

$$\begin{array}{r} 11011 \\ + 1011 \\ \hline \textcircled{1} 00110 \quad (\text{with carry}) \end{array}$$

1.2 Binary Subtraction

$$\begin{array}{r} 1000 \\ - 0001 \\ \hline 0111 \end{array}$$

$$\begin{array}{r} 1011 \\ - 0001 \\ \hline 1010 \end{array}$$

$$\begin{array}{r} 11011 \\ - 00100 \\ \hline 10111 \end{array}$$

<u>Decimal subtraction</u> $\begin{array}{r} 990 \\ - 002 \\ \hline 988 \end{array}$

Example

$$\begin{array}{r} 10.010_2 \\ - 00.101_2 \\ \hline 01.101 \end{array}$$

$$\begin{array}{r} 01101 \\ - 10010 \\ \hline \textcircled{1} 11011 \end{array}$$

see next section.

1.4 Signed numbers

Need to represent both sign and magnitude

$$(-1)^{as} \times (a_n 2^n + \dots + a_m 2^{-m})$$

1.5 Simple signed numbers

$$x = \left(\sum_{i=-m}^{n-1} a_i 2^i \right) + -a_n 2^n$$

-2^4	2^3	2^2	2^1	2^0	2^{-1}	
1	0	1	1	0	1	$= -16 + 4 + 2 + 0.5 = -9.5$
0	1	0	1	1	0	$= 8 + 2 + 1 = +11$
1	0	0	0	1	0	$= -16 + 1 = -15$
1	1	1	1	1	1	$= -16 + 8 + 4 + 2 + 1 + 0.5 = -0.5$

MSB LSB

Example

$$\begin{aligned} -8.5_{10} \text{ in } Q4.2 \text{ signed} &= -16 + 4 + 2 + 1 + 0.5 \\ &= 10111.10 \text{ } Q4.2_s \end{aligned}$$

Two's complement

Invert + LSB

$$8.5_{10} = 01000.10 \text{ (} Q4.2_s \text{)}$$

$$-8.5_{10} = 10111.01$$

$$+ 00000.01$$

$$\hline 10111.10$$

Not +1

But rather +LSB