

EE/CS120A-Logic Design

Homework 1-Solution

Problem 1: Convert unsigned decimal number $(49)_{10}$ to binary, octal, and hexadecimal numbers.

Solution: $(49)_{10} = (110001)_2 = (61)_8 = (31)_{16}$

Problem 2: Convert unsigned hexadecimal number $(A7)_{16}$ to octal, binary, and decimal numbers.

Solution: $(A7)_{16} = (1010\ 0111)_2 = (247)_8 = (167)_{10}$

Problem 3: Perform the following operations involving eight-bit 2's complement numbers and indicate whether arithmetic overflow occurs.

$$\begin{array}{r} 00110110 \\ + 01000101 \\ \hline \end{array} \qquad \begin{array}{r} 01110101 \\ + 11011110 \\ \hline \end{array}$$
$$\begin{array}{r} 00110110 \\ - 00101011 \\ \hline \end{array} \qquad \begin{array}{r} 01110101 \\ - 11010110 \\ \hline \end{array}$$

Solution:

$$\begin{array}{r} 00110110 \\ + 01000101 \\ \hline 01111011 \end{array} \qquad \begin{array}{r} 01110101 \\ + 11011110 \\ \hline 01010011 \end{array}$$

As $C_7=C_8=0$,
Overflow does **NOT** occur.

As $C_7=C_8=1$,
Overflow does **NOT** occur.

$$\begin{array}{r} 00110110 \\ - 00101011 \\ \hline \end{array} \quad \rightarrow \quad \begin{array}{r} 00110110 \\ + 11010101 \\ \hline 00001011 \end{array} \qquad \begin{array}{r} 01110101 \\ - 11010110 \\ \hline \end{array} \quad \rightarrow \quad \begin{array}{r} 01110101 \\ + 00101010 \\ \hline 10011111 \end{array}$$

As $C_7=C_8=1$,
Overflow does **NOT** occur.

As $C_7=1, C_8=0$,
Overflow does **Occurs**.

Problem 4: Determine the decimal values of the following numbers

- 1's complement numbers 01110110 and 10100111
- 2's complement numbers 01011110 and 10110011

Solution:

- The decimal values are 118 and -88.
- The decimal values are 94 and -77.

Problem 5: Construct a truth table with 3 inputs (x, y, z) and 3 outputs (f, g, h) or three truth tables each of which has 3 inputs and 1 output (f, g , or h). Show which of the three functions are equal. (Be sure to state whether they are equal.)

$$f = y'z' + x'y + x'yz'$$

$$g = xy' + x'z' + x'y$$

$$h = (x' + y')(x + y + z')$$

Solution:

$x y z$	$y'z'$	$x'y$	$x'yz'$	f	xy'	$x'z'$	$x'y$	g	$x' + y'$	$x + y + z'$	h
0 0 0	1	0	0	1	0	1	0	1	1	1	1
0 0 1	0	0	0	0	0	0	0	0	1	0	0
0 1 0	0	1	1	1	0	1	1	1	1	1	1
0 1 1	0	1	0	1	0	0	1	1	1	1	1
1 0 0	1	0	0	1	1	0	0	1	1	1	1
1 0 1	0	0	0	0	1	0	0	1	1	1	1
1 1 0	0	0	0	0	0	0	0	0	0	1	0
1 1 1	0	0	0	0	0	0	0	0	0	1	0

The function f is not equal to either of the other 2 functions. The functions g and h are equal.