Number System :- Decimal & Binary.

Q. What is number system?

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

→ Decimal no. system !!!

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

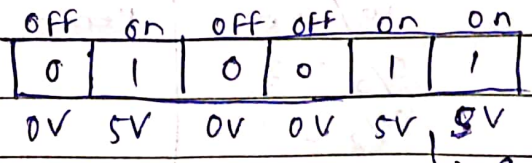
→ Binary Number system !!!

1. Number System using base 2.
2. It uses only two digits i.e. 0 & 1.

As we know,

Computer only understands Binary and communicates only in Binary (0s & 1s)

The CPU, memory and all things are encoded in Binary.



↳ 6 bit system.

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 no. by 2
2. Store remainder (That will be a bit)
3. Repeat above steps with quotient until quotient is less than 2.
4. Reverse the method.

eg: n = 10

Division →	$10/2 = 5$	Rem →	0
	$5/2 = 2$		1
	$2/2 = 1$		0
	$1/2 = 0$		1

Now Reversing bits >>>

0 → 0 * 10^0 + 0 = 0
1 → 1 * 10^1 + 0 = 10
0 → 0 * 10^2 + 10 = 10
1 → 1 * 10^3 + 10 = 1010

formula:

ans = 0 , i = 0
ans = (digit * 10^i) + ans

① 0 × 10^0 + 0 = 0
② 1 × 10^1 + 0 = 10
③ 0 × 10^2 + 10 = 10
④ 1 × 10^3 + 10 = 1010

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.

Explanation N = 10

1010. & 1.

```
  1 0 1 0
+ 0 0 0 1
---------
  0 0 0 0   → 0 (1st bit)
```

1 0 1 (0) → (nikal liya)

Let's Right shift the no.

1 0 1 0 → (neglect) → 1 0 1.

→ after right shift

Now N2 101

again...

```
  1 0 1
+ 0 0 1
---------
  0 0 1   → (1) 2nd bit.
```

again right shift

1 0 1 → 1 0

```
  1 0
+ 0 1
-------
  0 0   → (0) → 3rd bit
```

again same process

```
  1
+ 1
---
  1   → (1) → 4th bit.
```

> and put the same formula.

> Binary to Decimal conversion.

1. Multiple each digit with it's place value.
2. Add up all place values.
3. Sum is the decimal number.

eg:- 10 → 1010

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

$= 0 + 2 + 0 + 8$

$= 10$

eg:- 23 → 10111

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

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

$= 23$