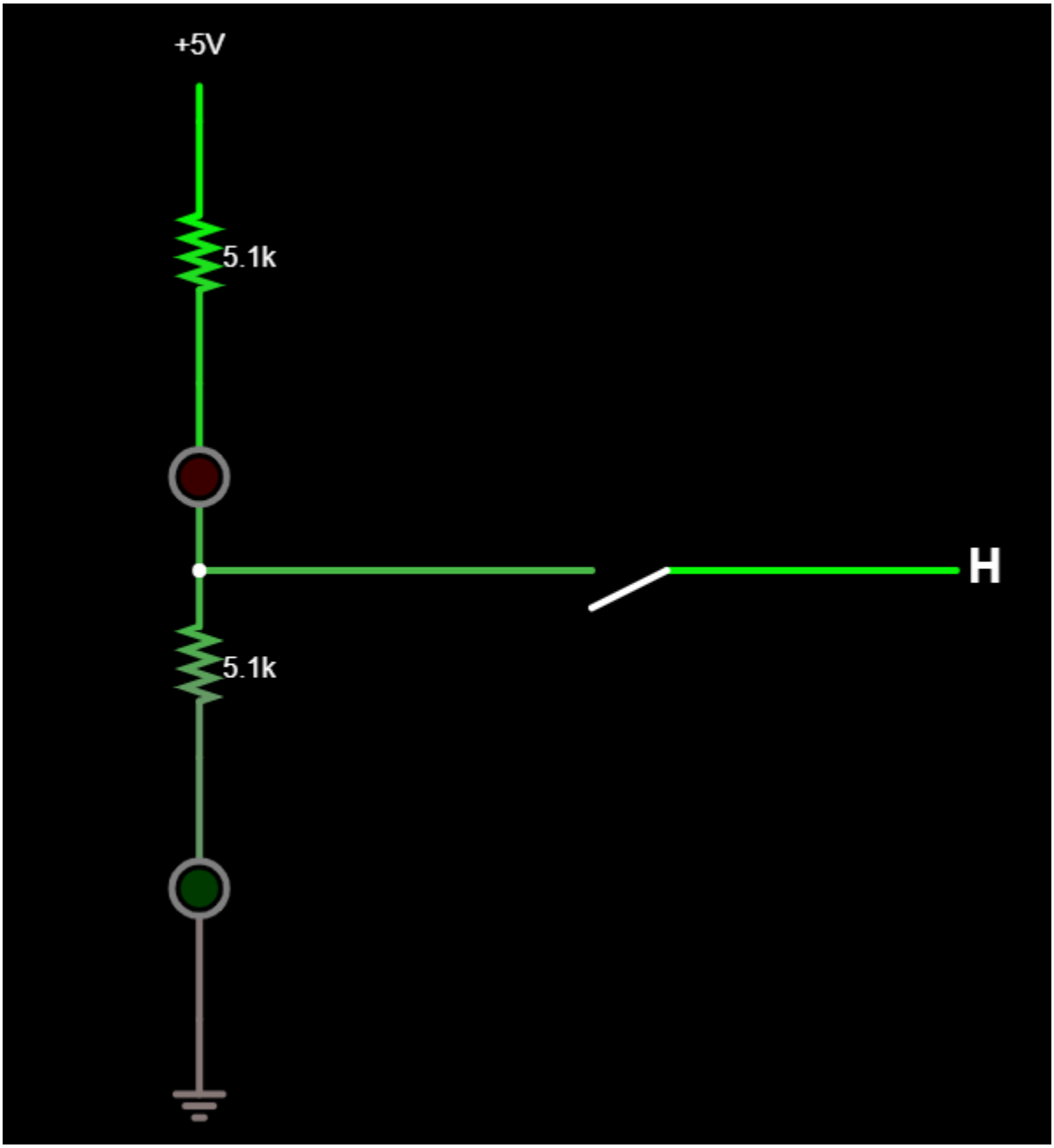
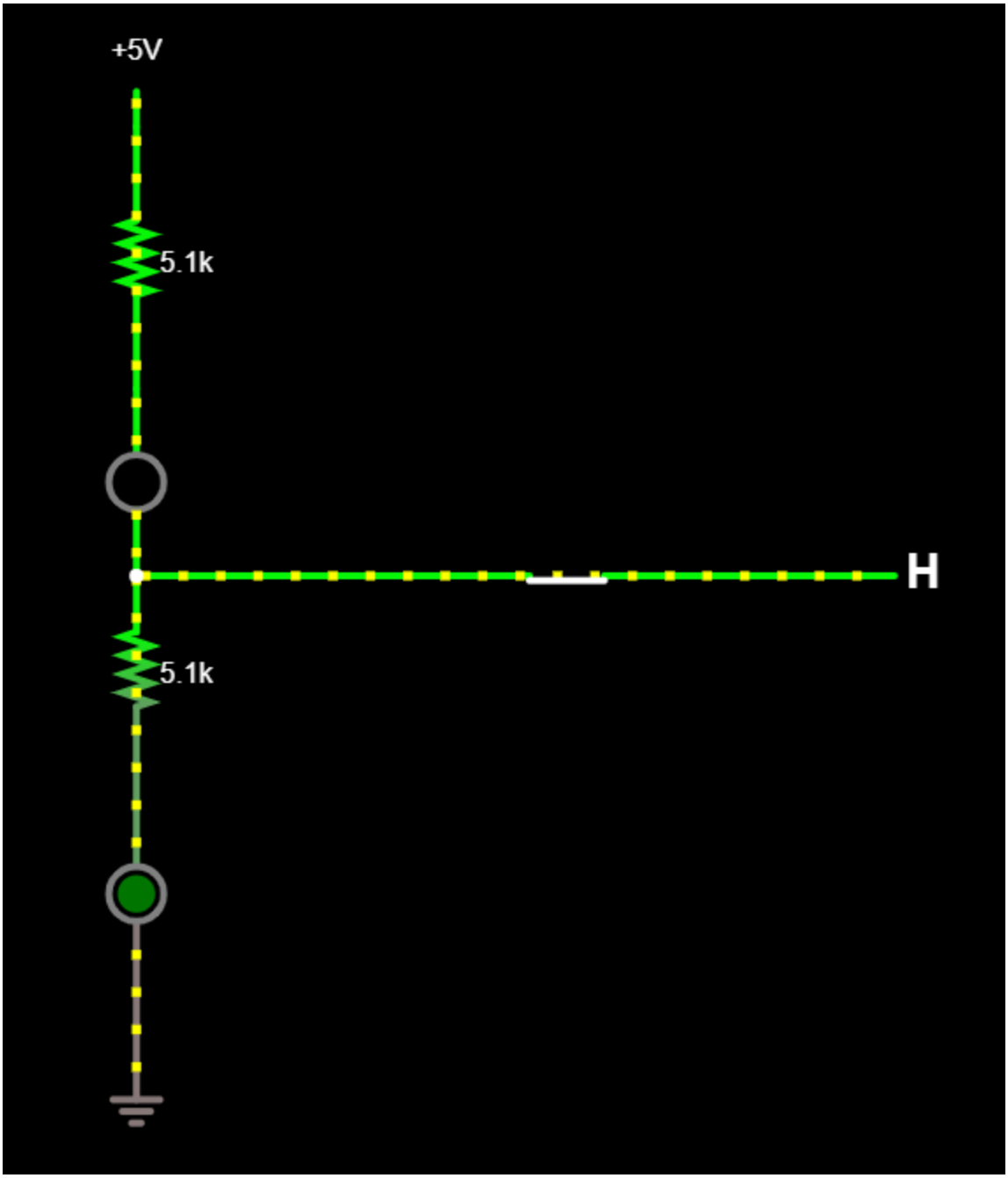
CSCI241 – Homework #2 (Logic Probe)
Due (2/14/2022, 10:00 am)

