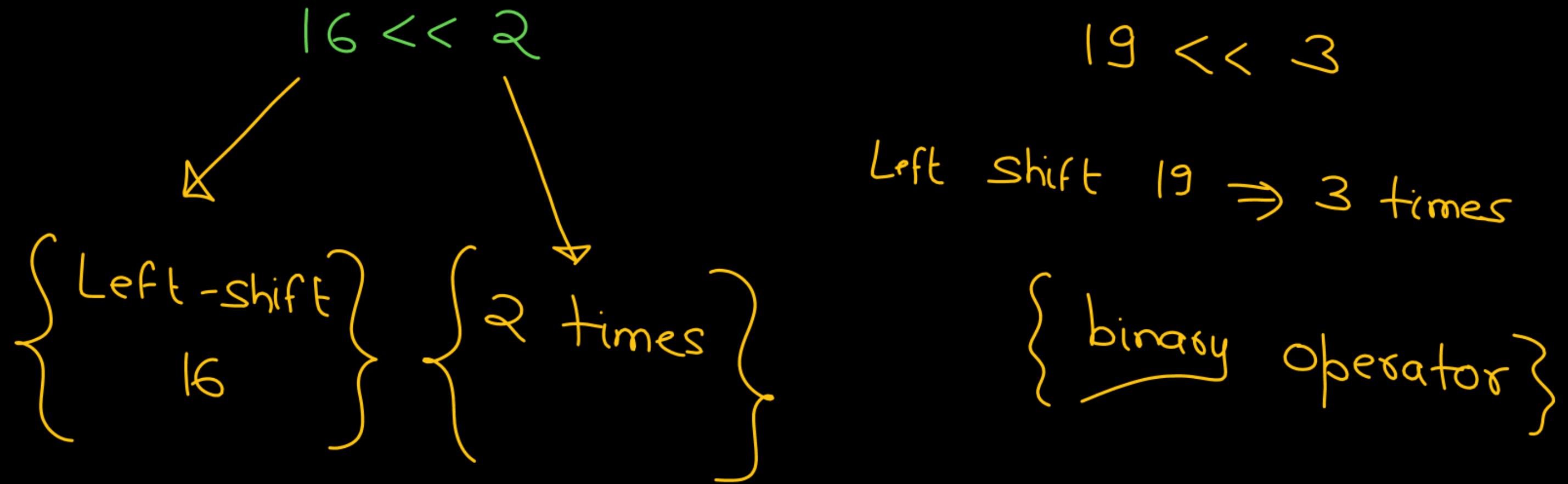
$$\begin{array}{l} 0 \wedge 0 = 0 \\ 1 \wedge 1 = 0 \end{array} \quad ] \text{ both bits are same}$$

```
int a=5, b=17, c;  
c = a ^ b;  
printf("%d", c);
```

20

$$\begin{array}{r} a \quad 0000\ 0000\ 0000\ 0101 \\ b \quad 0000\ 0000\ 0001\ 0001 \\ \hline & 0000\ 0000\ 0000\ 10100 \end{array}$$

## Bitwise Left-Shift ( $\ll$ )



```

int a=10,b ;
b = a<<1 ;
printf("%d",b); 20

```

Popped out

0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

```

int a=10,b ;
b = a<<2 ; 1 time
printf("%d",b); 40

