Lab 0

Week 3

EEL3701C: Digital Logic and Computer Systems

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Software Installation

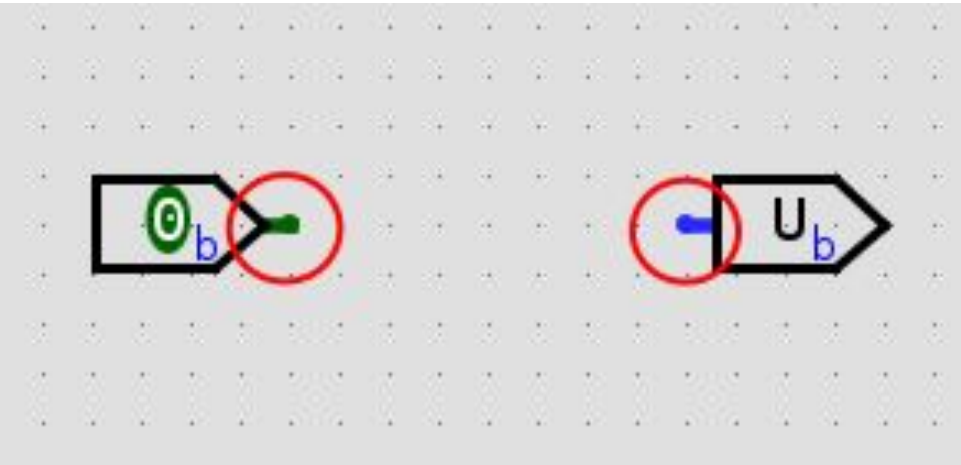
This first introductory ‘lab’ is intended to check that you were able to install the lab software you will be using this semester:

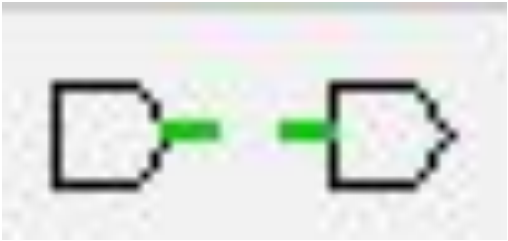
- Intel Quartus
- ModelSim
- Logisim
- Waveforms (you will get DAD3 now)

20 points

Logisim Introduction

Inputs and Outputs



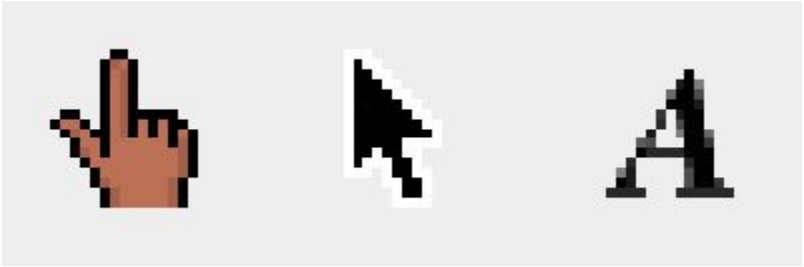


You can create them from the toolbar at the top. Go ahead and place an input on your schematic!

- ***Pin*** - circled - you can attach wires to these.
- ***Inputs*** (left) have a pointed edge on the pin
  - It shows a *binary* value – 0, or 1, representing *on* or *off*
- ***Outputs*** (right) have their pointed edge pointing away from the pin.
  - It shows a '*U*', representing an undefined value. Outputs *show* a value that you give them – however, this one isn't given a value, so it says it is undefined.
- Make sure not to confuse inputs and outputs! They have completely different purposes.

