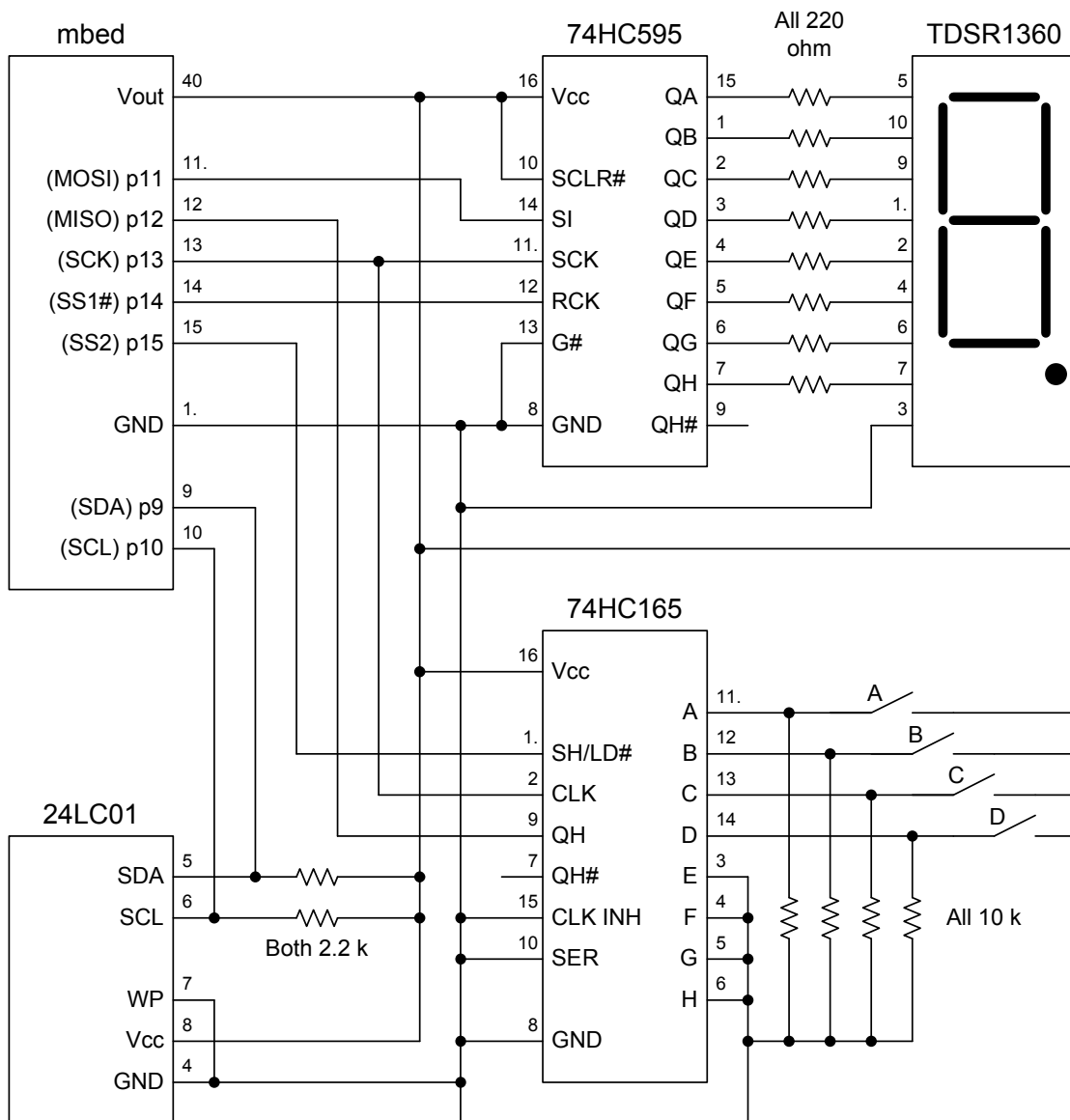Assignment #5 – Digital combination lock

In this assignment you will use the DigitalOut, SPI, and I2C interfaces on the mbed microcontroller board to implement a simple combination lock.

Construct the circuit shown below:



In this circuit the mbed operates as an SPI master and the two 8-bit shift register chips operate as SPI slave devices. The 74HC595 shift register uses SPI mode 0 and an active-low slave-select to display the 8-bit value sent to it on the 7-segment display. Bit 0 controls the decimal point, bit 1 controls LED segment G, bit 2 controls LED segment F, and so on up to bit 7 controlling LED segment A (note that this may be a different bit order than you used in assignment 4). The 74HC165 shift register uses SPI mode 2 and

an active-high slave-select to report the state of four active-high pushbutton switches. Bit 0 reports the state of switch A, bit 1 reports the state of switch B, bit 2 reports the state of switch C, and bit 3 reports the state of switch D.

The 24LC01 chip is a 128 byte memory chip that retains its contents even without power. Its 7-bit I2C device address is 1010000. To write data to the chip, follow the I2C sequence shown in Figure 6-1 or 6-2 in its data sheet. To read data from the chip, follow the I2C sequence shown in Figure 8-2 or 8-3 in its data sheet.

The lock should have two modes of operation: program mode and normal mode. The state of pin p20 on the mbed selects the mode.

If pin p20 on the mbed is connected to VOUT when the mbed starts, program mode is selected. In program mode, the user will enter a 4 letter combination by pressing the A, B, C, and/or D switches in some sequence, one at a time. As the user presses each switch, the LED display should briefly display the corresponding letter for confirmation. The combination should be stored to the 24LC01 chip.

If pin p20 on the mbed is not connected when the mbed starts, user mode is selected. The user will enter a 4 letter combination by pressing the A, B, C, and/or D switches in some sequence, one at a time. As the user presses each switch, the LED display should briefly display the corresponding letter for confirmation. After the 4 letters have been entered, the software should compare these 4 letters to the actual combination in the 24LC01 chip. If they do not match, the LED display should briefly show "L" to indicate the lock is still locked and then allow the user to try a new combination. If the combination was correctly enter, the LED display should show "U" to indicate that the lock is now unlocked.

Submit your "main.cpp" to the appropriate dropbox on Canvas by the end of April 19th.