```

popped out

0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Empty Space Filled by 0

$$a \ll 2 \equiv a \times 2 \times 2$$

$$= a \times 2^2$$

$$= 10 \times 4 = 40$$

0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Empty Space Filled by 0

# Right Shift Operator (>>)

$10 \rightarrow$   
↓  
2

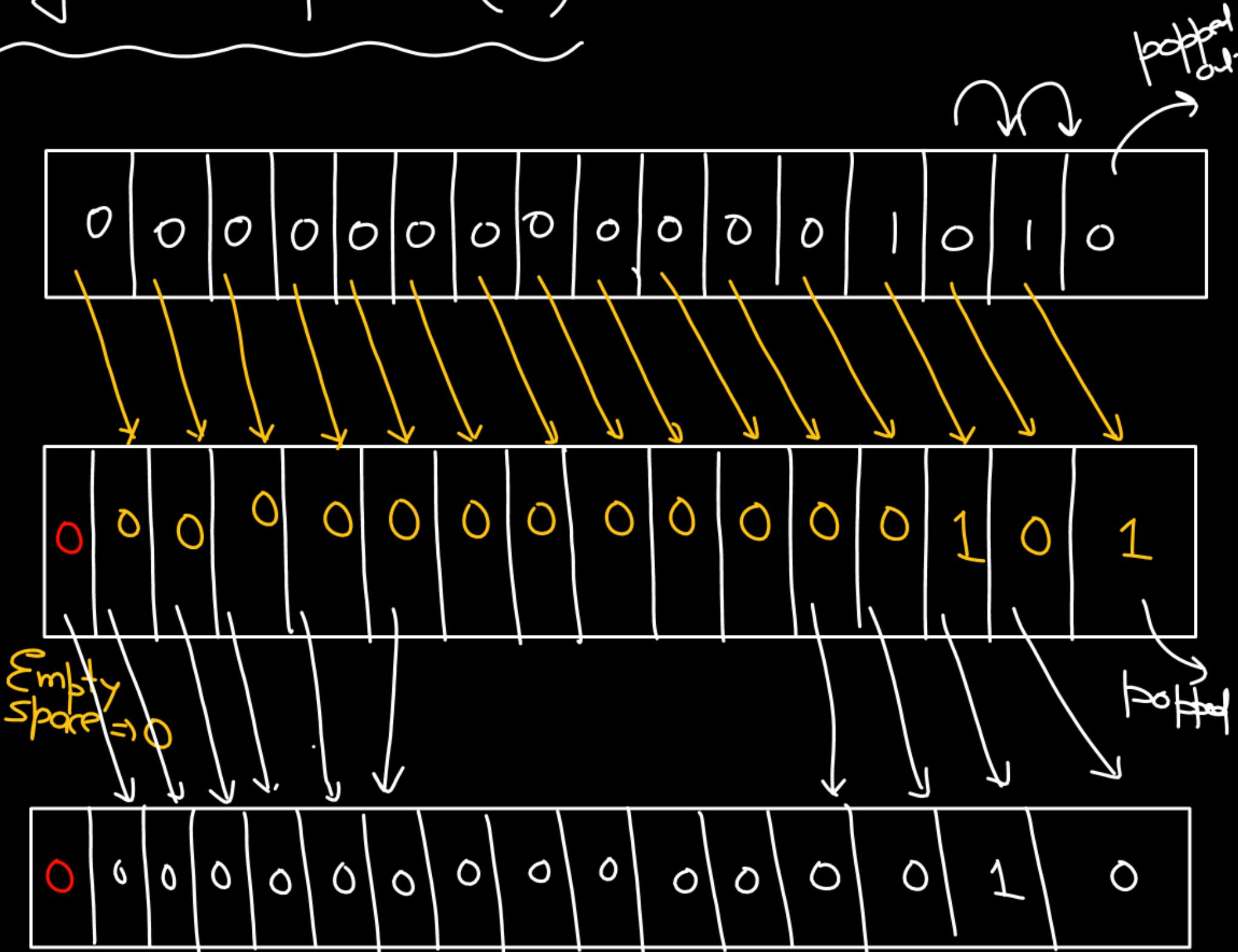
```
int a = 10, b;
b = a >> 1;
printf("%d", b); 5
```