Logisim Introduction

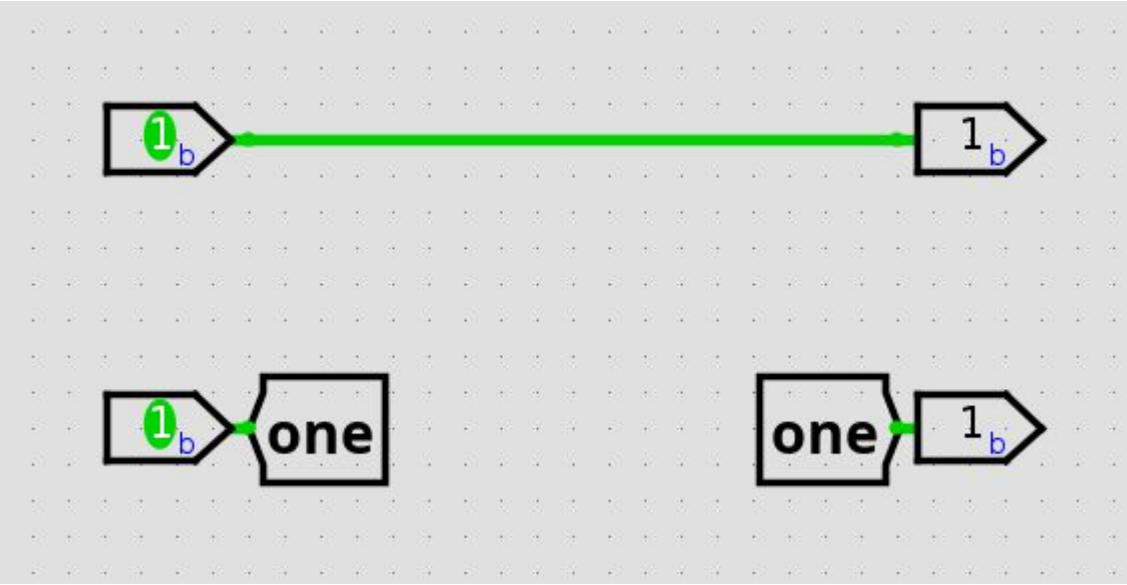
Main toolbar tools:

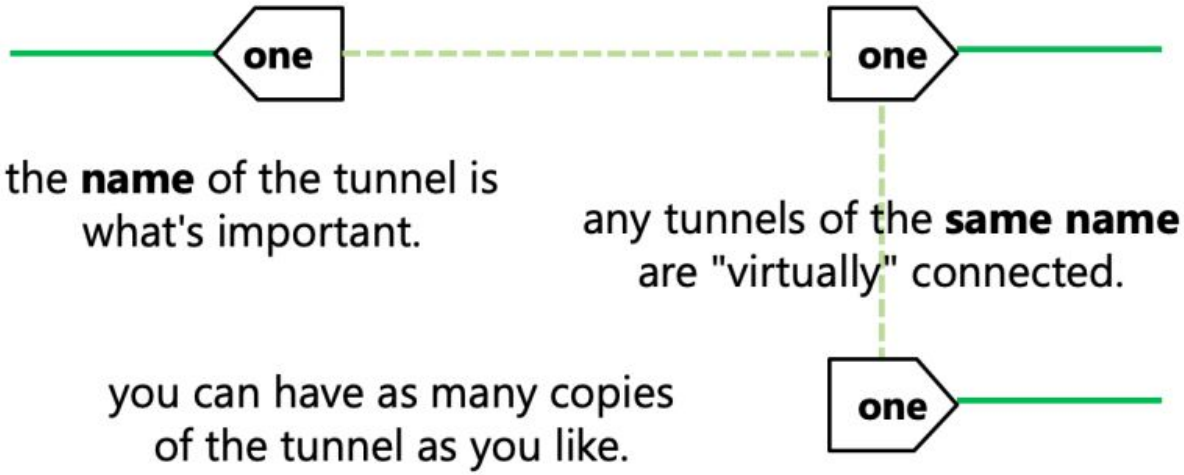


- The **hand** is **the poke tool** (Ctrl+1 or ⌘1). It's used for looking at your circuit and interacting with it (changing input values, pushing buttons etc), but **you can't edit the circuit with it.**
  - **Try it right now!** Use the hand tool to poke the bits in your input(s). They will toggle between 0 and 1.
- The **arrow** is **the edit tool** (Ctrl+2 or ⌘2). This is what you change your circuit with. You can select things, move them around, copy and paste them, create and destroy wires, all kinds of stuff.
- The ***A*** is **the text tool** (Ctrl+3 or ⌘3). You can use it to create/edit "comments" on your circuits.
  - Try it out. Put your name on your circuit. **Truly groundbreaking stuff!**

