**Signed numbers:**

There are three ways in which signed binary numbers may be expressed:

* + Signed magnitude (SM)
  + One’s complement and
  + Two’s complement.

In an 8-bit word, signed magnitude representation places the absolute value of the number in the 7 bits to the right of the sign bit.

Ex: in **8-bit signed magnitude(SM),**  positive 3 is: 00000011

Negative 3 is: 10000011

Ex: in 8-bit **one’s complement**, positive 3 is: 00000011

Negative 3 is: 11111100

Ex: Adding 1 gives us -3 in **two’s complement** form: 11111101

Ex:convert using SM method**(01011001)2** = +(1 \* 26 + 0 \* 25 + 1 \* 24 + 1 \* 23 + 0 \* 22 + 0 \* 21 + 1 \* 20)

= + (64 + 0 + 16 + 8 + 0 + 0 + 1)

= **(+89)10**

Ex: convert using SM method **(10011100)2** = - (0 \* 26 + 0 \* 25 + 1 \* 24 + 1 \* 23 + 1 \* 22 + 0 \* 21 + 0 \* 20)

= - (0 + 0 + 16 + 8 + 4 + 0 + 0)

= **(-28)10**

**7´s and 8´s complements in octal :**

7´s = 7 – each digit

8´s = 7´s + 1

***EX:*** 7777

- 2415

is 7´s comp. 5362

+1

5363 is 8´s comp.

***EX:*** Perform 75268 - 31428 using 8's comp.:

7777

-3142

4635 + 1 = 4636

1 1

7526

+ 4636

12 – 8 = 4

11 - 8 = 3

12 - 8 = 4

1 4364 the result

***H.W.*** Perform the following using 8's complement:

5458 – 148 =

67768 – 43378 =

**15´s and 16´s complements in hexadecimal :**

***EX***: Find 15´s and 16´s comp. of ( 1 F A D )16

15 15 15 15

- 1 F A D

E 0 5 2 15´s comp.

1 +

E 0 5 3 16´s comp.

***EX***: Perform A B E D – 1 F A D using 16's comp. :

1 1

A B E D

+ E 0 5 3

16 – 16 = 0

20 – 16 = 4

24 – 16 = 8

1 8 C 4 0 the result

***H.W.***:Perform the following using 16's complement :

F E E D16 – D A F 316 = ANS: 23FA16

9 8 A E16 – 1 F E E16 =