$\frac{n}{2}$

```
int a = 10, b;
b = a >> 2;
printf("%d", b);
```

1 times

Empty  
Space = 0

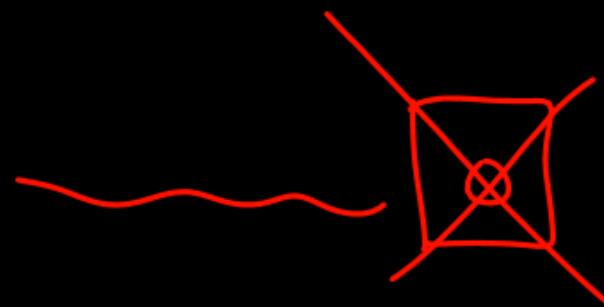


$$\underset{x}{\sim} \boxed{0} = 2x$$

$$\underset{x}{\sim} \boxed{1} = 2x + 1$$

$$2 \cdot 2 + 1$$

$$\Rightarrow 2$$



-ve  $\Rightarrow$

5  
00001010  $\Rightarrow$  10

00001010

~~101~~  $\Rightarrow$  ~~2.5 + 0~~  
~~101~~  $\Rightarrow$  ~~2.5 + 1~~

## bitwise NOT ( $\sim$ )

$$\sim a \equiv -(a+1)$$

$-(0x1)$   
 $, \sim$

```
int y = 0;  
printf("%d", ~y);
```

$(5+1)$   
 $, \sim$

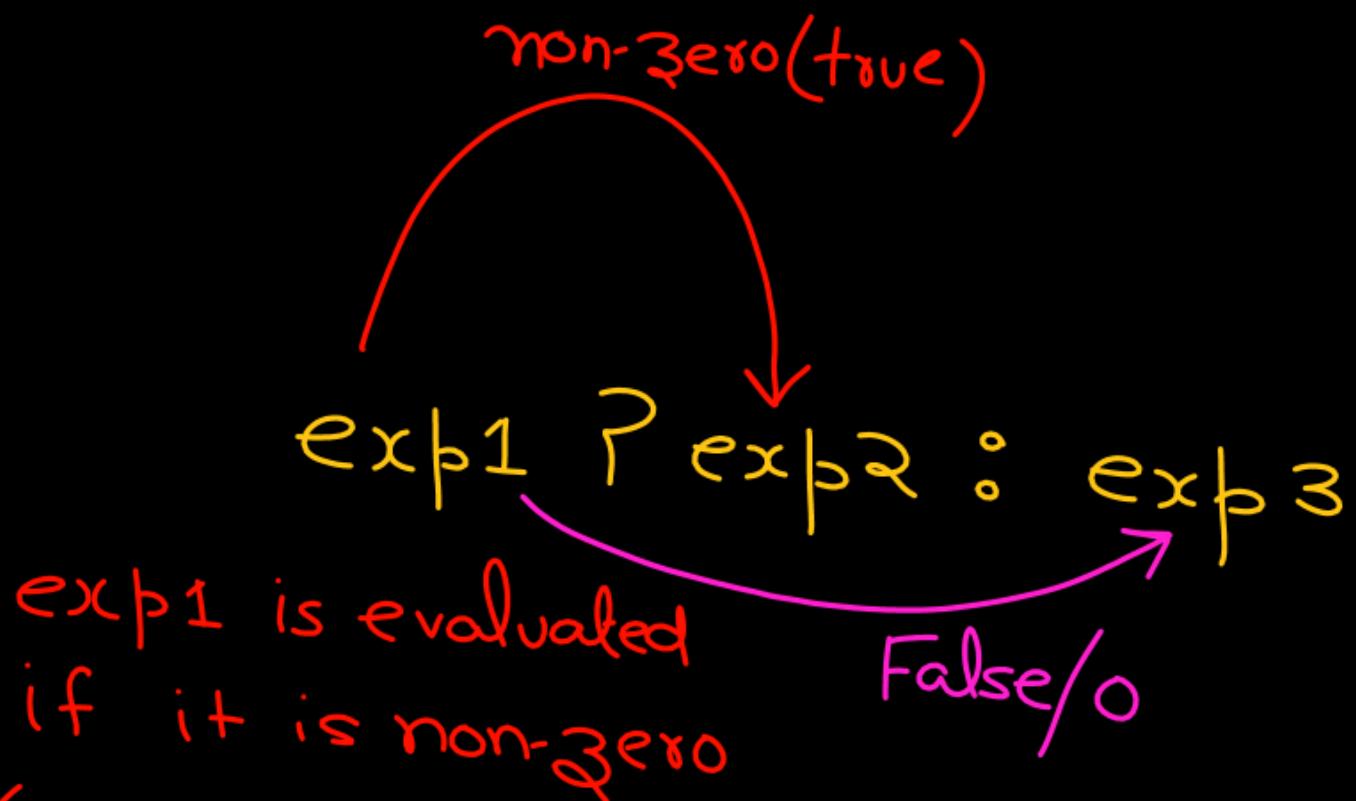
```
int x = 5;  
printf("%d", ~x); -6
```

```
int z = -3;  
printf("%d", ~z);
```

