COMPENG 3DQ5: Digital Systems Design Take-Home Exercise 2

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Thursday - Group 55

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This take home exercise was completed in two parts. The first part was to modify the existing .MIF file to add the LCD codes for the upper case characters, as well as to add an uppercase mode to the display using the PS/2 shift keys. The second part of the exercise was to turn the green and red LED lights on or off depending on whether the displayed line had the same first and last eight characters.

For the first part of the exercise, we added a new logic variable called “upper_case” that keeps track of whether or not the character that was just typed should be displayed in uppercase or lowercase. In the S_IDLE state, if the incoming PS/2 code is 12 (left shift) then this variable is set to a 1. If the incoming PS/2 code is a 59 (right shift) then the variable is set to a 0. It is important to note that if the PS/2 code is a 12 or 59 then it does not go into data_reg[0], since we are simply setting the mode and not displaying this as a character. We also made a new 16 bit shift register, called “upper_reg” to hold the upper_case variable, and as new PS/2 codes get added to the register “data_reg”, the new shift register, “upper_reg” also gets updated with a 1 or a 0 depending on if the mode was uppercase or lowercase. Both shift registers will be shifted at (almost) the same time, so that they remain in sync. When the 16 letters are being displayed to the board, inside the S_LCD_ISSUE_INSTRUCTION state, we pack together the upper_reg[15] and the data_reg[15] and get the translation from our updated MIF file, which is then displayed on the board.

With regards to the second part of the exercise, we implemented two conditional statements that check if the messages in the respective lines were the same. If data_reg[15:8] == data_reg[7:0] (the first 8 characters are the same as the last 8) for the top line (LCD_line == 1’b0), then the red LED lights all lit up. Following the same logic, the second conditional statement (also data_reg[15:8] == data_reg[7:0]) checked if the first 8 characters and the last 8 characters were the same for the bottom line (LCD_line == 1’b1) and if they were, the green LED lights all lit up. Since the upper/lower casing was controlled with a separate shift register, when comparing the first and last 8 characters, only the PS/2 codes are compared. Since PS/2 does not distinguish between upper and lower case, messages will be the same regardless of the casing. Finally, we implemented a separate conditional statement that is tasked with turning the previously lit lights off when a new key has been typed by checking if the data_reg[0] == 0’b0, meaning a (valid) key has been typed and has been added to the shift register, so the lights can turn off.