Homework 1

Due Apr 3 by 1pm **Points** 100 **Submitting** a file upload **File Types** circ, pdf, txt, zip, tar, and tgz
Available after Mar 30 at 12am

Submit online via Canvas.

We accept only the following file formats:

- .circ
- .pdf
- .txt
- and .zip, .tar, and .tgz of the above

Objective: to become familiar with the elements of combinatorial logic, and with the LogiSim tool, by seeing it for yourself!

Some ground rules (for this, and all courses, and your professional career):

- The universe helps those who try "help"! Don't forget to try the LogiSim "Help" menu, if you're confused.
- Things like code and circuits aren't actually complete unless you know they work. You should never turn something in (here, or in professional life) without having first evaluated whether it actually works. For this course, make sure you put in enough pins, probes, etc to test that it works---and then actually test it. We will test it too. If there's anything nonobvious about your testing, document it!
  (But note that, for this course, you DON'T need to build a circuit that automatically tests all possible scenarios for the system under test---that would be be way overkill.) **(Yes, for this homework, the testing is rather simple. But make sure you do it, and tell us you did!)**

LogiSim gates allow an option for "data bits" > 1. That's weird. Don't do that.

Q1 (50pts)

Using **skeleton.circ, (https://ssl.cs.dartmouth.edu/~sws/cs51-s15/hw1/skeleton.zip)** build a LogiSim circuit (using only basic gates: AND, OR, NOT, NAND, NOR, XOR, X-NOR) that outputs a 1 if and only if at least two of the four inputs are 1.

Objective: to get a feel for how to build basic logic circuits with LogiSim.

Q2 (50pts)

- A: Create a LogiSim subcircuit called "xor." There, Build an XOR gate from eight transistors. The first paragraph of the "Transistor" page in LogiSim's Library Reference may be helpful.

  (Objective: to get a feel for how we can build electrical machines that implement logic gates.)

- B. Use the "edit viewed circuit appearance" functionality (e.g., right-click on the circuit name) to create an XOR-like shape for your subcircuit. (Note that if you hit control AFTER clicking on a point, it "snaps to grid"... which makes it easier to make neater shapes.)
  In the "main" subcircuit, install your XOR and hook up some pins and probes to demonstrate it.

  (Objective: to learn how to create and use customized subcircuits in LogiSim.)

Criteria	Ratings	Pts
Q1. Correctness		30 pts
Q1. Clarity		10 pts
Q1. Simplicity		10 pts
Q2. Correctness		20 pts
Q2. Clarity		5 pts
Q2. Simplicity		5 pts
Q2b. Correctness		10 pts
Q2b. Looks like XOR		10 pts
		Total Points: 100