Solutions - Quiz 2

(February 8th @ 5:30 pm)

PROBLEM 1 (35 PTS)

- Complete the following table:

REPRESENTATION			
Decimal	**Sign-and-magnitude**	**1's complement**	**2's complement**
-6	1110	1001	1010
0	00	1111	0
-4	1100	1011	100
14	01110	01110	01110

- Convert the following decimal number to its 2's complement representation: -14.25 (5 pts)

  $14.25 = 01110.01 \rightarrow -14.25 = 10001.11_2$

PROBLEM 2 (30 PTS)

- Perform the following operations in the 2's complement system, i.e., provide the summands and the result in 2's complement representation (indicate the carries). Use the minimum number of bits to represent both the summands and the result so that the overflow bit is 0.

  ✓ -19 - 14

n = 6 bits

$c_6 \oplus c_5 = 1$ Overflow!

	c_6=1	c_5=0	c_4=0	c_3=0	c_2=0	c_1=0	c_0=0	
-19 =	1	0	1	1	0	1		+
-14 =	1	1	0	0	1	0		
-33 =	0	1	1	1	1	1		

$-19\ -14 = -33 \notin [-2^5, 2^5-1] \rightarrow$ overflow!

To avoid overflow:
n = 7 bits (sign-extension)

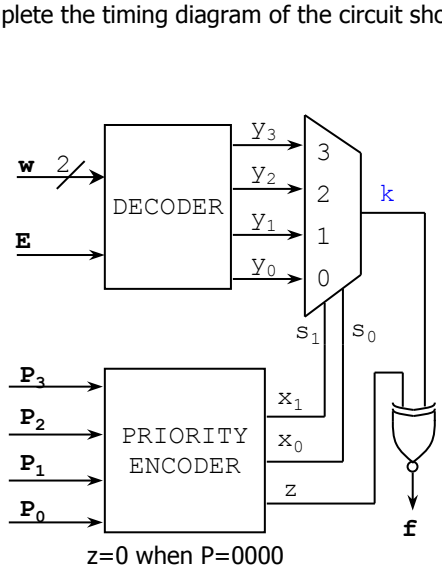
$c_7 \oplus c_6 = 0$ No Overflow

	c_7=1	c_6=1	c_5=0	c_4=0	c_3=0	c_2=1	c_1=0	c_0=0	
-30 =	1	1	0	1	1	0	1		+
-14 =	1	1	1	0	0	1	0		
-33 =	1	0	1	1	1	1	1		

$-19\ -14 = -33 \in [-2^6, 2^6-1] \rightarrow$ no overflow

PROBLEM 3 (35 PTS)

- Complete the timing diagram of the circuit shown below: $y = y_3y_2y_1y_0$, $x = x_1x_0$



z=0 when P=0000