

**Homework 1****Out:** 9.20.21**Due:** 9.28.21

## 1. [Combinational Logic]

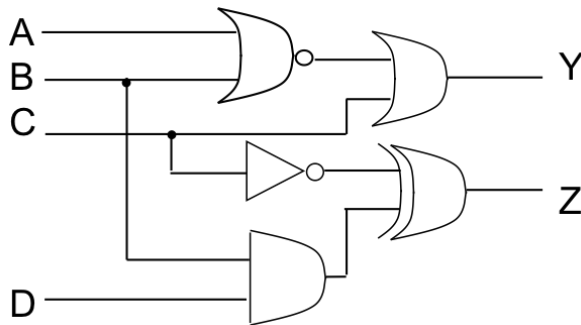
Given the following truth table:

A	B	C	Out
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

- Write the sum-of-products formula for the truth table.
- Simplify your formula as much as you can. Show your work.
- Draw the gate-level logic circuit which corresponds to your simplified formula.

## 2. [Combinational Logic]

Write the (un-simplified) formulas expression for Y and Z below:



## 3. [Number Representation]

Convert the following numbers to 8 bit signed 2's complement binary, and to hexadecimal. Provide both answers and show your work – do not use a calculator.

- $(25)_{10}$
- $(-62)_{10}$
- $(127)_{10}$

## 4. [Number Representation]

Convert the following numbers to decimal. Show your work – do not use a calculator.

- $(6AFA)_{16}$

- b) (0010 0001)<sub>2</sub>'s complement
- c) (1011 1001)<sub>2</sub>'s complement

5. [Floating Point Representation]

- a) Convert the decimal number 63.25 to binary representation using the IEEE 754 single precision format. Represent your answer in binary and hex, and show your work.
- b) Convert the IEEE 754 single precision format number 0xC1300000 to decimal. Show your work.

6. [Binary Arithmetic]

Perform the following operations involving 8-bit 2's complement numbers and indicate whether arithmetic overflow occurs. Check your answers by converting to decimal sign and magnitude representation. Notice that part (d) involves multiplication.

- |             |             |             |             |
|-------------|-------------|-------------|-------------|
| a) 00110110 | b) 01110101 | c) 10011101 | d) 00101101 |
| + 01000101  | + 11011110  | + 10000001  | x 00000101  |
| -----       | -----       | -----       | -----       |

7. [K-maps]

Simplify the following expressions using K-maps:

- a)  $F(x,y,z) = x'y'z' + x'y'z + x'yz + xy'z' + xy'z$
- b)  $F(x,y,z) = x'y'z + x'yz + xy'z + xyz$
- c)  $F(A,B,C,D) = A'B'C'D' + AC'D' + B'CD' + A'BCD + BC'D$
- d)  $F(w,x,y,z) = x'z + w'xy' + w(x'y + xy')$