Assignment 2
# Sequential Circuits, Multiplications, and Division

Due date: Feb 19, 2021

Submission Instructions

All work must be your own, and must be submitted by MyCourses. You are allowed to submit as many times as you want before the deadline. **Include your name and student number in your Logisim circuits**. Your circuits should be submitted as `.circ` files, and must respect the filenames, circuit name, and circuit layout (sub-circuit appearance, viewed with the right-most toolbar button in Logisim) to make it easier for TAs to test. Include a `readme.txt` file with any special instructions, or comments on limitations of your solutions. Submit the 4 requested files only, and do not create an archive (do not submit a zip file). Be sure to **check your submission** by downloading your submission from the server and verifying that it was correctly submitted. You will not receive marks for work that is incorrectly submitted.

1 Warm-Up Question (4 marks)

Implement a sequential circuit that displays your McGill ID one digit at a time on a row of 10 LED lights (shown below). The only input is the clock.
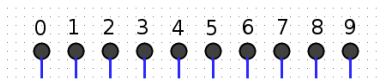
For example, your McGill ID is 260******. Light #2 should be on in the first clock cycle, light #6 should be on in the second clock cycle, light #0 should be on in the third clock cycle, etc. Extend the provided `led.circ` to implement your answer. You are allowed to use any circuits from logisim.

2 Sequential Multiplication (8 marks)

Create a sequential circuit that implements a 4 bit **unsigned** multiplier following the design of the simple sequential multiplier seen in class (either the simple version or the improved version). Your circuit will have a RESET input. On a rising clock edge, when RESET is high, your circuit should initialize its internal registers with the 4-bit inputs A and B, and then start the multiplication on subsequent clock cycles when RESET is low. Your circuit should also provide a DONE signal that goes high when the 8-bit result is ready. You may use anything you like from the default Logisim library (e.g., wiring, gates, plexers, memory), but you should only use the Adder circuit from the Arithmetic part of the library. Use the provided file to create your circuit, as it already defines the inputs and outputs.

3 Sequential Division (3 marks)

Create a sequential circuit that implements 4-bit unsigned division. While this is trickier than multiplication, the marks are few (diminishing returns for more effort). Again, you may use any circuits you like from the default library, except that you should only use Adder or Subtractor circuits from the Arithmetic part of the library. Implement RESET and DONE as per the previous question, and design your solution in the provided circuit file.