CSCI 210 – Fall 2017
Homework Assignment 02
4-Bit Binary to HEX Decoder
see Moodle for due date and time

You will create a combinational logic device that adheres to the following specifications. It will have 4 inputs and 7 outputs. The inputs are named $A_3A_2A_1A_0$ and represent one, 4-bit unsigned binary number **A**. The seven outputs, $O_aO_bO_cO_dO_eO_fO_g$, drive each of the 7 LEDs within a single seven segment display (SSD). Keep in mind that each LED in the SSD (know as a HEX display on the Altera DE1 board) is active-low, **in that a 0 turns it on and a 1 turns it off.** The semantics are as follows. Make the SSD display HEX characters 0x0 through 0xF given the input of 0 through 15 on the 4-bit input. *DO NOT MAKE USE OF A 7447 chip, or any other device built-in to the QuartusII IDE library.*

Part 1: Making a binary to HEX converter circuit by hand. ***(not hard, but tedious)***

(We started this in class) Write a truth table that completely describes the behavior of the system. From there, form seven k-maps, and determine the AND-OR expressions for the minimum sum of products (MSOP) equations for each of the seven outputs. Write this neatly, on notebook paper, with your name, date, and assignment number at the top of each page**.**

Part 2: (Single SSD) – to test the SSD decoder/driver
Using Quartus II, implement the system using a block diagram file / schematic capture. Map $A_3A_2A_1A_0$ to SW[3..0] and the outputs, $O_aO_bO_cO_dO_eO_fO_g$ to the HEX0 SSD. At the end of this, you probably want to make a block symbol file so that you can more easily use it in part 3 below. **Ask Jun Kai about how to do this.**

Demonstrate that this works by iterating on the switches all 16 possible combinations of 4 bits, and verify that it works by having displayed the hex characters 0x0 through 0xF on HEX0.

Part 3: Integrate with HW01

Using the SSD decoder from Part 2, modify HW01 to include a display for both the input and output numbers. From HW01, number A[2..0] should be displayed in HEX on HEX0 and number B[3..0] should be displayed on HEX3. Since A is a 3-bit number, and B is a 4-bit number, what should you do with the most-significant input bit of the SSD driver that represents A? (hint, it should be 0, right ?)

Submission:

Also, prior to the due date and time (see above), **upload your project into Moodle**. This will be a zip file that contains the **entire project directory structure**. The solution to PART 3 should be what opens by default when I open the enclosed Quartus Project File (.qpf). The submission file will be named userid-210-HW03.zip, where userid is your userid. Have Mr. Jun Kai, from the ACOB2 tutor lab, help you with determining how to do this if you have questions. **Make sure you check two things afterwards:**

1. That the file was actually uploaded correctly to Moodle.
2. That when you download your submission from Moodle, that you can save it in a temporary location on your laptop, and actually unzip, load, and execute it on the Altera DE0-CV board. (if I can't do this with the zip file you submit for ANY reason, you will loose significant credit for the assignment.