$$\begin{aligned} & -(-3+1) \\ &= -(-2) \\ &= +2 \end{aligned}$$

## Ternary Operator (P :)

3 operand



$\text{exp1}$  is evaluated  
if it is non-zero

(true) then the value  
of entire ternary exp  
is  $\text{exp2}$

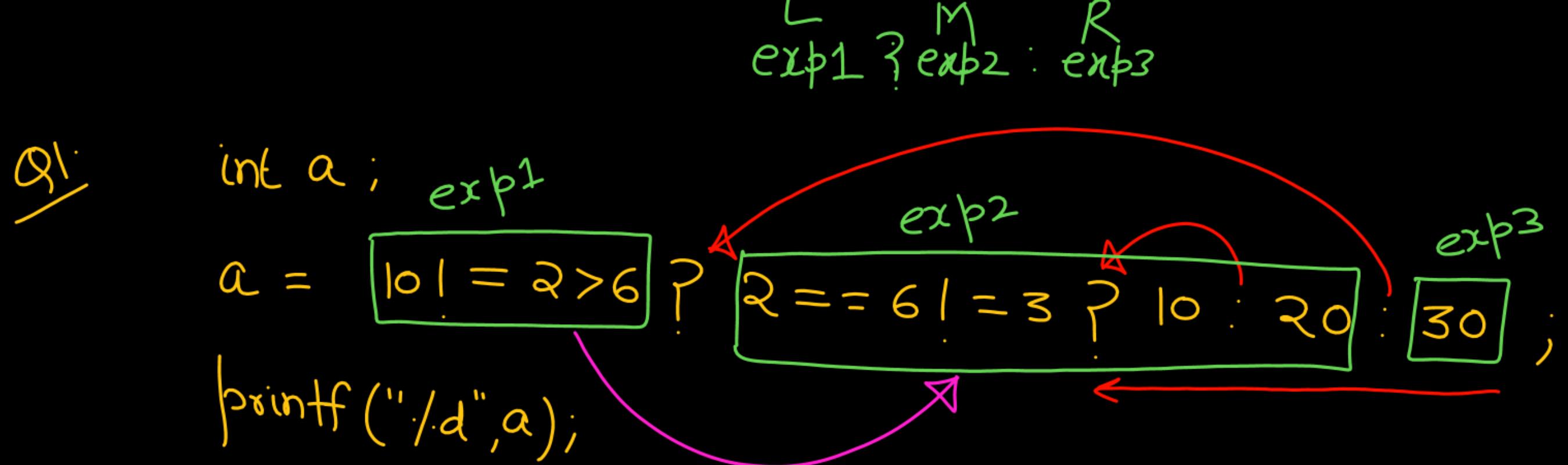
Otherwise, the value of  
entire exp is  $\text{exp3}$

int m;

$$m = \frac{10 > 5}{\text{exp1}} \quad ? \quad \frac{10}{\text{exp2}} : \frac{5}{\text{exp3}} ;$$

