

Section 26 : Miscellaneous #1

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Number Systems :

Number Systems

2 ✓ Binary — {0, 1}

8 → Octal — {0, 1, 2, 3, 4, 5, 6, 7}

10 → Decimal — {0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

16 → HexaDecimal — {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F}

Number Systems

Decimal	Binary	Octal	Hexadecimal
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F
16	10000	20	10

Conversion of Number System :

259₍₁₀₎

200 + 50 + 9

2 × 100 + 5 × 10 + 9 × 1

2 × 10² + 5 × 10¹ + 9 × 10⁰

10110₍₂₎

1 × 2⁴ + 0 × 2³ + 1 × 2² + 1 × 2¹ + 0 × 2⁰

$\frac{1 \times 16}{16} + \frac{0 \times 8}{0} + \frac{1 \times 4}{4} + \frac{1 \times 2}{2} + \frac{0 \times 1}{0} = 22$

Decimal to Binary :

- Divide by 2 and take remainder from end to start.

30₍₁₀₎ = 11110₍₂₎

$$\begin{array}{r} 2 \overline{) 30} \\ 2 \overline{) 15} - 0 \wedge \\ 2 \overline{) 7} - 1 \\ 2 \overline{) 3} - 1 \\ 2 \overline{) 1} - 1 \\ 0 - 1 \end{array}$$

Decimal to Octal :

- Divide by 8 and take remainder from end to start.

$$30_{(10)} = 36_{(8)}$$

$$\begin{array}{r} 8 \overline{) 30} \\ 8 \overline{) 3} - 6 \uparrow \\ 0 - 3 \end{array}$$

Decimal to Hexadecimal :

- Divide by 16 and take remainder from end to start.

$$30_{(10)} = 1E_{(16)}$$

$$\begin{array}{r} 16 \overline{) 30} \\ 16 \overline{) 1} - 14 \uparrow \\ 0 - 1 \end{array}$$

Binary to Decimal :

$$11110_{(2)} = 30_{(10)}$$

1	1	1	1	0
2^4	2^3	2^2	2^1	2^0

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

$$16 + 8 + 4 + 2 + 0 = 30$$

Octal to Decimal :

$$36_{(8)} = 30_{(10)}$$

3	6
8^1	8^0

$$3 \times 8 + 6 \times 8^0 =$$

$$24 + 6 = 30$$

Hexadecimal to Decimal :

$$1E_{(16)} = 30_{(10)}$$

1	E
16^1	16^0

$$1 \times 16 + E \times 1$$

$$16 + 14 = 30$$

Octal to Binary :

$$125_{(8)} = 1010101_{(2)}$$

$$\begin{array}{ccc} \underline{1} & \underline{2} & \underline{5} \\ \underline{001} & \underline{010} & \underline{101} \end{array}$$

Binary to Octal :

$$10110110_{(2)} = 266_{(8)}$$

010	110	110
2	6	6

Hexadecimal to Binary :

$$7C4_{(16)} = 1111000100_{(2)}$$

7	C	4
0111	1100	0100

Binary to Hexadecimal :

$$10011001010_{(2)} = 4CA_{(16)}$$

0100	1100	1010
4	C	A

Octal to Hexadecimal :

- So there is no direct method. One method, if we can convert into decimals and convert it to Hexadecimal, otherwise we can take help of binary also. So taking the whole of binary will be easy.
- **Octal -> Binary -> Hexadecimal Method :**

$$276_{(8)} = BE_{(16)}$$

2	7	6
10	111	110

1011	1110
B	E

Hexadecimal to Octal :

- No direct method.
- **Hexadecimal -> Binary -> Octal Method :**

$$276_{(8)} = BE_{(16)}$$

$$\begin{array}{r} 276 \\ \hline 1011110 \end{array}$$

$$\underline{10111110}_{(2)}$$

B E