Logisim Introduction

Connections can be made by simply creating wires directly between components, *or* you can use **Tunnels**. These are labels that act the same way as a wire, so long as they are named the same:





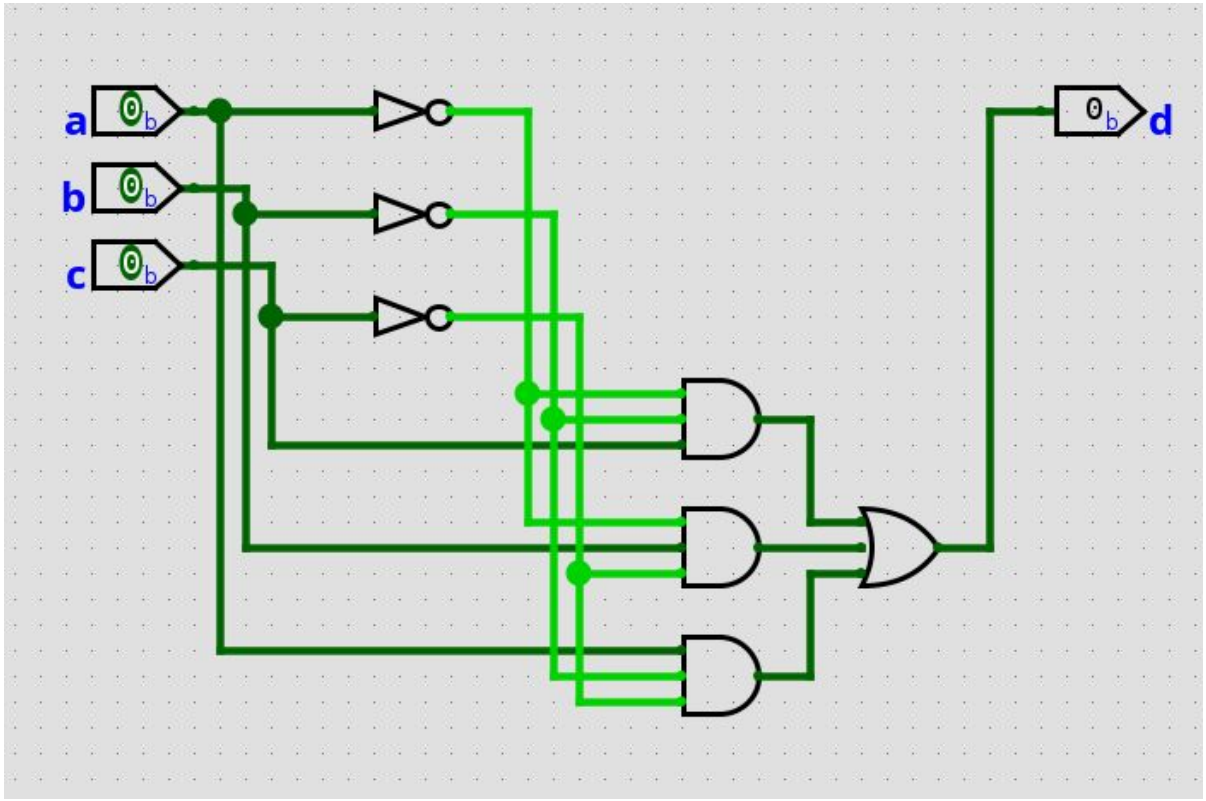
While you do not necessarily need to use these, they could make more complex diagrams less messy, since lots of overlapping wires could get cumbersome to look at.

