

Tue, Jan 23

Binary number formats (n-bit)

• Unsigned

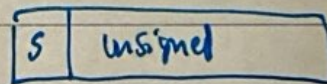
range $[0, 2^n - 1]$

$$\text{value} = \sum_{i=0}^{n-1} a_i b^i$$

$$b = 2$$

$$\begin{array}{cccc} 0 & 0 & 0 & 0 \\ \hline 1 & 1 & 1 & 1 \\ \hline 2^3 & 2^2 & 2^1 & 2^0 \\ 8 & + & 2 & 1 \end{array}$$

• Sign Magnitude



0 = pos.

1 = neg.

• 2's Complement

positional weight of MSB is negative

$$\text{range} [-2^{n-1}, +2^{n-1} - 1]$$

$$a = 2-3$$

$$\begin{array}{cccccc} 1 & 0 & 0 & 0 & = -8 \\ \hline 0 & 1 & 1 & 1 & = +7 \\ \hline -8 & + & 4 & 2 & 1 \end{array}$$

• BCD

$$\underline{0} \underline{0} \underline{1} \underline{1} \quad \underline{0} \underline{0} \underline{1} \underline{0} = 32_{10}$$

Ex: 0000 0101 = 5_{10} unsigned
 = $+5_{10}$ sign mag
 = $+5_{10}$ 2's compl
 = 05_{10} BCD

Ex: 1000 0011 = 131_{10} unsigned
 = -3_{10} sign mag.
 = -125_{10} 2's compl.
 = 83_{10} BCD