Warm Greetings!

Dear Students,

In this note, we are going to discuss Octal Number System Conversions.

Chapter 1: Number System Conversions

Octal to Decimal Conversion

To convert **Octal to Decimal**, we can use positional notation method.

Step 1. Write down the Octal digits and list the powers of 8 from right to left (Positional Notation)

Step 2. For each positional notation of the digit write the equivalent weight.

Step 3. Multiply each digit with its corresponding weight

Step 4. Add all the values

Example:

Convert $(1265)_8$ to equivalent Decimal number

Weight	512	64	8	1
Positional Notation	8^3	8^2	8^1	8^0
Given number	1	2	6	5

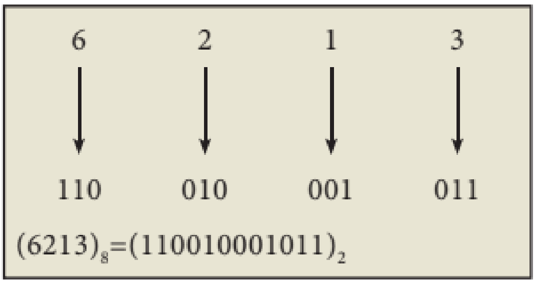
$$(1265)_8 = 512 \times 1 + 64 \times 2 + 8 \times 6 + 1 \times 5$$
$$= 512 + 128 + 48 + 5$$
$$(1265)_8 = (693)_{10}$$

Octal to Binary Conversion

For each **Octal digit in the given number write its 3 digits binary equivalent** using positional notation.

Example:

Convert $(6213)_8$ to equivalent Binary number:



Octal numbers and their Binary equivalent

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

Hexadecimal to Decimal Conversion

To convert **Hexadecimal to Decimal** we can use positional notation method.

Step 1. Write down the Hexadecimal digits and list the powers of 16 from right to left (Positional Notation)

Step 2. For each positional notation written for the digit, now write the equivalent weight.

Step 3. Multiply each digit with its corresponding weight

Step 4. Add all the values to get one final value.

Example

Convert $(25F)_{16}$ into its equivalent Decimal number.

Weight	256	16	1
Positional Notation	16^2	16^1	16^0
Given number	2	5	F(15)

$(25F)_{16} = 2\times256 + 5\times16 + 15\times1$

$= 512 + 80 + 15$

$(25F)_{16} = (607)_{10}$

Hexadecimal to Binary Conversion

Write 4 bits Binary equivalent for each Hexadecimal digit for the given number using positional notation method.

Example: Convert $(8BC)_{16}$ into its equivalent Decimal number.

8	B	C
↓	↓	↓
1000	1011	1100

$(8BC)_{16} = (100010111100)_2$

Binary Representation for Signed Numbers

- Computers can handle both positive (unsigned) and negative (signed) numbers.
- The simplest method to represent negative binary numbers is called Signed Magnitude.
- In signed magnitude method, the left most bit is Most Significant Bit (MSB), is called sign bit or parity bit.
- The numbers are represented in computers in different ways:
  - ✓ Signed Magnitude representation
  - ✓ 1's Complement
  - ✓ 2's Complement

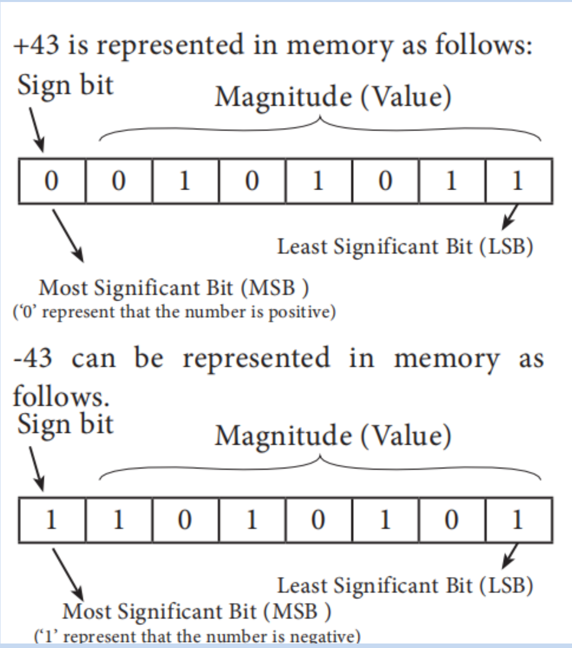
Signed Magnitude representation

- ✓ The value of the whole numbers can be determined by the sign used before it.
- ✓ If the number has '+' sign or no sign it will be considered as positive.
- ✓ If the number has '–' sign it will be considered as negative.

Example:

+43 or 43 is a positive number –43 is a negative number

- ✓ In signed binary representation, the left most bit is considered as sign bit.
- ✓ If this bit is 0, it is a positive number and if it 1, it is a negative number.
- ✓ Therefore a signed binary number has 8 bits, only 7 bits used for storing values (magnitude) and the 1 bit is used for sign.



1's Complement representation

- This is an easier approach to represent signed numbers.
- This is for negative numbers only i.e. the number whose MSB is 1.
- The steps to be followed to find 1's complement of a number:

  Step 1: Convert given Decimal number into Binary

  Step 2: Check if the binary number contains 8 bits , if less add 0 at the left most bit, to make it as 8 bits.

  Step 3: Invert all bits (i.e. Change 1 as 0 and 0 as 1)

Example

Find 1's complement for (–24)

Given Number	Binary Number	1's Compliment
$(-24)_{10}$	00011000	11100111

2's Complement representation

- ✓ The 2's-complement method for negative number is as follows:
- ✓ a. Invert all the bits in the binary sequence

  (i.e., change every 0 to1 and every 1 to 0 ie.,1's complement)
- ✓ b. Add 1 to the result to the Least Significant Bit (LSB).

Example

- ✓ 2's Complement represent of $(-24)_{10}$

Binary equivalent of +24:	11000
8bit format:	00011000
1's complement:	11100111
Add 1 to LSB:	+1
2's complement of -24:	**11101000**

NEXT NOTE,
WE SHALL DISCUSS OCTAL NUMBER SYSTEM CONVERSIONS