**CSC 3101- Winter 2020**

**Lab Assignment 4**

1. Design a 4-bit register that can accept an input from the user and store the accepted input. The 4-bit register will operate in two modes: 1) the data input is stored into the register, and 2) The register retains its past value and does not store the new value. To operate in these two states, the register should accept 5 inputs: 4 data inputs and 1 control input. If the control input is 0, the input is stored. Otherwise, the input is not stored. (30 points)
2. Design two 4-bit registers and a controller that can let the user store a specific value in one of the two 4-bit registers. (30 points)
3. Use the 4-bit parallel adder and 4-bit parallel subtractor circuits from assignment 3 and two 4-bit registers from question 2 to make a mini 4-bit processor with the following functionalities. (40 points)
   1. The processor should allow the user to store a 4-bit value in any of the two registers.
   2. The processor should allow the user to add or subtract the values in the two registers.

Note: You will have two types of input: 1) a 4-bit binary input, and 2) a controller input. Table below shows the desired output for each controller input.

**Controller**

**Input Functionality**

1. Load the 4-bit input to Register 0
2. Load the 4-bit input to Register 1
3. Add the value in register 0 and register 1 and show the result
4. Subtract value of register 1 from register 0 and show the result.

You don’t have any restriction on the number of light bulbs. I would recommend that you have 18 light bulbs: 4 for register 0, 4 for register 1, 5 for the adder, and 5 for the subtractor.

**Bonus Questions:**

1. In the circuit for question 3, if you give the flexibility to perform R0 – R1 and R1 – R0, then you will get 10 additional points.
2. In the circuit for question 3, If you use an additional register R2, and give me the flexibility to perform R0 + R1, R0 + R2, R1 + R2, R0 – R2, R0 – R1, R1 – R0, R1 – R2, R2 – R0, R2 – R1, then you will get 50 additional points.