Example:

Convert (511.95) to ($)_2$

Number	quotient	Remainder
511/2	255	1
255/2	127	1
127/2	63	1
63/2	31	1
31/2	15	1
15/2	7	1
7/2	3	1
3/2	1	1
1/2	0	1

Number		
0.95*2	1.8	1
0.8*2	1.6	1
0.6*2	1.2	1
0.2*2	0.4	0
0.4*2	0.8	0
0.8*2	1.6	1

$(511.95)_{10}$ → (1111111111.111001 $)_2$

Example:

Convert (39.25) to ($)_2$

Number	quotient	Remainder
39/2	19	1
19/2	9	1
9/2	4	1
4/2	2	0
2/2	1	0
1/2	0	1

Number		
0.25*2	0.5	0
0.5*2	1.0	1

(39.25) ⟶ (100111.01 $)_2$

Octal Number System

The Octal Number System is another type of computer and digital numbering system which uses the Base-8 system.

The octal numeral system, is the base-8 number system, and uses the digits 0 to 7. Numerals can be made from binary numerals by grouping consecutive binary digits into groups of three (starting from the right). For example, the binary representation for decimal 74 is 1001010, which can be grouped into (00)1 001 010 — so the octal representation is 112.

In decimal systems each decimal place is a base of 10.

For example:

In octal numerals each place is a power with base 8. For example:

By performing the calculation above in the familiar decimal system we see why 112 in octal is equal to 64+8+2 = 74 in decimal.

Hexadecimal Number System

In mathematics and computer science, hexadecimal (also base 16, or hex) is a positional numeral system with a radix, or base, of 16. It uses sixteen distinct symbols, most often the symbols 0–9 to represent values zero to nine, and A, B, C, D, E, F (or alternatively a through f) to represent values ten to fifteen. For example, the hexadecimal number 2AF3 is equal, in decimal, to (2 × 163) + (10 × 162) + (15 × 16) + 3, or 10,995.

Hexadecimal	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Decimal to octal

To convert integer decimals to octal, divide the original number by the largest possible power of 8.

Example:

Convert (25) decimal to octal

Number	quotient	Remainder
25/8	3	1
3/8	0	3

Example:

Convert (120) decimal to octal

Number	quotient	Remainder
120/8	15	0
15/8	1	7
1/8	0	1

Example:

Convert (131) decimal to octal

Number	quotient	Remainder
131/8	16	3
16/8	2	0
2/8	0	2

Convert

Decimal to hexadecimal

To convert integer decimals to hexadecimal, divide the original number by the largest possible power of 16.

Example:

Convert (25) decimal to Hexa.

Number	quotient	Remainder
25/16	1	9
1/16	0	1

The hexadecimal number : (19)H

Example:

Convert (180) decimal to Hexa.

Number	quotient	Remainder
180/16	11	4
11/16	0	11--(B)

The hexadecimal number : $(B4)_{H}$

Example:

Convert (3315) decimal to Hexa.

Number	quotient	Remainder
3315/16	207	3
207/16	12	15—(F)
12/16	0	12—(C)

The hexadecimal number : $(CF3)_{H}$

Example:

Convert $(0.265)_{10}$ to ($)_{8}$

0.265*8	2.120	2
0.120*8	0.96	0
0.96*8	7.68	7
0.68*8	5.44	5
0.44*8	3.52	3
0.52*8	4.16	4
0.16*8	1.28	1

$(0.265)_{10}$ to (0.2075341 $)_{8}$

Example:

Convert $(44.5625)_{10}$ to ($)_8$

Number	quotient	Remainder
44/8	5	4
5/8	0	5
0. 5625 * 8	0.1800	4
0.5*8	0	4

$(44.5625) \longrightarrow (54.44)_8$

The weight of Binary system

$---2^8\ 2^7\ 2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0\ .\ 2^{-1}\ 2^{-2}\ 2^{-3}\ 2^{-4}\ ---$

The weight of Octal system

$---8^8\ 8^7\ 8^6\ 8^5\ 8^4\ 8^3\ 8^2\ 8^1\ 8^0\ .\ 8^{-1}\ 8^{-2}\ 8^{-3}\ 8^{-4}\ ---$

The weight of Hexadecimal system

$---16^8\ 16^7\ 16^6\ 16^5\ 16^4\ 16^3\ 16^2\ 16^1\ 16^0\ .\ 16^{-1}\ 16^{-2}\ 16^{-3}\ 16^{-4}\ ---$

Octal to Decimal

Example:

Convert (54.44 $)_8$ to ( )10

54

$4*8^0+5*8^1=4+40=44$

44

$4*8^{-1}+4*8^{-2} = 4/8+4/64 = 36/46$

Hexadecimal to Decimal

Example

Convert hexadecimal number : $(CF3)_H$

$CF3 = 3*16^0+F*16^1+C*16^2 = 3+ 240 + 3072 = 3315$

Binary to Octal

The binary digits are grouped by threes, starting from the decimal point and proceeding to the left and to the right. Add leading 0s to fill out the last group of three if necessary.