Background/Overview:

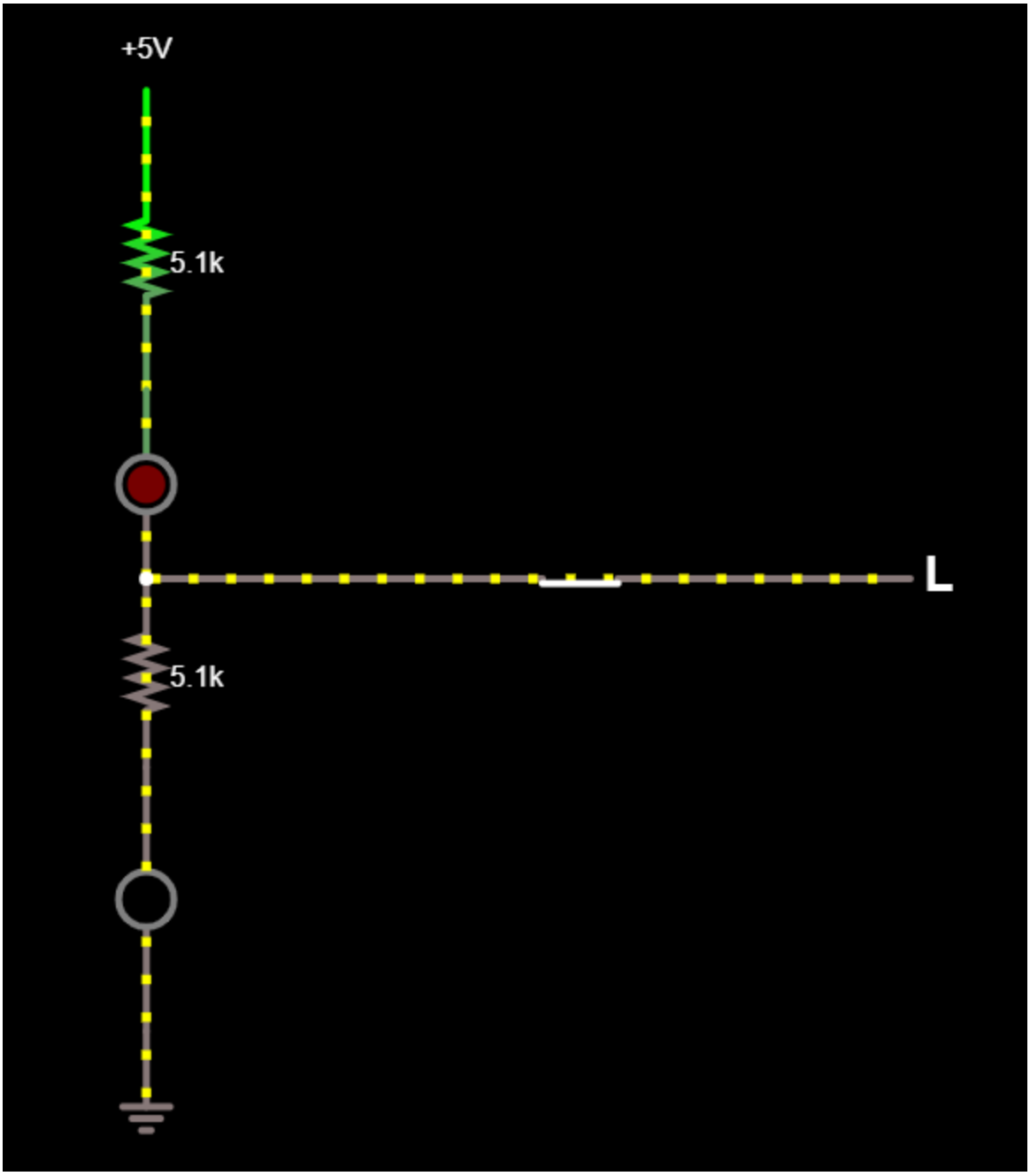
Here's the implementation of a simple logic probe. The schematic is available on the CMU shared **K:** drive and can be loaded into the Falstad circuit simulator. Here's a picture of the schematic:



The circuit has three external wires: one to ground, one to the +5v power source of the circuit being probed and a longer "probe wire". (Note: There is no actual switch. The switch shown above is so we can simulate