

What is Number System?

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

0
①
2
3
4
5
6
7
8
9

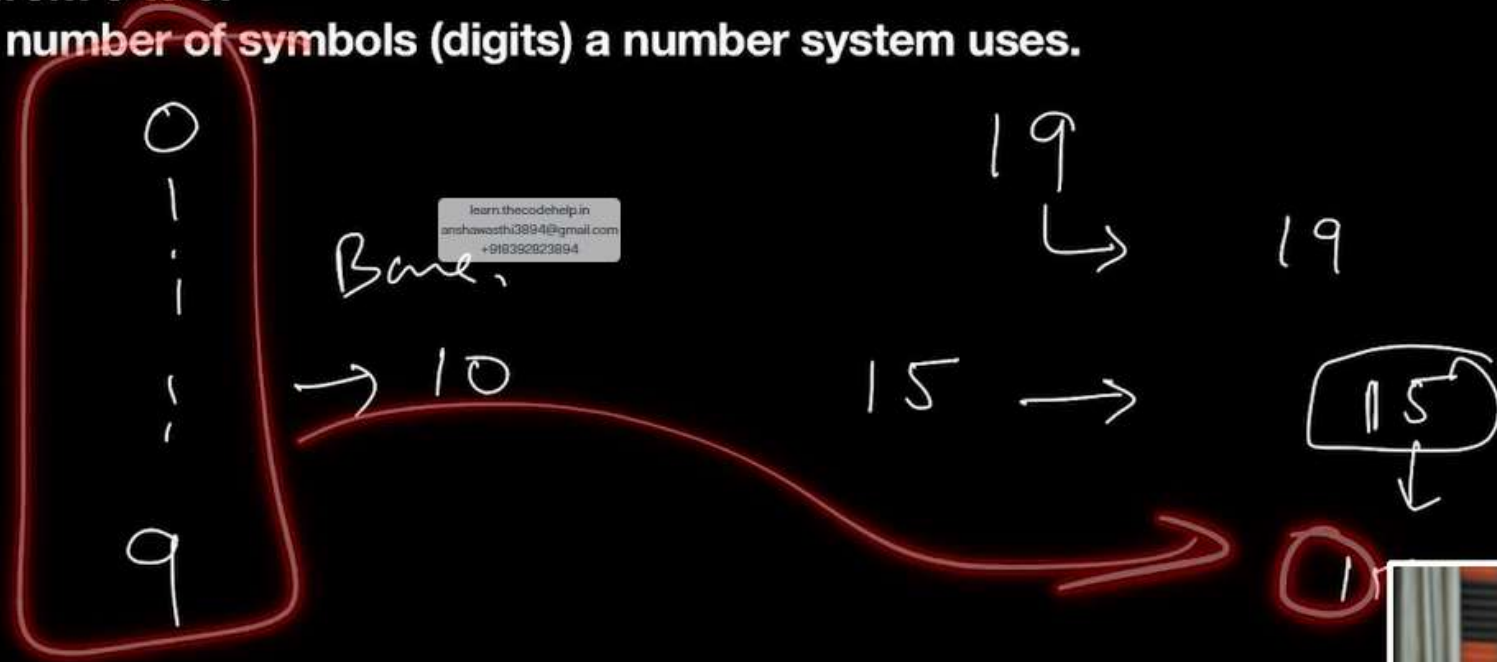
$$\begin{array}{r} 121 \\ \downarrow \\ \begin{array}{r} 100 \\ 20 \\ + 1 \\ \hline 121 \end{array} \end{array}$$

\$0 Cars
↳ ①0
↓
10
17 → ①7 → ①7



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.



