

## Binary arithmetic practice

1.

$$\begin{array}{r} 63 \quad 00111111 \\ + 8 \quad +00001000 \\ \hline 71 \end{array}$$

2.

$$\begin{array}{r} 65 \quad 01000001 \\ - 8 \quad +00001000 \\ \hline 57 \end{array}$$

3.

$$\begin{array}{r} \phantom{0} 0 1 0 \quad \text{s4} \quad \text{u4} \\ \phantom{0} 0 1 0 \quad +2 \quad 2 \\ + 1 1 0 0 \quad -4 \quad 12 \\ \hline \end{array}$$

4.

$$\begin{array}{r} \phantom{0} 1 0 0 0 \quad \text{s4} \quad \text{u4} \\ \phantom{0} 1 0 0 0 \quad -8 \quad 8 \\ + 0 1 0 0 \quad +4 \quad 4 \\ \hline \end{array}$$

5.

$$\begin{array}{r} \phantom{0} 1 1 0 \quad \text{s4} \quad \text{u4} \\ \phantom{0} 1 1 0 \quad +6 \quad 6 \\ - 0 0 1 0 \quad +2 \quad 2 \\ \hline \end{array}$$

6.

$$\begin{array}{r} \phantom{0} 1 1 1 1 \quad \text{s4} \quad \text{u4} \\ \phantom{0} 1 1 1 1 \quad -1 \quad 15 \\ + 1 1 1 0 \quad -2 \quad 14 \\ \hline \end{array}$$

7.

$$\begin{array}{r} \phantom{0} 1 0 1 \quad \text{s4} \\ \phantom{0} 1 0 1 \quad +5 \\ - 0 0 1 1 \quad +3 \\ \hline \end{array}$$

8.

$$\begin{array}{r} \phantom{0} 1 0 0 1 \quad \text{s4} \\ \phantom{0} 1 0 0 1 \quad -7 \\ - 1 1 1 0 \quad -2 \\ \hline \end{array}$$

9.

$$\begin{array}{r} \phantom{0} 1 0 1 \quad \text{s4} \\ \phantom{0} 1 0 1 \quad +5 \\ + 0 0 1 0 \quad +2 \\ \hline \end{array}$$

10.

$$\begin{array}{r} \phantom{0} 1 1 0 0 \quad \text{s4} \\ \phantom{0} 1 1 0 0 \quad -4 \\ - 0 1 0 0 \quad -4 \\ \hline \end{array}$$

## Unsigned Binary <-> Decimal Conversion

□	□	□	□	□
$\times 16$	$\times 8$	$\times 4$	$\times 2$	$\times 1$
$(2^4)$	$(2^3)$	$(2^2)$	$(2^1)$	$(2^0)$

$$=$$

□	□	□	□	□
$\times 16$	$\times 8$	$\times 4$	$\times 2$	$\times 1$
$(2^4)$	$(2^3)$	$(2^2)$	$(2^1)$	$(2^0)$

$$=$$

## Two's Complement Binary <-> Decimal Conversion

□	□	□	□	□
<del><math>\times 16</math></del>	$\times 8$	$\times 4$	$\times 2$	$\times 1$
<del><math>(2^4)</math></del>	$(2^3)$	$(2^2)$	$(2^1)$	$(2^0)$

$$=$$

$\times -16$   
 $-(2^4)$

□	□	□	□	□
<del><math>\times 16</math></del>	$\times 8$	$\times 4$	$\times 2$	$\times 1$
<del><math>(2^4)</math></del>	$(2^3)$	$(2^2)$	$(2^1)$	$(2^0)$

$$=$$

$\times -16$   
 $-(2^4)$

## Synchronous circuit analysis

