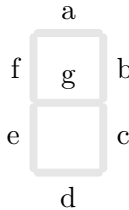


CSCI 210
HOMEWORK ASSIGNMENT 02

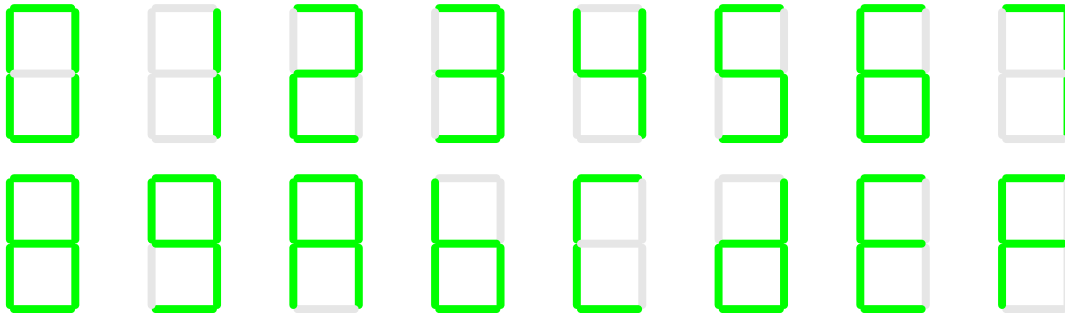
4-BIT BINARY TO HEX DECODER

DESCRIPTION

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 a single 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). The outputs correspond to the segments in the HEX display as in the following figure.



Keep in mind that each LED in the SSD (known as a HEX display on the Altera DE0 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 Quartus IDE library. Our HEX characters should be displayed on HEX0 as



PART 1: (MAKING A BINARY TO HEX CONVERTER CIRCUIT BY HAND)

Write a truth table that completely describes the behavior of the system. From there, form seven Karnaugh 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, and submit physically to me in the class prior to the date this assignment is due. Assignments will not be accepted late.

PART 2: (IMPLEMENT IN QUARTUS)

Using Quartus, 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. 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, the number $a[2..0]$ should be displayed in HEX on HEX5 and number $b[3..0]$ should be displayed on HEX0. Since a is a 3-bit number, what should you do with the most-significant input bit of the SSD driver that represents a ?

If you want to make future homeworks easier, look up how to make a new symbol in Quartus. Then make a symbol for your SSD. We will be using this SSD in many homeworks.

SUBMISSION: (NO LATE WORK ACCEPTED)

Prior to the due date and time posted in Moodle, upload your project into Moodle. This will be a zip file which contains the entire project directory structure. Your submission should be named userid-210-HW02.zip, where userid is your userid. Make sure to check two things after submitting your assignment:

- (1) Your file has successfully been uploaded into Moodle.
- (2) Download your file from Moodle, unpack the file, load and execute it on your board. If this doesn't work for me, you will lose significant credit on the assignment.