CISC 260 Machine Organization and Assembly Language (Spring 2019)

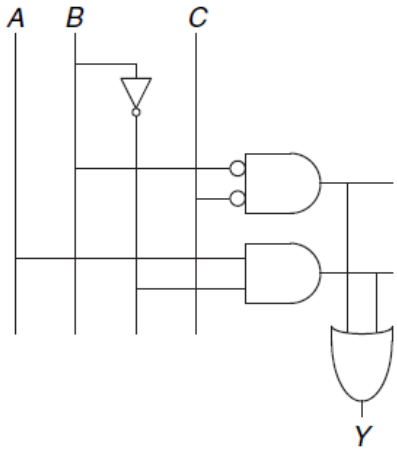
Assignment # 2

(Due: March 7, 2019)

1. [25 points] Given the following truth table, where X, Y, and Z are input and W is output, write the canonical expression and generate gate-level logical circuit (draw the wire diagram).

X	Y	Z	W
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

2. [25 points] Write the Boolean expression and fill out the truth table for following logical circuit.



3. [25 points] You are asked to design a circuit to detect if an overflow occurs when ***subtracting*** two integers represented in two's complement: Z = X - Y. Let Sz, Sx, and Sy be the sign bit for Z, X, and Y respectively, and they are fed as input to the circuit. Let O be the output bit of the circuit, whose value is 1 if an overflow happens, and 0 if otherwise.

a) Build the truth table for O as a Boolean function of Sx, Sy, and Sz.
b) Write the canonical expression (sum-of-product) for the Boolean function defined in the part a.
c) Implement the Boolean expression defined in part b with a circuit by using AND, OR, and NOT gates. Draw the wiring diagram.

4. [25 points] A binary logic operation is called LT, where A LT B = 1 if and only if A < B. The truth table is given as follows. Prove that the set of gate types {LT, NOT} is logical complete.

A	B	A LT B
0	0	0
0	1	1
1	0	0
1	1	0