

→ 8 bit → 16 bit → 32 → 64

→ Char → 1 byte → 8 bit
 int → 4 byte → 32 bit
 float double

11 bit higher bit lower 8 bit Double

Signed +ve

01011 ← 5 bit

01010

000011010

000011011 ← 8 bit

-ve → 1's
 → 2's

1's (-) 1011 ← 4 bit
 (+) 0001011 ← 8 bit

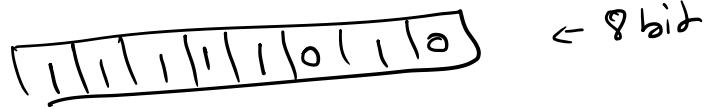
1's (-) 1011 ← 4 bit
 1's (-) 1011 ← 4 bit
 00000100 ← 8 bit

1's (-) 1001 ← 4 bit
 1's (-) 1001 ← 4 bit
 111111001 ← 8 bit

2's Complement

-2³ 2² 2¹ 2⁰ ← 4 bit
 1 0 1 0

$$\text{msb} \rightarrow -8 + 2 = (-6)$$



$$\begin{array}{r} -2^7 \quad 2^6 \quad 2^5 \quad 2^4 \quad 2^3 \quad 2^2 \quad 2^1 \quad 2^0 \\ 1 \quad 1 \quad 1 \quad 0 \quad 1 \quad 0 \\ -32 + 16 + 8 + 0 + 2 + 0 \\ -16 + 8 + 2 = -6 \end{array}$$

$$\begin{array}{r} 1 \quad 0 \quad 1 \quad 0 \quad \leftarrow 4 \text{ bit} \\ 1 \quad 1 \quad 1 \quad 0 \quad 1 \quad 0 \quad \leftarrow \end{array}$$

$$\begin{array}{r} -2^3 \quad 2^2 \quad 2^1 \quad 2^0 \\ 4 \text{ bit} \quad - \quad - \quad - \quad - \end{array}$$

$$\begin{array}{r} \text{2's} \rightarrow \begin{array}{r} -2^{12} \\ 1 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1 \quad 1 \end{array} \left| \begin{array}{r} 2^7 \quad 2^6 \quad 2^5 \quad 2^4 \quad 2^3 \quad 2^2 \quad 2^1 \quad 2^0 \\ 1 \quad 0 \quad 1 \quad 0 \quad 1 \\ -2^4 \quad 2^3 \quad 2^2 \quad 2^1 \quad 2^0 \\ 1 \quad 0 \quad 1 \quad 0 \quad 1 \\ -16 + 4 + 1 = -11 \end{array} \end{array}$$

$$\begin{array}{r} 1 \quad 0 \quad 1 \quad 0 \quad 1 \\ \uparrow \\ \text{msb} \end{array}$$

$$\begin{array}{r} \text{2's} \quad -2^3 \quad 2^2 \quad 2^1 \quad 2^0 \\ 1 \quad 1 \quad 0 \quad 1 \quad (-3) \\ -8 + 4 + 1 \\ (-3) \end{array}$$

$$\begin{array}{r} 1 \quad 1 \quad 1 \quad 0 \quad 1 \\ \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ -16 + 8 + 4 + 0 + 1 \\ -8 + 4 + 1 \end{array}$$

(n+1) bit 2's bit shift
Slow n bit msb

$$\begin{array}{l} \rightarrow (n+1) \text{ bit represent 2's} \\ \rightarrow -2^n + 2^{n-1} + 2^{n-2} + \dots + 2^0 \\ (n+1) \text{ bit} \rightarrow \begin{array}{c} -2^n + 2^{n-1} + 2^{n-2} + \dots + 2^0 \\ \uparrow \\ -2^{n-1} + 2^{n-2} + \dots + 2^0 \\ \uparrow \\ -2^n + 2^{n-1} \\ \uparrow \\ -2^n + \frac{2^n}{2} \\ \uparrow \\ -2^n + \frac{2^n}{2} \\ \uparrow \\ -2^n + \frac{2^n}{2} \\ \uparrow \\ -2^n + \frac{2^n}{2} \end{array} \\ \rightarrow 2^n \left(-1 + \frac{1}{2} \right) \\ \rightarrow -2^{n-1} \end{array}$$

$$\text{2's} \rightarrow \text{FFAB} \text{ Decimal} = -85 \text{ An}$$

$$\begin{array}{r} \text{2's} \rightarrow \begin{array}{r} 1111 \quad 1111 \quad 1010 \quad 1011 \\ -2^7 \quad 2^6 \quad 2^5 \quad 2^4 \quad 2^3 \quad 2^2 \quad 2^1 \quad 2^0 \\ 1010 \quad 1011 \end{array} \end{array}$$

$$-128 + 32 + 8 + 2 + 1$$

$$3 \quad -96 + 8P2 + 1$$

$$21 - 85 \quad \underline{\underline{Dwy}}$$