

Decimal  $\leftrightarrow$  Binary  $\leftrightarrow$  HEX

0001101.0010  
1 D . 2

0000 0  
↓ ↓  
1111 15

0001 1111

Binary  $\rightarrow$  14-based

11011  $\rightarrow$  decimal  $\rightarrow$  14-based

Binary  $\rightarrow$  Octal

00 10 1111

①

$$\begin{array}{r}
 47 \\
 \hline
 5 \overline{) 235} \\
 \underline{200} \\
 35 \\
 \underline{35} \\
 0
 \end{array}$$

# Binary Division

$$\begin{array}{r}
 101 \\
 \hline
 101 \overline{) 110111} \\
 \underline{101000} \\
 1111 \\
 \underline{1010} \\
 101 \\
 \underline{101} \\
 0
 \end{array}$$

(2)

# Data Representation

unsigned    signed

0101  $\rightarrow$  5    0101  $\rightarrow$  5  
 101  $\rightarrow$  5    1101  $\rightarrow$  -5

~~0000  $\rightarrow$  +0  
 1000  $\rightarrow$  -0~~

Complement

1's complement    2's complement

0101  
 1111  
 -----  
 1010

0000 0  
 1111  $\rightarrow$  -0

10's complement of

5	is	5
6	is	4
1	is	9

# Concept of 2's Complement (Definition)

$$\begin{array}{r}
 8 \quad 2 \quad 1 \\
 \uparrow \quad \uparrow \quad \uparrow \\
 01011 = +11
 \end{array}$$

$$\begin{array}{r}
 10100 \\
 + \quad 0101 \\
 \hline
 10101 \quad -11
 \end{array}$$

$$\begin{array}{r}
 0101 \quad +5 \\
 \hline
 1111 \\
 -0101 \\
 \hline
 1010 \\
 + \quad 1010 \\
 + \quad 1 \\
 \hline
 1011 \quad +1
 \end{array}$$

1's complement

2's complement  
-5

$$10111$$

$$\begin{array}{r}
 1011 \rightarrow -5 \\
 - \quad 1 \\
 \hline
 1010 \quad 0101 = 5
 \end{array}$$

$$-16 \frac{10111}{+7} = -9$$

$$\begin{array}{r} 10110 \\ 01001 \\ \hline \end{array}$$

~~$$+++++$$~~

$$-2 \times 11 = -1$$

$$\frac{111111110}{-} = -2$$

$$-4 \times \begin{array}{r} 111 \\ 2 \end{array} = -1$$

$$-8 \times \frac{1111}{+7} = -1$$

$$+ \frac{111111111111}{-} = -1$$

$$\begin{array}{l} -2 \times 10 = -2 \\ + \times \begin{array}{r} 110 \\ 2 \end{array} = -2 \end{array}$$

(5)