

Number System & Their conversion

Decimal Number - Base 10

Binary Number - Base 2

Octal Number - Base 8

Hexadecimal Number - Base 16

Ex 1 . Convert $(25)_{10}$ to binary number.

Operation	Output	Remainder
$25 \div 2$	12	1 (MSB)
$12 \div 2$	6	0
$6 \div 2$	3	0
$3 \div 2$	1	1
$1 \div 2$	0	1 (LSB)

$\therefore (25)_{10} = (11001)_2$

Q2 $(21304)_{10} = (?)_2$

$$\begin{array}{r} = 2 \overline{) 21304} \\ \underline{2} \\ 106 \\ \underline{2} \\ 53 \\ \underline{2} \\ 26 \\ \underline{2} \\ 13 \\ \underline{2} \\ 6 \\ \underline{2} \\ 3 \\ \underline{2} \\ 1 \\ \underline{2} \\ 1 \end{array}$$

$= 11010101$

$$4 \times 2 = 8 \rightarrow 0$$

$$8 \times 2 = 16 \rightarrow 1$$

$$6 \times 2 = 12 \rightarrow 1$$

$$= 011$$

$$\therefore (213.4)_{10} = 11010101.011$$

Decimal to Octal Number:- To convert decimal to octal number, we have to divide the given original number by 8 such that base 10 changes to base 8.

Eg. 1 Convert $(128)_{10}$ to octal number

Operation	Output	Remainder
$128 \div 8$	16	0 (MSB)
$16 \div 8$	2	0
$2 \div 8$	0	2 (LSB)

\therefore The equivalent octal number = $(200)_8$

Decimal to Hexadecimal

We have to divide the given decimal number by 16.

Eg

Eg 1 convert $(128)_{10}$ to hex

Operation	Output	Remainder
$128 \div 16$	8	0 (MSB)
$8 \div 16$	0	8 (LSB)

\therefore the equivalent hexadecimal no is 80_{16}

Binary to Decimal:

In this conversion, binary number to a decimal no, we use multiplication method, in such a way that if a no with base n has to be converted into a number with base 10, then each digit of the given no is multiplied from MSB to LSB with reducing the power of the base.

Let's take an eg-

Eg 1 convert $(1101)_2$ into a decimal number.

Soln. Multiply each digit from MSB to LSB with reducing the power of the base number.

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

$$= 8 + 4 + 0 + 1$$

$$= 13$$

$$\therefore (1101)_2 = (13)_{10}$$

Octal to Decimal

To convert octal to decimal, we multiply the digits of octal no with decreasing power of the base number 8, starting from MSB to LSB and then add them all together.

Ex 1. Convert $(22)_8$ to decimal no.

Solution. Given $(22)_8$

$$= 2 \times 8^1 + 2 \times 8^0$$

$$= 16 + 2$$

$$= 18$$

$$\therefore (22)_8 = (18)_{10}$$

Hexadecimal to Decimal

Ex 1. Convert $(121)_{16}$ to decimal no.

Soln. - $1 \times 16^2 + 2 \times 16^1 + 1 \times 16^0$

$$= 16 \times 16 + 2 \times 16 + 1 \times 1$$

$$= 289$$

$$\therefore (121)_{16} = (289)_{10}$$

Hexadecimal to binary

Eg. Convert $(89)_{16}$ into a binary no.

Soln. Convert each digit into equivalent four digit binary number

$$8 = 1000, 9 = 1001$$

$$\therefore (89)_{16} = (10001001)_2$$

Octal to Binary

E.g. Convert $(214)_8$ into a binary no

Soln. Convert each digit into a equivalent 3-bit binary number.

$$2 \rightarrow 010$$

$$1 \rightarrow 001$$

$$4 \rightarrow 100$$

$$\therefore (214)_8 = (010001100)_2$$