$$
\begin{array}{r}
+'b01 \\
-0111 \\
\hline
0110
\end{array}
$$

$$
\begin{array}{r}
'b01\ 'b01 \\
-01\ 0111 \\
\hline
010010
\end{array}
$$

$$
\begin{array}{r}
0111 \\
-\ 1000 \\
\hline
[1]\ \ 1111
\end{array}
\Longrightarrow Q3 \text{ unsigned}
$$

↑ Carry.

1.4 Signed numbers

$(-1)^s \times \sum_{i=-m}^{n} a_i 2^{-i} = y$ (sign + magnitude) (A)

$-(a_n 2^n) + \sum_{i=-m}^{n-1} a_i 2^i = z$ (Two's comp) (C)

-1 in Q4 signed: 11111 Σ

$+1$ in Q4 signed: 00001

$[1]\ 00000$

$+7$ in Q3 signed: 0111 Σ

$+1$ in Q3 signed: 0001

$1000 \neq +8$

$\hookrightarrow -8$

overflow

Binary	A	B	C	D
0000	+0	0	0	+0
0001	1	1	1	1
0010	2	2	2	2
0011	3	3	3	3
0100	4	4	4	4
0101	5	5	5	5
0110	6	6	6	6
0111	7	7	7	7
1000	-0	8	-8	-7
1001	-1	9	-7	-6
1010	-2	10	-6	-5
1011	-3	11	-5	-4
1100	-4	12	-4	-3
1101	-5	13	-3	-2
1110	-6	14	-2	-1
1111	-7	15	-1	-0

$$w = \begin{cases} \sum_{i=-m}^{n-1} a_i 2^i & : a_n = 0 \\ -\sum_{i=-m}^{n-1} \overline{a_i}\, 2^i & : a_n = 1 \end{cases}$$

one's comp (D)

13752

Binary Multiplication:

$$\begin{array}{rl} 011 & Q2 \\ \times\ 010 & Q2 \\ \hline 010 & \\ \sum\ 0100 & \\ \hline 00000 & \\ \hline 00110 & Q4 = Q(2+2) \end{array}$$

1011.01×011.00

$$
\begin{array}{rr}
 & 1011.01 \quad Q3.2 \\
\times & 011.00 \quad Q2.2 \\
\hline
 & 01100 \\
\sum & 00000\,0 \\
 & 01100\,00 \\
 & 01100\,000 \\
 & 00000\,0000 \\
 & 01100\,00000 \\
\hline
 & 100001.1100 \quad Q5.4
\end{array}
$$

$Q n_1 \cdot m_1 \times Q n_2 \cdot m_2 = Q (n_1+n_2) \cdot (m_1+m_2)$

10110 (Q1.3 signed) $\times$ 01101 (Q1.3 signed)

$= -1 \times (\underbrace{01010 \times 01101}_{\text{unsigned } (\checkmark)})$

$$
\begin{array}{rr}
 & 01010 \\
\times & 01101 \\
\hline
 & 00000 \\
 & 01101\,0 \\
\sum & 00000\,00 \\
 & 01101\,000 \\
 & 00000\,0000 \\
\hline
 & 0100000010 \\
\text{negate} & 1011111101 \\
+ & \qquad\qquad\quad 1 \\
\hline
 & 1011111110
\end{array}
$$

$$
\begin{array}{rr}
 & 011 \\
 & 001 \\
+ & 001 \\
\hline
 & 101
\end{array}
$$