Conversion from a Binary to Octal and Vice Versa

Binary to **octal**

To convert from **binary** to **octal**, we start from the LSB and then group three digits at a time and replace them by the decimal equivalent as follow:

Ex) Convert $(101101010)_2$ into an equivalent octal number.

Solution.

The binary number given is	101101010
Starting with LSB and grouping 3 bits	101 101 010
Octal equivalent	5 5 2

Hence the octal equivalent number is $(552)_8$.

Ex) Convert $(1011110)_2$ into an equivalent octal number.

Ex) Convert $(1101.0111)_2$ into an equivalent octal number.

Solution.

The binary number given is	1101.0111
Grouping 3 bits	001 101. 011 100
Octal equivalent:	1 5 3 4

Hence the octal number is $(15.34)_8$.

In this case, we complete the real part by adding two 0s (left padding) and adding two 0s on the right side (right padding).

Ex) Convert $(11010111.0101)_2$ into an equivalent octal number.

Octal to **binary**

To convert from **octal** to **binary**, each octal digit is converted into a 3-bit-equivalent binary number.

Ex) Convert $(235)_8$ into an equivalent binary number.

Solution.

The octal number given is	2	3	5
3-bit binary equivalent	010	011	101

Hence the binary number is $(010011101)_2$.

Ex) Convert $(47.321)_8$ into an equivalent binary number.

Solution.

The octal number given is	4	7	·	3	2	1
3-bit binary equivalent	100	111	·	011	010	001

Hence the binary number is $(100111.011010001)_2$.

Conversion from a Binary to Hexadecimal and Vice Versa

Binary to **hexadecimal**

To convert from **binary** to **hexadecimal**, we start from the LSB and then group four digits at a time and replace them by the decimal equivalent as follow:

Ex) Convert $(110011110)_2$ into an equivalent hexadecimal number.

Solution.

The binary number given is	110011110		
Starting with LSB and grouping 4 bits	0001	1001	1110
Hexadecimal equivalent	1	9	E

Hence the hexadecimal equivalent number is $(19E)_{16}$.

Ex) Convert $(111011.011)_2$ into an equivalent hexadecimal number.

Solution.

The binary number given is	111011.011		
Grouping 4 bits	0011	1011.	0110
Hexadecimal equivalent	3	B	6

Hence the hexadecimal equivalent number is $(3B.6)_{16}$.

Ex) Convert $(1010101011.011010)_2$ into an equivalent hexadecimal number.

Hexadecimal to **binary**

To convert from **hexadecimal** to **binary**, each hexadecimal digit is converted into a 4-bit equivalent binary number.

Ex) Convert $(29C)_{16}$ into an equivalent binary number.

Solution. The hexadecimal number given is 2 9 C
4-bit binary equivalent 0010 1001 1100
Hence the equivalent binary number is $(001010011100)_2$.

Ex) Convert $(9E.AF2)_{16}$ into an equivalent binary number.

Conversion from Octal to Hexadecimal and Vice Versa

Octal to hexadecimal

To convert from **octal to hexadecimal**, the following steps are followed:

(*i*) First convert the octal number to its binary equivalent.

(*ii*) Then form groups of 4 bits, starting from the LSB.

(*iii*) Then write the equivalent hexadecimal number for each group of 4 bits.

Ex) Convert $(247)_8$ into an equivalent hexadecimal number.

Solution. Given octal number is 2 4 7
Binary equivalent is 010 100 111
= 010100111
Forming groups of 4 bits from the LSB 1010 0111
Hexadecimal equivalent A 7
Hence the hexadecimal equivalent of $(247)_8$ is $(A7)_{16}$.

Ex) Convert $(36.532)_8$ into an equivalent hexadecimal number.

Ex) Convert $(735.461)_8$ into an equivalent hexadecimal number.

Hexadecimal to octal

Similarly, to convert from **hexadecimal** number into an **octal** number:

(*i*) First convert the hexadecimal number to its binary equivalent.

(*ii*) Then form groups of 3 bits, starting from the LSB.

(*iii*) Then write the equivalent octal number for each group of 3 bits.

Ex) Convert the following hexadecimal numbers into equivalent octal numbers.

(a) A72E (b) 4.BF85

(*a*)	Given hexadecimal number is			A	7	2	E
	Binary equivalent is			1010	0111	0010	1110
		= 1010011100101110					
	Forming groups of 3 bits from the LSB	001	010	011	100	101	110
	Octal equivalent	1	2	3	4	5	6
	Hence the octal equivalent of $(A72E)_{16}$ is $(123456)_8$.						

(b)