To add a tunnel, find it in **Wiring**.

To add labels (to any component), simply double click the component and give it a name.

Creating your own Logisim circuit!

You will create the following circuit in Logisim.

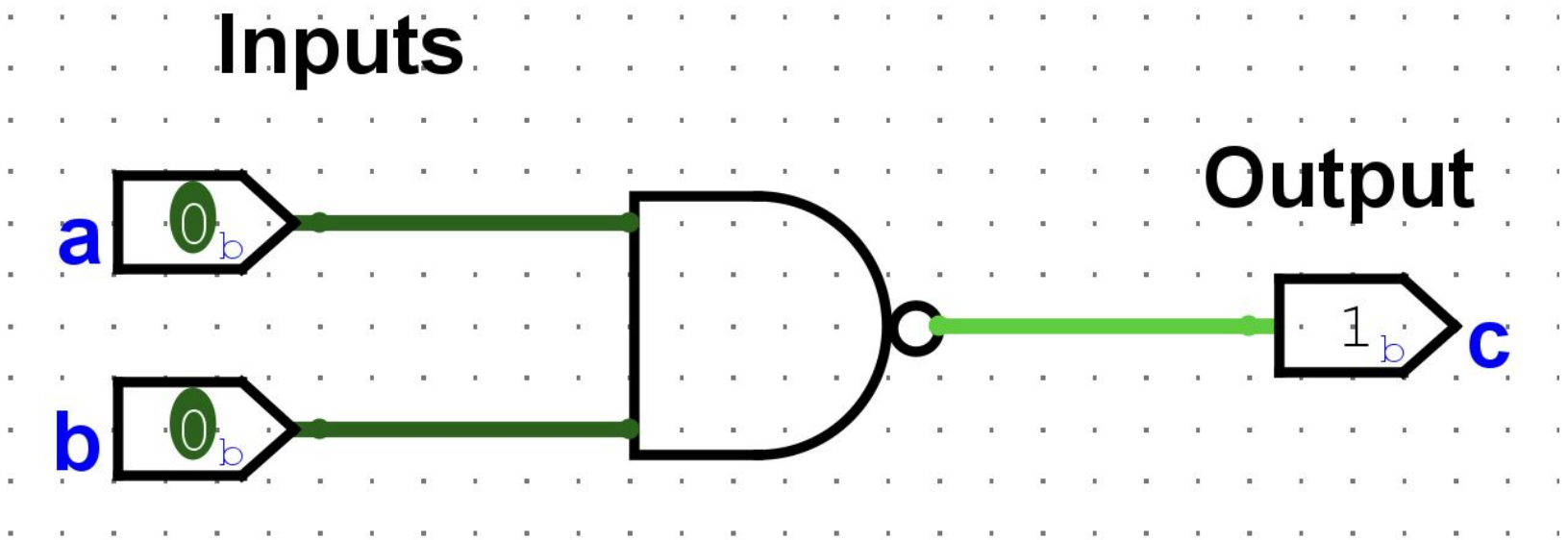


To add different gates to the circuit, find the **Gates** folder and add the corresponding gates.

Try and figure out what the circuit does! You will eventually learn how to design these circuits yourself.

Intro to Circuits & Breadboarding

Let's say that we want to implement this circuit in real life:

