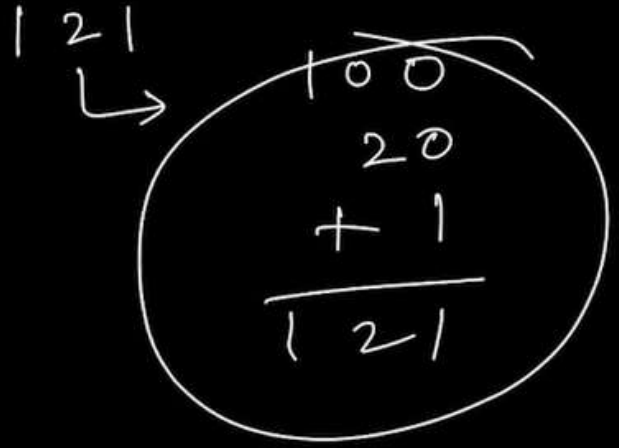
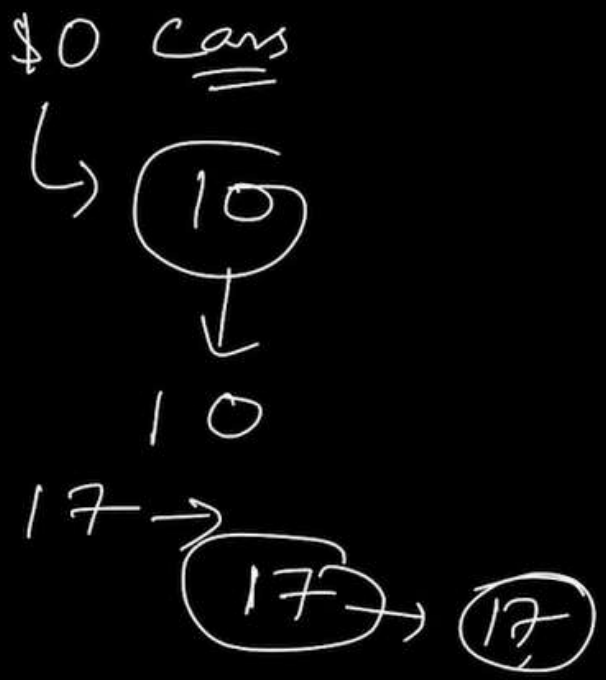
What is Number System?

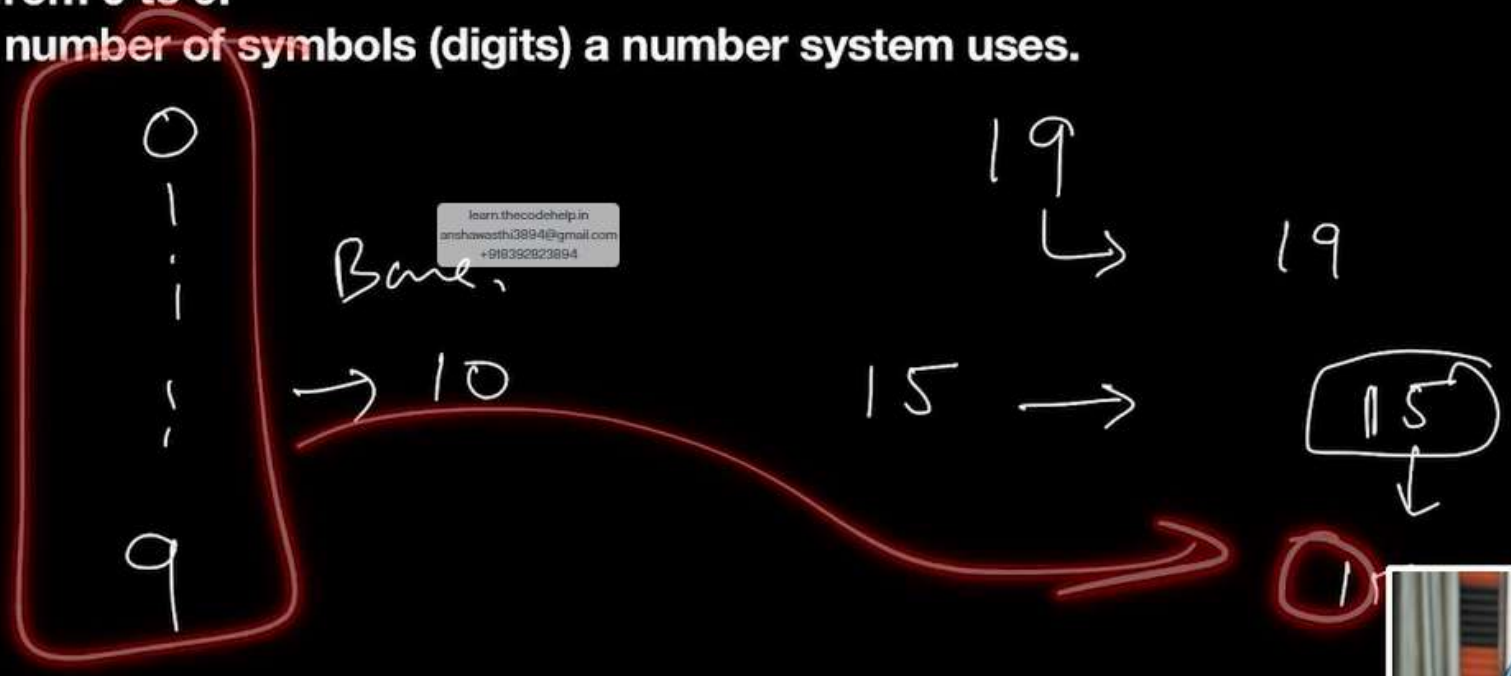
1. Method to represent numeric values or quantities using different digits.