$(000)_2 \longrightarrow (0)_8$
$(001)_2 \longrightarrow (1)_8$
$(010)_2 \longrightarrow (2)_8$
$(011)_2 \longrightarrow (3)_8$
$(110)_2 \longrightarrow (4)_8$
$(101)_2 \longrightarrow (5)_8$
$(110)_2 \longrightarrow (6)_8$
$(111)_2 \longrightarrow (7)_8$

EXAMPLE 2:

convert (101111010110) binary to octal

Binary
101 111 010 110
Octal
5 7 2 6 The octal number : $(5726)_8$

EXAMPLE 3:

Convert (10111110001110110) binary to octal

Binary

010 111 110 001 110 110

Octal

2 7 5 1 6 6

The octal number : $(275166)_8$

Binary to Hexadecimal

$(0000)_2 \rightarrow (0)_{16}$
$(0001)_2 \rightarrow (1)_{16}$
$(0010)_2 \rightarrow (2)_{16}$
$(0011)_2 \rightarrow (3)_{16}$
$(0110)_2 \rightarrow (4)_{16}$
$(0101)_2 \rightarrow (5)_{16}$
$(0110)_2 \rightarrow (6)_{16}$
$(0111)_2 \rightarrow (7)_{16}$
$(1000)_2 \rightarrow (8)_{16}$
$(1001)_2 \rightarrow (9)_{16}$
$(1010)_2 \rightarrow (A)_{16}$
$(1011)_2 \rightarrow (B)_{16}$
$(1100)_2 \rightarrow (C)_{16}$
$(1101)_2 \rightarrow (D)_{16}$
$(1110)_2 \rightarrow (E)_{16}$
$(1111)_2 \rightarrow (F)_{16}$

EXAMPLE 1:
convert (01011110101101010010) binary to hexadecimal
Binary
0101 1110 1011 0101 0010
hexa
5 E B 5 2

The octal number : $(5EB52)_{16}$

EXAMPLE 2:
convert (11001100101010111110) binary to hexadecimal
Binary
0110 0110 0101 0101 1110
hexa
6 6 5 5 E

The octal number : $(6655E)_{16}$

Octal to Binary

To convert octal to binary, replace each octal digit by its binary representation.
$(0)_8 \longrightarrow (000)_2$
$(1)_8 \longrightarrow (001)_2$
$(2)_8 \longrightarrow (010)_2$
$(3)_8 \longrightarrow (011)_2$
$(4)_8 \longrightarrow (110)_2$
$(5)_8 \longrightarrow (101)_2$
$(6)_8 \longrightarrow (110)_2$
$(7)_8 \longrightarrow (111)_2$

EXAMPLE 1: convert (27643) octal to binary
Octal
2 7 6 4 3
Binary
010 111 110 100 011
The binary number : $(010111110100011)_2$

EXAMPLE 3: convert (46534) octal to binary

Octal

4 6 5 3 4

Binary

100 110 101 011 100

The binary number : (100110101011100)B

Octal To hexadecimal

The conversion is made in two steps using binary as an intermediate base. hexadecimal is converted to binary and then binary to octal, grouping digits by threes, which correspond each to a octal digit.

Example1:

convert hexadecimal AB6 to octal

First step convert it to binary number

$(AB6)_H=(101010110110)_2$

second step convert it to octal number

$(101010110110)_2=(5266)_8$

Relationship between Binary - Octal and Binary-hexadecimal As demonstrated by the table below, there is a direct correspondence between the binary system and the octal system, with three binary digits corresponding to one octal digit. Likewise, four binary digits translate directly into one hexadecimal digit

. BIN OCT HEX DEC ----------

0000	00	0	0
0001	01	1	1
0010	02	2	2
0011	03	3	3
0100	04	4	4
0101	05	5	5
0110	06	6	6
0111	07	7	7

1000	10	8	8
1001	11	9	9
1010	12	A	10
1011	13	B	11
1100	14	C	12
1101	15	D	13
1110	16	E	14
1111	17	F	15