# Quiz 1 – Spring 2014 – EECS 270

Name: Key uname: Key

This quiz is graded out of 100 points. Please remember you can drop your lowest quiz score. You will have 20 minutes for the quiz. It is closed book and closed notes. Show your work and ***circle your answer!*** The last problem is quite hard and worth fewer points than the effort required.

1. Write the canonical sum-of-products for the following truth table. **[25 points]**

| B | C | D | X |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

X= $\bar{B}\bar{C}\bar{D} + \bar{B}CD + BC\bar{D}$

00110
11001
11010

2. Fill-in-the-blank **[20 points, -4 for each wrong or blank answer]**

   a. The 5-bit 2's complement number representation of -6 is 11010.

   b. The range of representation for a 6-bit unsigned number is from 0 to 63.

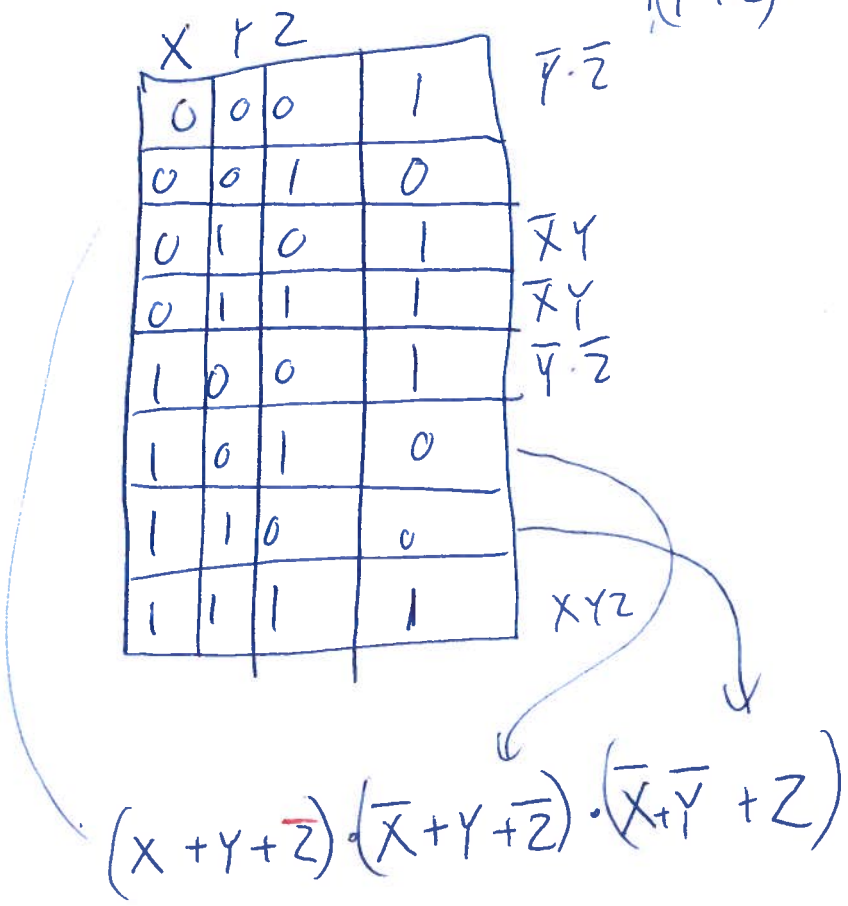
   c. (X+Y)+Z=X+(Y+Z) is a theorem called associativity in Boolean algebra.

   d. (X+Y)*(X+Z) = ~~X·(X+Z)~~ X + Y·Z according to the distributive theorem.

3. Convert the following to ***product-of-sums*** (not sum-of-products!) form using any method. Show your work (you don't need to state rules or anything, but we should be able to tell how you got your answer).

F=X*Y*Z+!X*Y+!(Y+Z) **[30 points]**

$\overline{(Y+Z)} = \overline{Y} \cdot \overline{Z}$




$(X + Y + \overline{Z}) \cdot (\overline{X} + Y + \overline{Z}) \cdot (\overline{X} + \overline{Y} + Z)$

4. Using only the devices listed below, design a circuit which takes two *3-bit signed-magnitude numbers* (X[2:0] and Y[2:0]) and has one output "EQ". EQ should be a "1" if the two numbers have the same value.

   Unfortunately, you are limited to using the parts you have found lying around in the lab. In your design you may only use the devices listed (as well as freely using "0" and "1" as inputs as desired).

   - One 3-bit *unsigned* comparator (has an "equal" and "greater than" output)
   - One 3-bit adder
   - Three 3-input OR gates
   - Two 3-input AND gates
   - One 3-bit 2-to-1 MUX
   - Three inverters

   You must clearly label any device you use (other than gates) and your design should be clear enough that someone else could understand how everything was to be connected. Your grade will be based in part upon the efficiency of your design. **[25 points]**