Decimal System

1. The decimal number system has base 10.
2. It uses digits from 0 to 9.
3. Base: it is the number of symbols (digits) a number system uses.

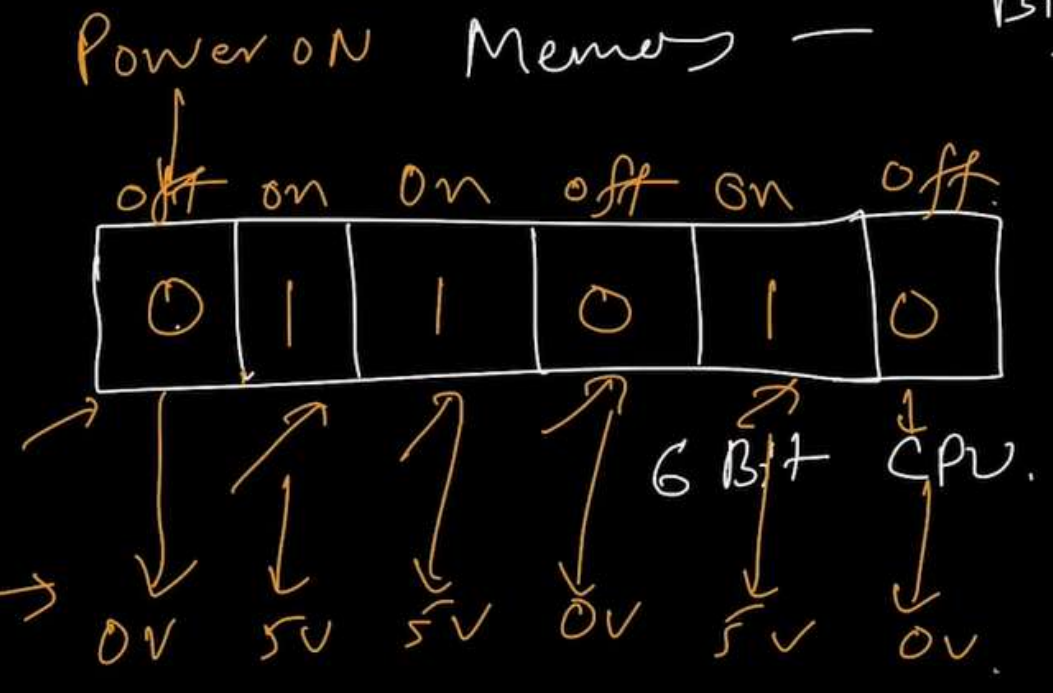


Binary Number System

1. Number system using base 2.
2. It uses only two digits i.e., 0 and 1.

0
1

Computer Storage.
CPU — Binary
Memory — Binary



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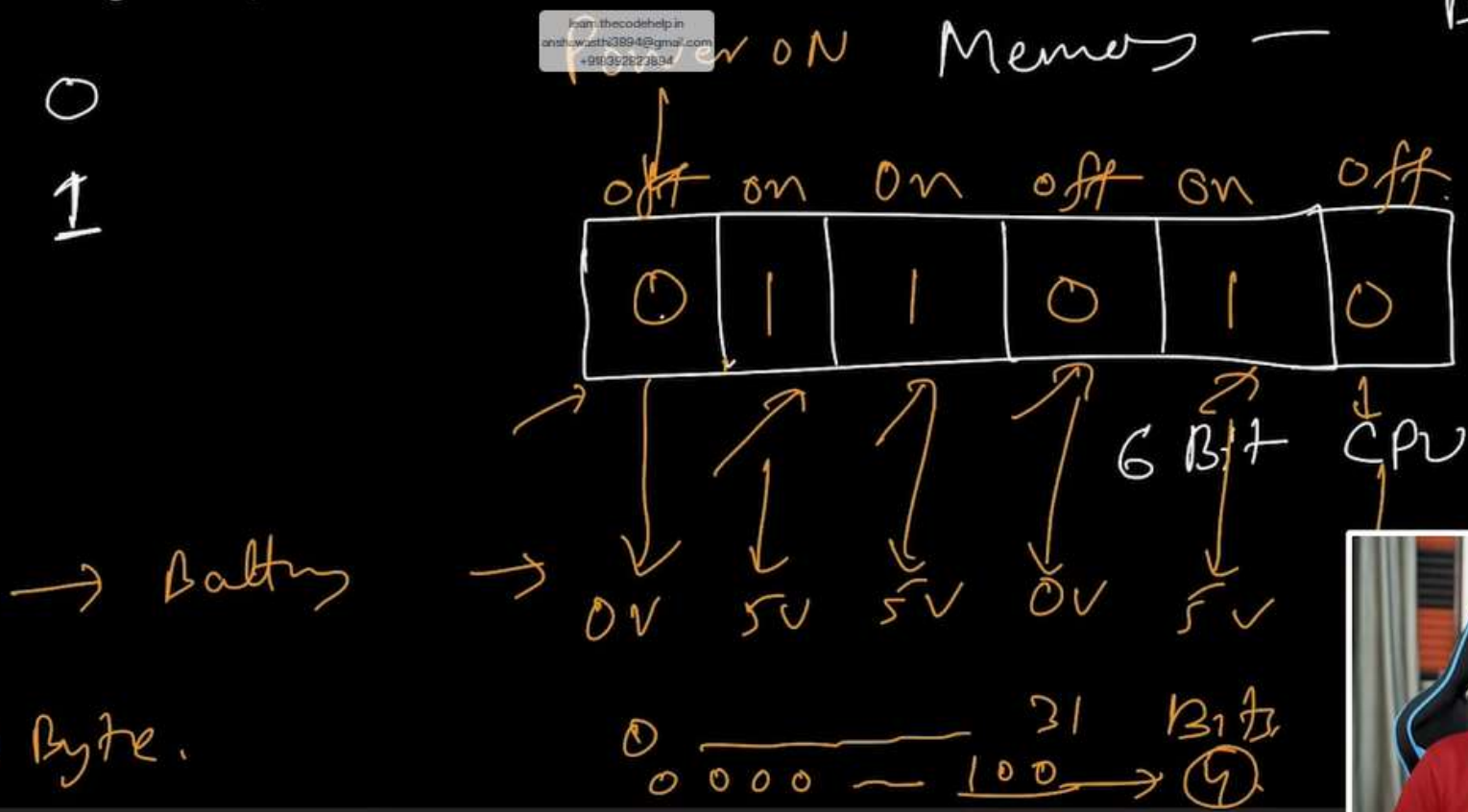


Counting in Binary Number System

Decimal	Binary	Decimal	Binary
0	0	12	1100
1	1	13	1101
2	10	14	1110
3	11	15	1111
4	100	16	10000
5	101	17	10001
6	110	18	10010
7	111	19	10011
8	1000	20	10100
9	1001	21	10101
10	1010	22	10110
11	1011	23	10111

Decimal to Binary Conversion

Division Method

1. Divide number by 2.
2. Store reminder. (That will be a bit in binary number)
3. Repeat above steps with the Quotient until quotient is less than 2.