$10 > 5 \Rightarrow \text{true}/1$

$$\boxed{m = 10}$$



$10 = 2 > 6$

$\#(P) \Rightarrow \#(())$

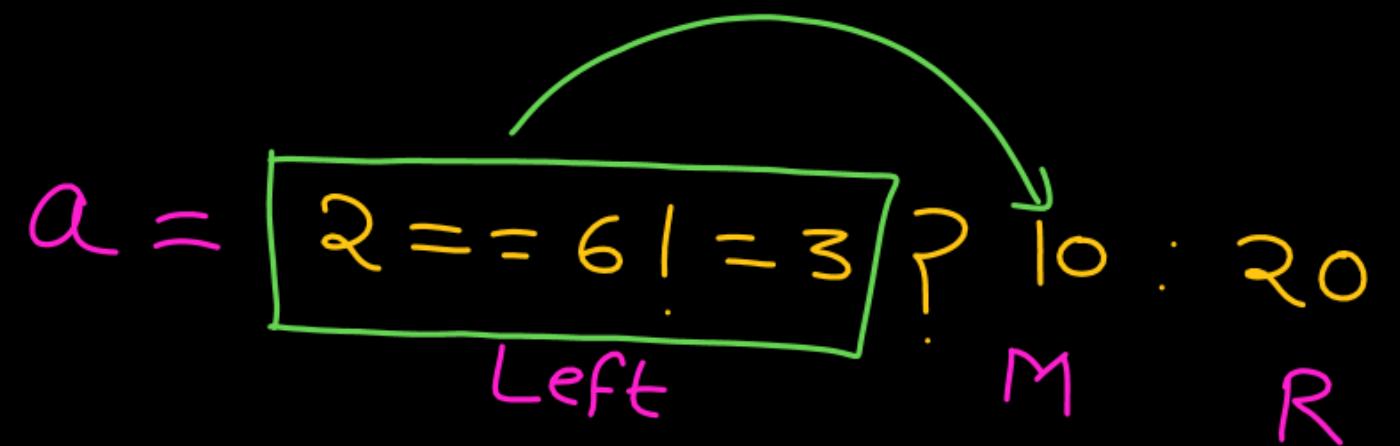
$10 = 0$

1/true

$a = 2 == 6 = 3 ? 10 : 20 ;$

$\frac{L}{exp1 ? exp2 : exp3}{M}{R}$

Q1 int a ;



$2 == 6 | = 3$

0 | = 3

1  
(true)

$a = 10$

int a;

$$a = \frac{15 < 3}{L}$$

$$\frac{3! = 4 > 10}{M}$$

$$\frac{4 < 7 \mid = 7 > 10}{R} \mid 5 \mid 30 \mid 12 \mid = 2 \mid 4 \mid 5 \mid 6$$

$15 < 3 \Rightarrow \text{False}$

$$a =$$

$$\frac{4 < 7 \mid = 7 > 10}{L}$$

$$\frac{15 \mid 30 \mid 12 \mid = 2 \mid 4 \mid 5}{R}$$

$$\boxed{4 < 7} \mid = 7 > 10$$

True

$$1 \mid = \boxed{7 > 10}$$

11:0  
true

$$a = 15 \mid 30 \mid 12 \mid = 2 \mid 4 \mid 5$$

$$a = \frac{!5 \rightarrow 30}{\begin{matrix} L \\ M \end{matrix}} : !2 = 2 \rightarrow 4 : 5$$

R

false

! unary

$!5 \Rightarrow 0 \Rightarrow \text{false}$

$! =$

$$a = \boxed{!2 = 2} \rightarrow 4 : 5$$

True

$\circled{!2} = 2$

$0! = 2$

True

$\boxed{a = 4}$



int a=2, b=2, c=0, d=2, e;

a	b	c
3 2	3 2	01

e = a++ && b++ && c++ || d++ ;

printf("%d%d%d%d%d", a, b, c, d, e);

$((a++ \&\& b++) \&\& c++) || d++$   
 $(1 \&\& c++) || d++$   
 $1 \&\& 2 \&\& 0 \&\& 2 \&\& 1 || d++$

$\downarrow$   
 $\&\& c++ || d++$   
 $e = 0 || 2$   
 $1$

3.

int a;

a = 12 > 2 ?

printf("./d", a);

← M

printf("Gate") && printf("Wallah")

Anna 24 Ghante Chaukanna

||| printf("2023");

printf("Sir");

a = 12 > 2 ?

True

(printf("Gate") && printf("Wallah"))

R

||| printf("2023");

printf("Sir")

① printf("Gate") → Gate

①  $a = \left( \text{printf("Gate")} \& \& \text{printf("Wallah")} \right) \parallel \text{printf("2023")}$   
 $\text{printf("Gate")} \rightarrow \text{Gate}$

②  $a = \left( 4 \& \& \text{printf("wallah")}) \right) \parallel \text{printf('2023')}$   
 $\text{printf("Wallah")} \rightarrow \text{Wallah}$

$a = (4 \& \& 6) \parallel \text{printf("2023")}$  GateWallah1

$a = 1 \parallel \text{printf("2023")}$  X short-circuit eval.  
1

$$x = x + 10 \Rightarrow x+ = 10$$

$$x = x - 10 \Rightarrow x- = 10$$

$$x = x \times 10 \Rightarrow x \times = 10$$

$$x = x / 10 \Rightarrow x/ = 10$$

$$x = x \cdot 10 \Rightarrow x \cdot = 10$$

$$x = x | 10 \Rightarrow x| = 10$$

$$x = x \& 10 \Rightarrow x\& = 10$$

$$x = x ^ 10 \Rightarrow x^ = 10$$

$$x = x << 10 \Rightarrow x << = 10$$

$$x = x >> 10 \Rightarrow x >> = 10$$

