Systems I
Lab 5
A small, addressable memory
This assignment is due Thursday, Oct-22, 11:59 pm.

1 CircuitVerse

We will use a new tool for implementing our circuits: *CircuitVerse*, which is an online tool that you use in your browser at `circuitverse.org`. It is a *logic circuit simulator* that allows you not only to draw a circuit using gates, but also to test the circuit by simulating the values that would move through those gates. To get started with it:

1. Go to the web site. In the upper left, click the *Log In* button.

2. On the login page, you may need to verify that you are not a robot, and doing so may involve a captcha. Go ahead and do that. Then click the button to login with *Google*. Doing so will bring you to a page in which you can select your college Google account; select that, and confirm you want to login using that account.[1]

3. Once you are logged in, click on the *Launch Simulator* button.

4. Here is where the work actually happens. You will see, on the left, the ability to choose *Input* devices that provide 0 and 1 values to the circuit, *Gates* that perform the logic and can be connected to one another, and *Output* devices that display the values on selected connections in the circuit. **We will demonstrate** how to select input devices, gates, and show outputs.

5. We recommend creating some small circuit (e.g., your old half-adder) in this simulator. Then…

6. In the upper-left of the simulator window, click on the *Project* drop-down menu. Select *Save Online*. Name it (e.g., `half-adder`) and save it.

[1] CircuitVerse may require that you go back to the login page, enter your college email address in the email line, and then select *Google* again. It will send an email to verify your email address, which you should receive and follow that email's instructions so that you may finally login.

You will now have created a circuit and saved it. Later, we will see how you can submit work of this kind by sharing it with the instructor and the TA.

2 Building a addressable memory

We are going to build a small, addressable memory. Specifically, we want to build a memory that has:

- 4 registers
- 4 bits/register

The *inputs* to this addressable memory should be:

- A 2-bit *address* ($A = A_1A_0$) to select one register.
- A 4-bit *data input* ($D = D_3D_2D_1D_0$) that provides a new value to write into one of the registers.
- A 1-bit *clock* input.

Finally there should be a 4-bit *data output* ($Y = Y_3Y_2Y_1Y_0$). A user should be able to select an address A at any time to see the current value stored in that memory element. A user should also be able to provide a value D that, when the clock C is *cycled* (asserted and then deasserted), register A should take on that value, which should immediately as the output Q.

3 Submitting your work

Create a video: Show each of the memory elements storing arbitrarily chosen values, and show that the correct values can be read from each memory element after a new value is written. That is, after a *write* operation into a register, show not only that the written register has changed, but also that the other three registers have **not** changed.

Upload your video to your `lab-5` folder in your shared Google Drive folder for this class. Then, in CircuitVerse, add as collaborators…

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