4. Reverse the bits so obtained.

(1) $N = 10 \rightarrow$

Division	Rem.
$10/2 \rightarrow 5$	0
$5/2 \rightarrow 2$	1
$2/2 \rightarrow 1$	0
$1/2 \Rightarrow 0$	1

$(1010)_2$

↳ 10 Binary Rep.

Decimal to Binary Conversion

Division Method

1. Divide number by 2.
2. Store reminder. (That will be a bit in binary number)
3. Repeat above steps with the Quotient until quotient is less than 2.
4. Reverse the bits so obtained.

(1) N = 10 →

0 →

0 * 10^0 + 0 = 0

1 → 1 * 10^1 + 0 = 10

0 → 0 * 10^2 + 10 = 10

1 → 1 * 10^3 + 10 = 1010

Division	Rem.
10/2 → 5	0
5/2 → 2	1
2/2 → 1	0
1/2 → 0	1

Decimal to Binary Conversion

Bitwise Method

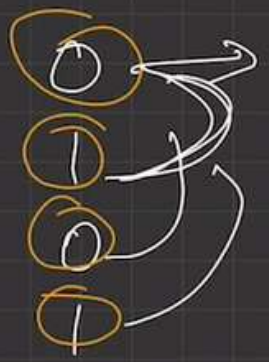
1. Obtain bit with bitwise AND operation i.e., (N & 1)
2. Right Shift N by 1. (N = N >> 1)
3. Repeat above steps till N > 0.
4. Reverse the bits so obtained.