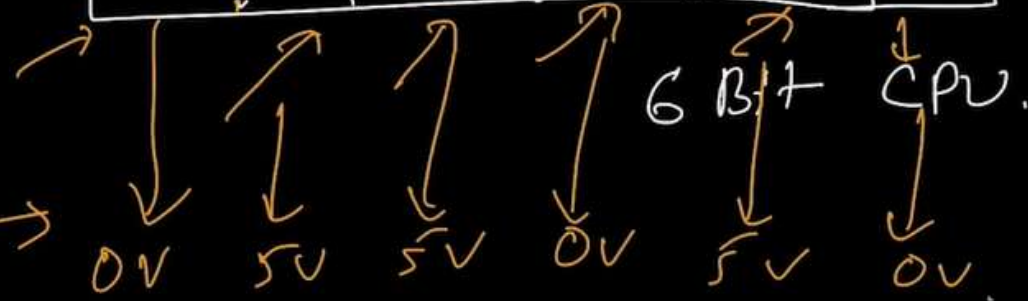
Binary Number System

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

Power ON
off on on off on off



→ Battery



Binary Number System

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

0
1

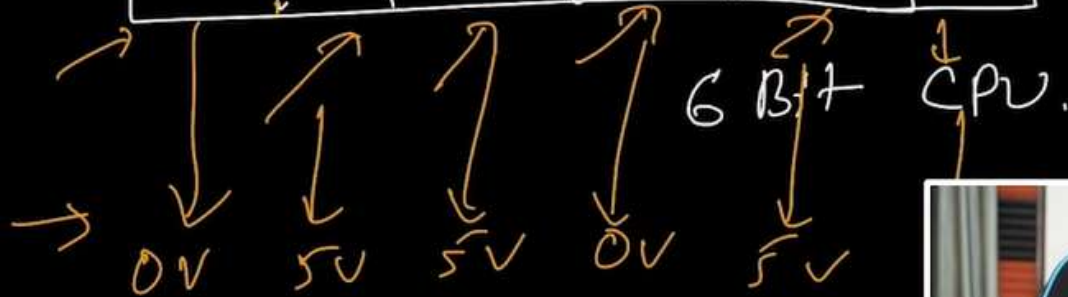
→ Battery

4 Byte.

from thecodehelp.in
anshu.wasthi3894@gmail.com
+91-93-2827894

Power ON

off on on off on off



0 0000 ~ 100 → 31 Bits

Computer

CPU

Memory

Storage.

Binary

Binary



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 remainder. (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

$N = 10 \rightarrow$

$(1010)_2$

$\rightarrow 10$ Binary
Rep.

Division

$$10/2 \rightarrow 5$$

$$5/2 \rightarrow 2$$

$$2/2 \rightarrow 1$$

$$1/2 \rightarrow 0$$

Rem.

0

1

0

1



Decimal to Binary Conversion

Division Method

1. Divide number by 2.
2. Store remainder. (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

$$N = 10 \rightarrow$$

$$0 \rightarrow 0 \times 10^0 + 0 = 0$$

$$1 \rightarrow 1 \times 10^1 + 0 = 10$$

$$0 \rightarrow 0 \times 10^2 + 10 = 10$$

$$1 \rightarrow 1 \times 10^3 + 10 = 1010$$

Division

$$10/2 \rightarrow 5$$

$$5/2 \rightarrow 2$$

$$2/2 \rightarrow 1$$

$$1/2 \Rightarrow 0$$

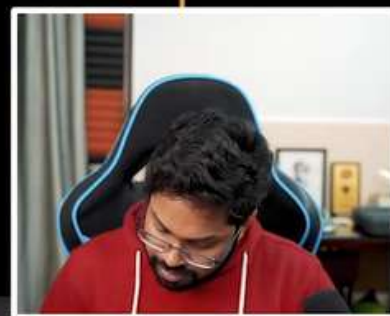
Rem.

0

1

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. $(N = N \gg 1)$
3. Repeat above steps till $N > 0$.
4. Reverse the bits so obtained.

$1010 \xrightarrow{\gg}$
↓
neglect

$101 \xrightarrow{\gg}$
↓
 $N = 101$

$N = 101$

$\gg \Rightarrow 10$

$10 \& 1 = 0$ 3rd.