the probe not connected to anything (i.e., dangling in air). When the probe is not connected, both the red LED (the top one) and the green LED (the bottom one) glow dimly. When the probe wire is connected to a logic HIGH in some circuit, the green LED glows brighter and the red doesn't. For example:



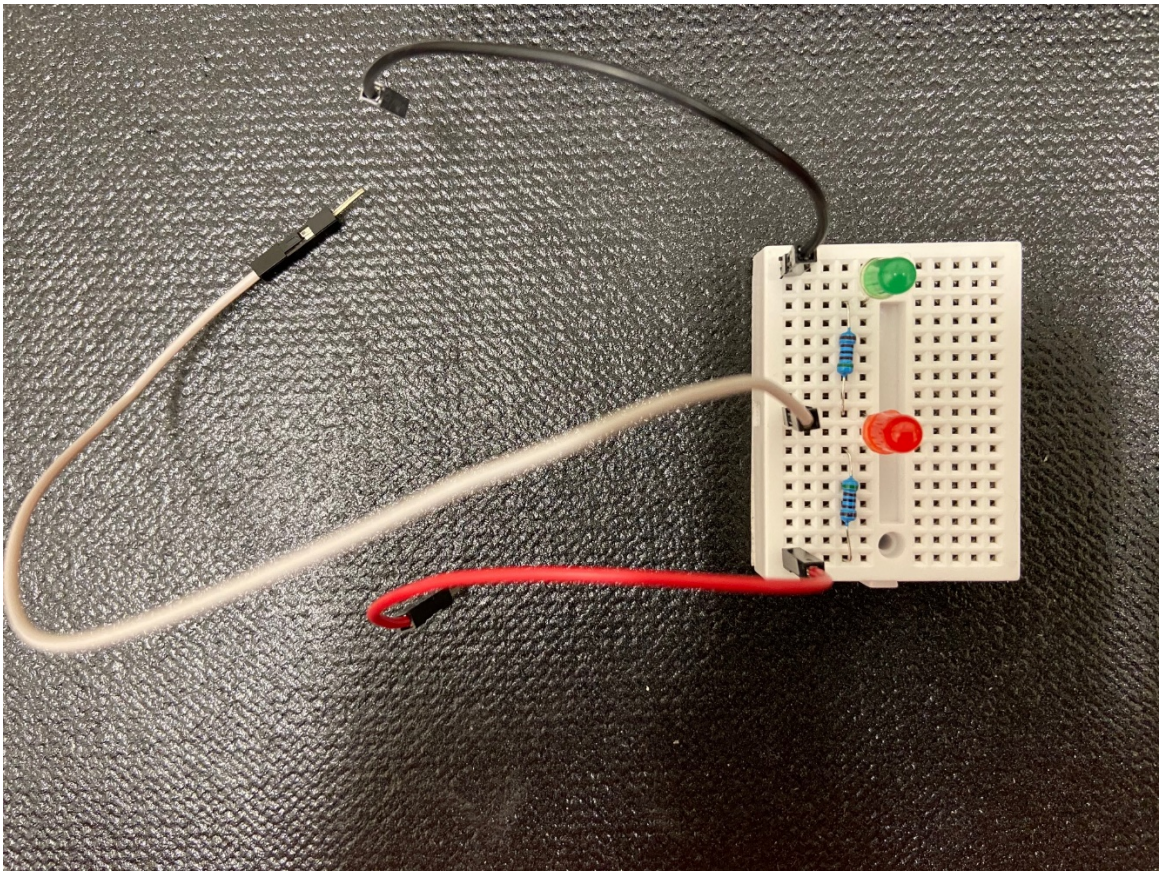
When the probe wire is connected to a logic LOW in some circuit, the red LED glows brighter and the green LED doesn't. For example:



