

## SC1005 Digital Logic Tutorial 3

### Digital arithmetic

1. Perform the following unsigned binary addition and subtraction.

a. 
$$\begin{array}{r} 1100110 \\ + 1111001 \\ \hline \end{array}$$

b. 
$$\begin{array}{r} 11100011 \\ - 1011101 \\ \hline \end{array}$$

2. Perform the following two's complement additions. Clearly indicate whether or not an overflow occurs.

a. 
$$\begin{array}{r} 11010100 \\ + 11101011 \\ \hline \end{array}$$

c. 
$$\begin{array}{r} 01011101 \\ + 00110001 \\ \hline \end{array}$$

b. 
$$\begin{array}{r} 10111111 \\ + 11011111 \\ \hline \end{array}$$

d. 
$$\begin{array}{r} 01100001 \\ + 00011111 \\ \hline \end{array}$$

3. Perform the following two's complement subtractions. Clearly indicate whether or not an overflow occurs. Check by converting to decimal values.

a. 
$$\begin{array}{r} 00110110 \\ - 01000101 \\ \hline \end{array}$$

c. 
$$\begin{array}{r} 11010111 \\ - 11101100 \\ \hline \end{array}$$

b. 
$$\begin{array}{r} 01110101 \\ - 11010110 \\ \hline \end{array}$$

d. 
$$\begin{array}{r} 10000011 \\ - 10001111 \\ \hline \end{array}$$

4. Perform the following unsigned binary multiplications. Verify with decimal values.

a. 
$$\begin{array}{r} 110101 \\ \times 1110 \\ \hline \end{array}$$

b. 
$$\begin{array}{r} 010110 \\ \times 1101 \\ \hline \end{array}$$

5. Perform the following signed 2's complement binary multiplications. Verify with decimal values.

a. 
$$\begin{array}{r} 110101 \\ \times 1110 \\ \hline \end{array}$$

b. 
$$\begin{array}{r} 010110 \\ \times 1101 \\ \hline \end{array}$$

## **Answers**

1.

- a. 1101 1111
- b. 1000 0110

2.

- a. 1011 1111 (no overflow)
- b. 1001 1110 (no overflow)
- c. 1000 1110 (overflow)
- d. 1000 0000 (overflow)

3.

- a. 1111 0001 (no overflow)
- b. 1001 1111 (overflow)
- c. 1110 1011 (no overflow)
- d. 1111 0100 (no overflow)

4.

- a. 10 1110 0110
- b. 01 0001 1110

5.

- a. 00 0001 0110
- b. 11 1011 1110