

## Tutorial 4 (Solutions) : Data representation

### Objectives

- By the end of this Unit you will be able to:  
Explain how integers are represented in computers using: unsigned, signed magnitude, excess, and two's complement notations

### Introduction:

Most modern computer systems do not represent numeric values using the decimal system. Instead, they typically use a binary or two's complement numbering system. To understand the limitations of computer arithmetic, you must understand how computers represent numbers.

### Summary:

This unit discusses several important concepts including the binary numbering systems, binary data organization, signed and unsigned numbering systems, arithmetic operations on binary values.

**1. Choose the correct answer:** (The numbers are represented in 2's complement if not mentioned otherwise)

2. The 4-bit binary number 0111 represents  
(a) 15, (b) -7 (c) 7 (d) -1

ANSWER: (c)

3. The unsigned decimal number 255 may be represented by  
(a) 1111 1111B, (b) 10000000B, (c) EEEEH, (d) 0111 1111

ANSWER: (a)

4. The 8-bit binary number 1111 1111 represents  
(a) 255, (b) -255 (c) -127 (d) -1

ANSWER: (d)

5. The decimal number 127 may be represented by  
(a) 1111 1111B, (b) 1000 0000B, (c) EEH, (d) 0111 1111

ANSWER: (d)

6. Information is stored and transmitted inside a computer in  
(a) binary form (b) ASCII code form (c) decimal form (d) alphanumeric form

ANSWER: (a)

7. The minimum number of bits required to store the hexadecimal number FF is  
(a) 2, (b) 4, (c) 8, (d) 16.

ANSWER: (c)

7. In computers, subtraction is generally carried out by  
(a) 9's complement                      b) 10's complement  
(c) 1's complement                      (d) 2's complement

ANSWER: (d)

2. Determine the decimal value represented by 10001011 in each of the following four systems.
- i. Unsigned notation?
  - ii. Signed magnitude notation?
  - iii. One's complements
  - iv. Two's complements?

ANSWER:

i. (139) ii. (-11) iii. (-116) iv. (-117)

3. Given decimal numbers A and B. Complete the table below:

A	B	A in 2's comp. (8 bits)	B in 2's comp. (8 bits)	A+B (8 bits binary)
16	-5	0001 0000	1111 1011	0000 1011
-25	-10	1110 0111	1111 0110	1101 1101