Relation between signed & unsigned Integer.

Let's say we have 3 bits to represent the counting.

C	B	A

C B A		
0 0 0	{ }	0
0 0 1	A	1
0 1 0	B	2
1 0 0	C	4
0 1 1	A B	3
1 1 0	B C	6
1 0 1	A C	5
1 1 1	A B C	7

$\Rightarrow 2^3 = 8$

So, total allowed representation is

$\underline{2^n}$ where n is given bits.

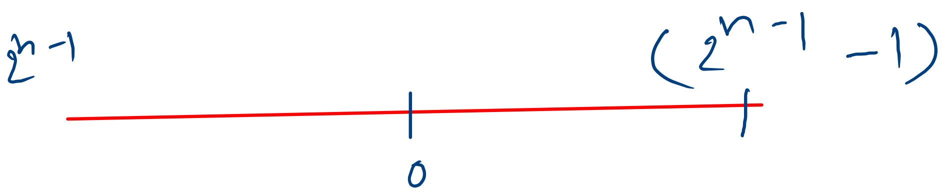
Total unsigned numbers = $\underline{2^n}$

Total signed numbers = $2 \times 2^{n-1} = (2^{n-1} + 2^{n-1})$

-ve numbers

-ve numbers

Range of +ve & -ve numbers



Example: given bits = 3.

total unsigned numbers = $2^3 = 8$

range = 0 to 7.

Signed numbers $\Rightarrow 2 \times 2^2 = (2^2 + 2^2)$

+ve

-ve

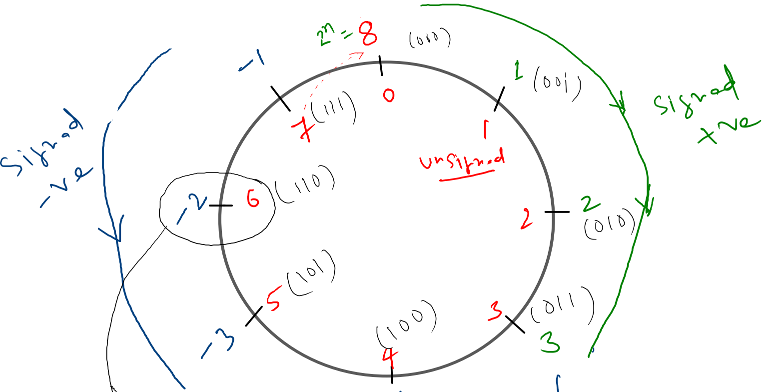
+ve number range = 0 to $2^2 - 1$

$\Rightarrow$ 0 to 3

-ve number range = -2^2 to -1

= -4 to -1

Signed & Unsigned relations



Signed max + 1 = Unsigned Min

Signed & Unsigned relations

$\rightarrow$ $\boxed{2^n + \text{Signed} = \text{Unsigned}}$

$2^3 + (-1) = 7$

same bit representations

| 1 | 1 | 1 |

Unsigned

$1\times2^2 + 1\times2^1 + 1\times2^0 = 7$

| 1 | 1 | 1 |

reserved for sign

1 => -ve

0 = +ve

since it is signed representations so, first we have to get 2's complement.

$111 \xrightarrow{1's} 000 \xrightarrow{\text{add } 1} 001$

2's complement

| 0 | 0 | 1 |

$0\times2^2 + 0\times2^1 + 1\times2^0 = 1$

absolute value

Since signbit is 1, so it is minus 1.