CMPEN 270 Summer 2021

Design Project #1 – 5% of Final Grade

Instructions

1. **All submitted work must be independent. All college and university guidelines regarding academic integrity will be strictly enforced.**

2. **VERIFY the contents of any submissions is included in the Canvas course drop box. No credit will be given for blank or corrupt submissions.**

Due Friday, 2/11/2022 @11:59pm

As a new digital designer, your job is to develop a calculator for a number system. In this particular task, given a 4-bit number $X_3X_2X_1X_0$ in a 2's complement system, design a circuit that takes the absolute value of this number and outputs $Y_3Y_2Y_1Y_0$. Therefore, if the input is positive the output is the same as the input. If the input is negative, the output is positive. As an example, you may use IN3, IN2, IN1, IN0 on the DEB to represent $X_3X_2X_1X_0$ and OUT3, OUT2, OUT1, and OUT0 on the DEB to represent $Y_3Y_2Y_1Y_0$.

1) Knowing about the 2's complement number system, how can you implement digit Y_3 immediately? Explain your reasoning.

2) Assume that the input combination $X_3X_2X_1X_0$ = 1000 never shows up and is irrelevant. Why is it useful or practical to make this assumption? What is the most efficient way to handle that condition?

3) Submit your answers to questions (1) and (2) and a written explanation of how you approached the design – about one page NEATLY handwritten or typed. Describe any methods used and include a schematic of the circuit design.

4) Build the circuit and take a video demo of your working prototype. A working demo shall be submitted via Gradescope along with your write-up. This is most easily done using a Digital Evaluation Board (DEB).

You may check your progress at any time, during office hours or lab. Experimentation is encouraged!

Although you may find and use IC's supplied by the lab, we do not guarantee that parts will always be available. You are responsible for obtaining your own hardware if needed, which is best with a DEB-1002. Please see more info in Lecture Set 1 or syllabus for acquiring necessary course materials.