Number System

10 → Rem →

ans = 0. i = 0

ans = (digit × 10^i) + ans



(1) $0 \times 10^0 + 0 = 0$

(2) $1 \times 10^1 + 0 = 10$

(3) $0 \times 10^2 + 10 = 10$

(4) $1 \times 10^3 + 10 = 1010$

Binary to Decimal Conversion

1. Multiple each digit with its place value.
2. Add up all place values.
3. Sum is the Decimal number.

$10 \rightarrow$ 1010

$\rightarrow$

1 0 1 0

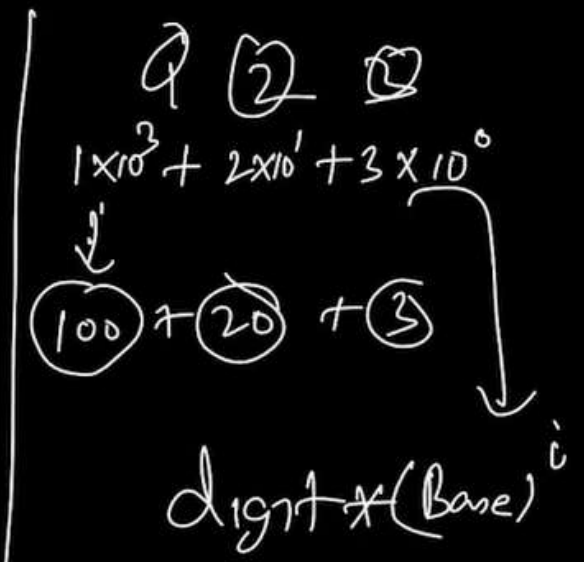
$1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$8 + 0 + 2 + 0 = 10$

eg, $23 \rightarrow$ 1 0 1 1 1

$1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$16 + 0 + 4 + 2 + 1 = 23$



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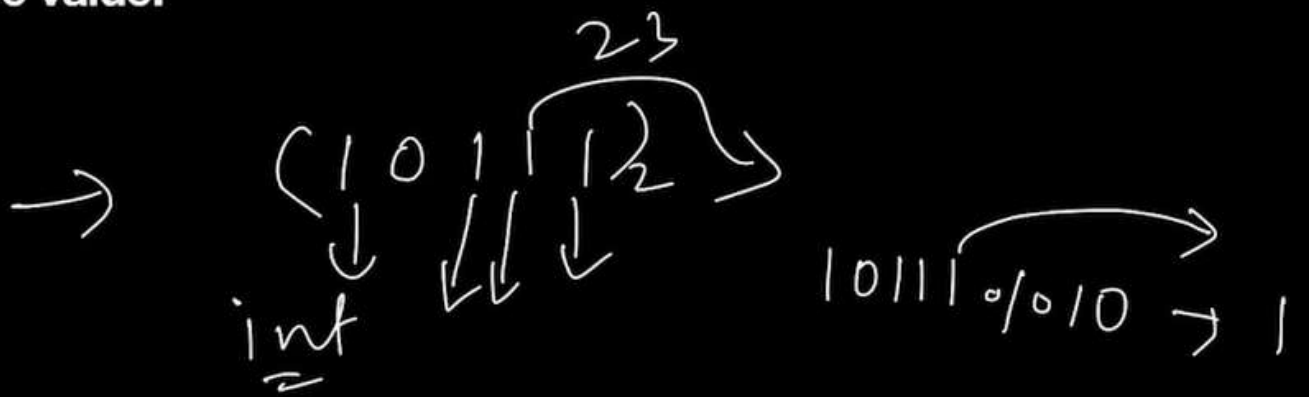

Binary to Decimal Conversion

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3. Sum is the Decimal number.

Binary = $(1010)_2$ →

→

1 0 1 0

→ $1\times2^3 + 0\times2^2 + 1\times2^1 + 0\times2^0$

→ $8 + 0 + 2 + 0 = 10$

$dec = 2 + 1\times2^3$

$= 2 + 8 = 10$

③

① Bit = 1010 % 10

⇒ 0

dec ⇒ $0 + 0\times2^0$

dec = 0

N = N/10 → 101

② 101

Bit → 101 % 10 = 1

decimal = $0 + 1*2^1$

dec = 2 N = N/10

10 → Bit → 0

dec = $2 + 0\times2^2$ = 2

N = N/10