In Two’s Complement -x = 2^n th number - x

0 0 0000

1 1 0001

2 2 0010

3 3 0011

4 4 0100

5 5 0101

6 6 0110

7 7 0111

8 -8 1000

9 -7 1001

10 -6 1010

11 -5 1011

12 -4 1100

13 -3 1101

14 -2 1110

15 -1 1111

Two’s Complement

x (-5) = 1011

First subtract x from all 1s

1111

-1011

0100

Then add 1 to x

0100

+ 1

0101 (5)

x: 1100 (-4)

y: 1011 (-5)

y- x (Normal 2s Complement Arithmetic)

-x = 0011 + 1 = 0100

y: 1011 (-5)

-x: 0100 (4)

1111 (-1)

y-x (ALU Logic)

x: 1100 (-4)

y: 1011 (-5)

1. Negate y

~y = 0100 (4)

1. Add x + y

x: 1100 (-4)

~y: 0100 (4)

0000 (0) (ignore the overflow bit)

1. Negate the output

~0000 = 1111 (-1)

~x (ALU Logic)

x: 1100 (-4)

y: 1011 (-5)

1. Make y zero

y: 0000 (0)

1. Not y

y: 1111

1. And x and y

x: 1100 (-4)

y: 1111 (-1)

1100 (-4)

1. Not the output

~1100 = 0011