$N \Rightarrow 10$ ✓
↓
 1010 ✓

$N = 10$

$\gg \Rightarrow 1$

$1 \& 1 = 1$ 4th.

$1010 \xrightarrow{\gg}$
 $\& 0001$

 $0000 \rightarrow 0$

101
 $\& 001$

 $001 \rightarrow 1$ 2nd.

1st.
 1 ✓
✓

0
1
0
1



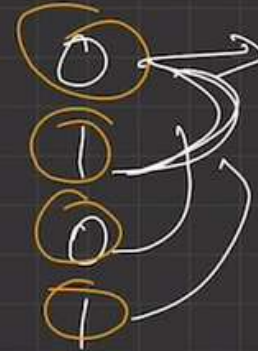
NUMBER System

learn thecodehelp.in
ansh.wartha3894@gmail.com
+915392623894

10 \rightarrow Rem \rightarrow

ans = 0. $i = 0$

$$\text{ans} = (\text{digit} \times 10^i) + \text{ans}$$



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.

$10 \rightarrow 1010$

$1 \quad 0 \quad 1 \quad 0$

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

$$8 + 0 + 2 + 0 = 10$$

eg, $23 \rightarrow 10111$

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

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

$1 \times 10^3 + 2 \times 10^1 + 3 \times 10^0$

\downarrow

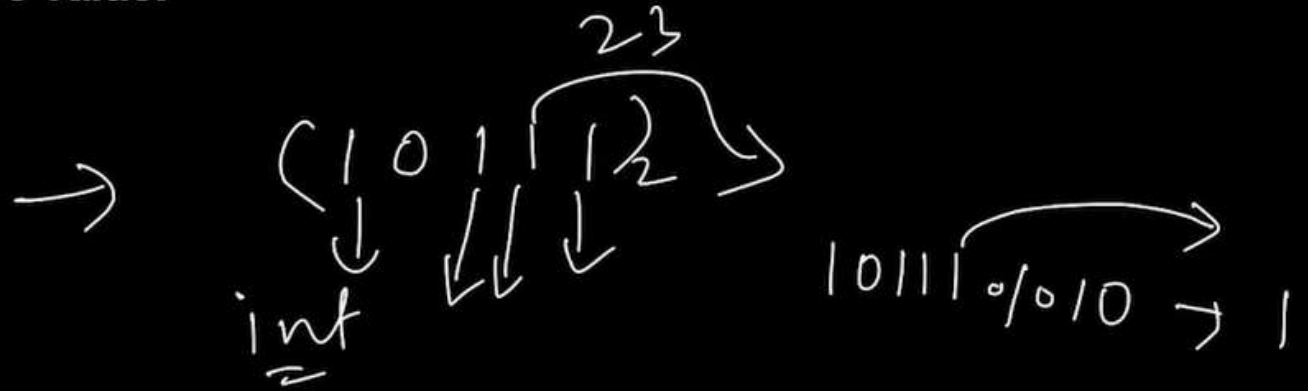
$100 + 20 + 3$

digit \times (Base)ⁱ



Binary to Decimal Conversion

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



Binary to Decimal Conversion

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

→ Binary = $(1010)_2 \rightarrow$

1 0 1 0

→ $1 \times 2^3 + 0 \times 2^2 + \underline{1 \times 2^1} + 0 \times 2^0$

→ $8 + 0 + \underline{2} + 0 = 10$

$$\text{dec} = 2 + 1 \times 2^3$$
$$= 2 + 8 = 10$$

① Bit = $1010 \div 10$

→ 0

dec → $0 + 0 \times 2^0$

dec = 0

$N = N/10 \rightarrow 101$

② 101

Bit → $101 \div 10 = 1$

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

dec = 2 $N = N/10$

③ 10 → Bit → 0

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

$N = N/10$