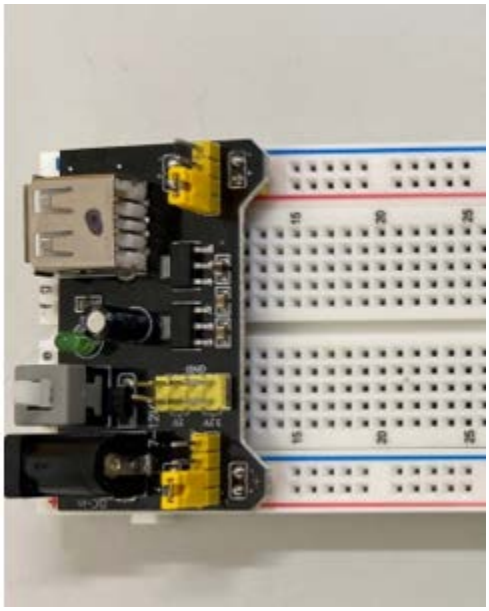
Thus, after connecting to +5v and ground of the circuit you want to test, you can use the end of the probe wire to touch points in the circuit and the LED pattern will indicate whether there's a logic HIGH or a LOW at that point. This is a simple tool that can be used when a multimeter is not available.

Problem:

On the very small white breadboard (no power rails, just rows of pins), you are to neatly wire the circuit above. All the parts are in your boxed kit. Use a short black colored jumper wire for the external ground wire, a short red colored jumper wire for the external +5v wire and a longer white wire for the external probe wire. Here's a picture of the breadboard containing the logic probe circuit above:



Your board should look nearly identical to this. (Of course, you must get the LEDs oriented the correct direction.) You can test your logic probe board by using your experimental breadboard power supply. Take the long experimental breadboard from your boxed kit (the one where you fixed the discontinuity in the power rails using four short pieces of bare wire). Orient the board so the blue power rail "-" and the red power rail "+" are in the upper left corner, with the blue rail going across the top of the board. Now take the breadboard power supply and plug it into the board on the left side so the round barrel connector is facing toward the left. The left end of the board should look like this:



To apply power to the experimental breadboard, plug your black 9V power module (a.k.a. "wall wart") into a 110v AC outlet and plug the round end into the barrel connector. To turn on power, push the on/off switch down (and the small green LED on the power module should light up). To turn power off, push the on/off switch down again.

Now hook your logic probe board to the experimental breadboard. Hook the black wire to the "-" power supply rail and the red wire to the "+" power supply rail. When the white probe is not connected (i.e., dangling in air), BOTH red and green LEDs should be dimly lit. When the white probe is connected to power supply +5V (which is a logic HIGH), the green LED should glow brighter and the red LED should go out (or almost out). When the probe is connected to power supply "-" (which is a logic LOW), the red LED should glow brighter and the green LED should go out (or almost out).

Once you've wired and tested the board, set it aside as it will be used extensively over the next several weeks. Take a closeup overhead photo of your board with a small piece of paper containing your handwritten initials. Submit your photo file to D2L assignment **Homework #2 (Logic Probe)** before the due date and time.