Binary to Decimal Conversion:

Others to decimal $(a_3 a_2 a_1 a_0 . a_{-1} a_{-2})_r \rightarrow (\quad)_{10}$ (binary point)

$a_3 r^3 + a_2 r^2 + a_1 r^1 + a_0 r^0 + a_{-1} r^{-1} + a_{-2} r^{-2} = (\quad)_{10}$

Ex: $(10101.11)_2 \rightarrow (21.75)_{10}$

$1\times2^4 + 0\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0 + 1\times2^{-1} + 1\times2^{-2}$

$16 + 0 + 4 + 0 + 1 + 0.5 + 0.25$

21.75

Binary to octal conversion:

→ Split the given binary number into 3 pair groups

→ For integer part move from right to left for splitation

→ For fractional part move from left to right.

Eg: $(10110.11)_2 \longrightarrow (26.6)_8$

0 1 0 1 1 0 . 1 1 0

2 6 . 6

$(1001.1)_2 \longrightarrow (11.4)_8$

0 0 1 0 0 1 . 1 0 0

1 1 . 4

000 - 0
001 - 1
010 - 2
011 - 3
100 - 4
101 - 5
110 - 6
111 - 7

Binary to hexadecimal conversion:

→ Same as octal, but split the number into 4 pair groups.

Eg: $(1000\ 1001 . 1100)_2 \longrightarrow (89.C)_{16}$

1000 1001 . 1100

8 9 C

$(1101\ 1110\ 1010\ 1111)_2 \rightarrow (DEAF)_{16}$

1101 1110 1010 1111

13(D) E A F

0000 - 0
0001 - 1
0010 - 2
0011 - 3
0100 - 4
0101 - 5
0110 - 6
0111 - 7
1000 - 8
1001 - 9
1010 - 10 (A)
1011 - 11 (B)
1100 - 12 (C)
1101 - 13 (D)
1110 - 14 (E)
1111 - 15 (F)

Octal to Binary Conversion:
The eight digit no. of octal system can be represented by a equivalent 3-bit number.

Eg: $(37.45)_8 \longrightarrow (011111.100101)_2$

3 - 011
7 - 111
4 - 100
5 - 101

$(27.07)_8 \longrightarrow (010111.000111)_2$

Octal to Decimal Conversion:
→ Same as binary to decimal

octal point
$a_3\ a_2\ a_1\ a_0 \checkmark a_{-1}\ a_{-2}$

$a_3 \times 8^3 + a_2 \times 8^2 + a_1 \times 8^1 + a_0 \times 8^0 + a_{-1} \times 8^{-1} + a_{-2} \times 8^{-2}$

Eg: $(57.4)_8 \longrightarrow (47.5)_{10}$

$5 \times 8^1 \qquad 4 \times 8^{-1}$
7×8^0
$40 + 7 + 0.5 = 47.5$

Octal to hexadecimal Conversion:
→ First convert octal to binary, then binary to hexadecimal

Eg: $(652)_8 \longrightarrow (1AA)_{16}$

6 5 2
000 110 101 010
1 A A

$(707)_8 \longrightarrow (1C7)_{16}$

7 0 7
111 000 111
1 C 7

Hexadecimal to binary Conversion:

→ Each 16 different digits of hexadecimal system is represented by a 4 bit binary number.

Eg: $(2\ 5\ 9\ A)_{16} \longrightarrow (0010\ 0101\ 1001\ 1010)_2$

2	5	9	A
0010	0101	1001	1010

$(CAFE.3D)_{16} \rightarrow (1100\,1010\,1111\,1110 . 0011\,1101)_2$

Hexadecimal to decimal Conversion

$h_3\ h_2\ h_1\ h_0\ .\ h_{-1}\ h_{-2}$ (. : hexadecimal point)

$h_3 \times 16^3 + h_2 \times 16^2 + h_1 \times 16^1 + h_0 \times 16^0 + h_{-1} \times 16^{-1} + h_{-2} \times 16^{-2}$

10 → A
11 → B
12 → C
13 → D
14 → E
15 → F

Eg: $(BAD)_{16} \longrightarrow (2989)_{10}$

$11 \times 16^2 + 10 \times 16^1 + 13 \times 16^0 = 2989$

$(57.4)_{16} \rightarrow (87.25)_{10}$

$5 \times 16^1 + 7 \times 16^0 + 4 \times 16^{-1}$

$80 + 7 + 0.25 = 87.25$

Hexadecimal to octal conversion:

→ First from hexadecimal to binary then binary to octal

~~Eg: $(1100\,0010\,0110.1010)_{16} \rightarrow (\quad)_8$~~

$(17A.E)_{16} \longrightarrow (572.7)_8$

$0001\ 0111\ 1010 . 1110$

$0\ \ 5\ \ 7\ \ 2 \ . \ 7\ \ 0$

$(572.70)_8$