Computer Science 210 –Computer Organization

Homework Exercise 3
Due on github 11:59pm Wednesday 2 February

All homework should be turned in no later than the due date listed above. What you turn in will consist of document files (use PDF) and files of circuit diagrams (use Logisim). Place these files in a folder named **project3**. If you have difficulty setting up folders on github, shoot me an email and I'll show you how.

Download and install Logisim from one of the links provided on the webpage below this assignment. Launch *Logisim* and run the tutorial from the **Help** menu to become familiar with its features.

Now, complete the following exercises:

1. A *majority rules circuit* has an odd number of input lines and a single output line. The value on the output line is the same as the value on the majority of the input lines. Construct a truth table for a 3-bit majority rules circuit and use the sum-of-products algorithm to derive its Boolean expression. Put these results in a file named **Exercise1.pdf**. Then draw the circuit using *Logisim*. Label the lines appropriately and be sure to include your name, circuit title, and exercise number as well. Test the circuit with all of the inputs specified in the truth table. Save it in a file named **Exercise1.circ**.

2. Do Exercise 3.36 on page 106 of the textbook. As before, put your truth table and Boolean expression in a **PDF** file and your two circuit diagrams in **circ** files for the turn in.

3. Construct a 1-bit ALU that performs logical AND, logical OR, logical NOT, addition, and subtraction. The ALU includes two multiplexors, one to select among AND (code 00), OR (code 01), and addition (code 10), and the other to invert the B bit (code 1 inverts, code 0 does not invert). Subtraction inverts and adds 1 (from the carry in bit). Test your circuit using all the codes. Feel free to use the built-in adder and mux circuits in your ALU. Save your diagram in a **circ** file for the turn in.