

2's Complement - MSB indicates sign

Convert -12 (1-re, 0+ve)

We will use 5-bit

$$2^{n-1} \Rightarrow 2^{5-1} = 2^4 = 16$$

Those numbers which makes 12 will have 1 and all others will have 0

+12

16 8 4 2 1

0 1 1 0 0

1's → complement Take complement

0 0 0 1 1

2's → complement Now add 1

-12 → 1 0 1 0 0 MSB tells sign of number 1-re, 0+ve

~~16~~

$$-2^4 + 2^3 + 2^2 + 2^1 + 2^0$$

$$1 \times -2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$$

$$-16 + 4 \Rightarrow -12$$

we have 1 in 16 column so we use -16 and have 0 in 8 column so we will not use it and have 1 in 4 column we will use it and remaining also have 0 in 2 and 1 column skip it

$$-16 + 4 \Rightarrow -12$$

-1

8-bit

$$2^{8-1} =$$

	16	8	4	2	1	
+1	0	0	0	0	1	
	1	1	1	1	0	1's complement
add 1 +					1	2's complement
-1 →	1 1 1 1 1					

$$-16 + 8 + 4 + 2 + 1$$

$$-16 + 15 \Rightarrow -1$$

Simple subtraction

	64	32	16	8	4	2	1	
	0	0	2	2	1	1	1	
-	0	0	1	1	0	0	1	
	0	0	0	1	1	1	0	

decimal

(+39)
(-25')
14

Subtracted two +ve numbers

$$32 + 4 + 2 + 1 \Rightarrow 39$$

$$16 + 8 + 1 \Rightarrow 25'$$

$$8 + 4 + 2 \Rightarrow 14$$

Subtraction with of 2's complement numbers

	64	32	16	8	4	2	1	
	1	0	0	0	1	1	1	
	1	0	0	0	1	1	1	
(1)	0	0	0	1	1	1	0	

+39

+(-25')

14

6-bit

$2^{6-1} \Rightarrow 2^5$

32

ignore the

overflow value.

	64	32	16	8	4	2	1
+25'	0	0	1	1	0	0	1
	1	1	0	0	1	1	0
+							1
-25'	1	1	0	0	1	1	1

$$-64 + 32 + 4 + 2 + 1$$

$$-64 + 32 + 7 \Rightarrow -25'$$

simple method

128	64	32	16	8	4	2	1	
0	0							
0	0	1	0	⁰ 1	² 0	1	1	(+43)
0	1	0	0	0	1	1	1	-(+71)
(-) → 1	1	0	0	1	0	0	0	-28

$$-64 + 32 + 4 = \boxed{-28}$$

$$\boxed{1100100}$$

2's complement method

First convert +71 into -71 + 43

$$128 \quad 64 \quad 32 \quad 16 \quad 8 \quad 4 \quad 2 \quad 1 \quad -28$$

$$0 \quad 1 \quad 0 \quad 0 \quad 0 \quad 1 \quad 1 \quad 1$$

$$1 \quad 0 \quad 1 \quad 1 \quad 1 \quad 0 \quad 0 \quad 0$$

$$+ \quad 1 \quad 0 \quad 1 \quad 1 \quad 1 \quad 0 \quad 0 \quad 1$$

$$1 \quad 0 \quad 1 \quad 1 \quad 1 \quad 0 \quad 0 \quad 1$$

$$-128 + 32 + 16 + 8 + 1 = -71$$

$$0 \quad 0 \quad 1 \quad 0 \quad 1 \quad 0 \quad 1 \quad 1$$

$$+ \quad 1 \quad 0 \quad 1 \quad 1 \quad 1 \quad 0 \quad 0 \quad 1$$

$$1 \quad 1 \quad 1 \quad 0 \quad 0 \quad 1 \quad 0 \quad 0$$

lets check it

$$-128 + 64 + 32 + 4 = -28$$

we have different answers in simple and in 2's complement

Simple method

1 1 0 0 1 0 0

extra 2's complement

1 1 1 0 0 1 0 0 0

but have same

this extra one represent
(-) sign