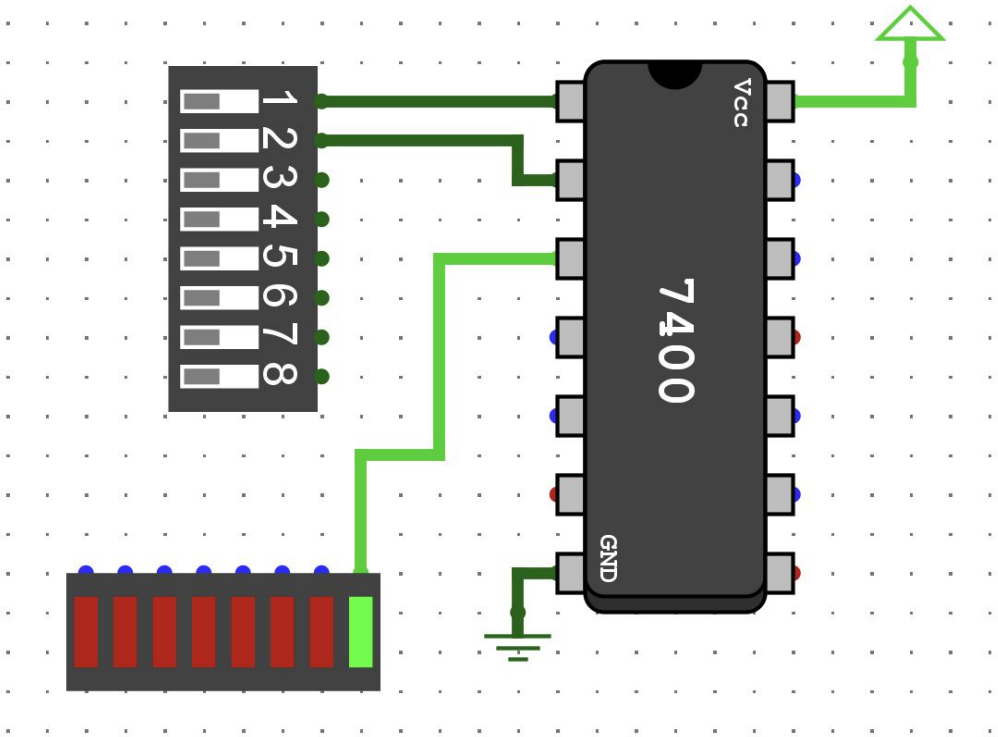


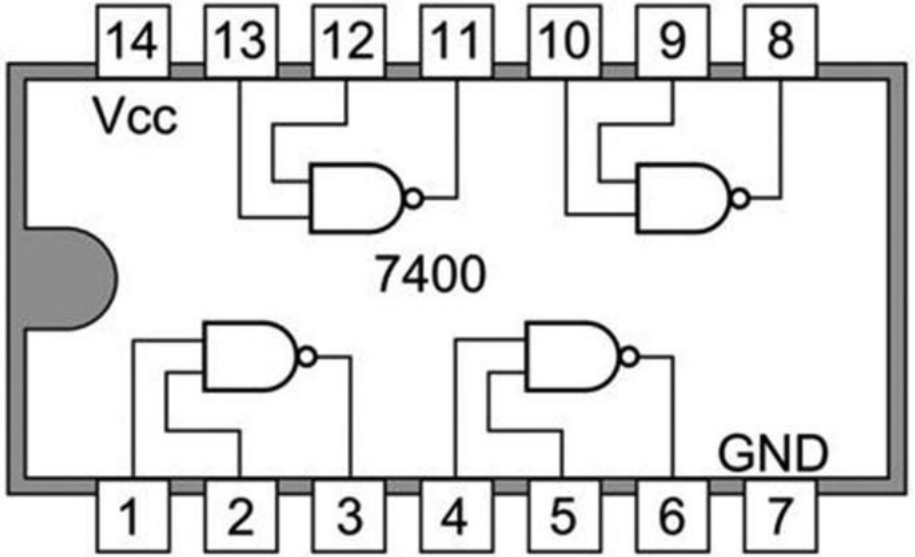
A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

This circuit is simple. It has **2 inputs**, and **1 output**. It does input **a** and input **b** are both true at the same time, and then inverts the truth value. We need to find some physical components that can model this behavior.

Intro to Circuits & Breadboarding

We will try to implement this NAND gate using switches as our inputs and an LED (light emitting diode) as our single output. We will also use an **IC** (integrated circuit) as our physical implementation of the logic gate.



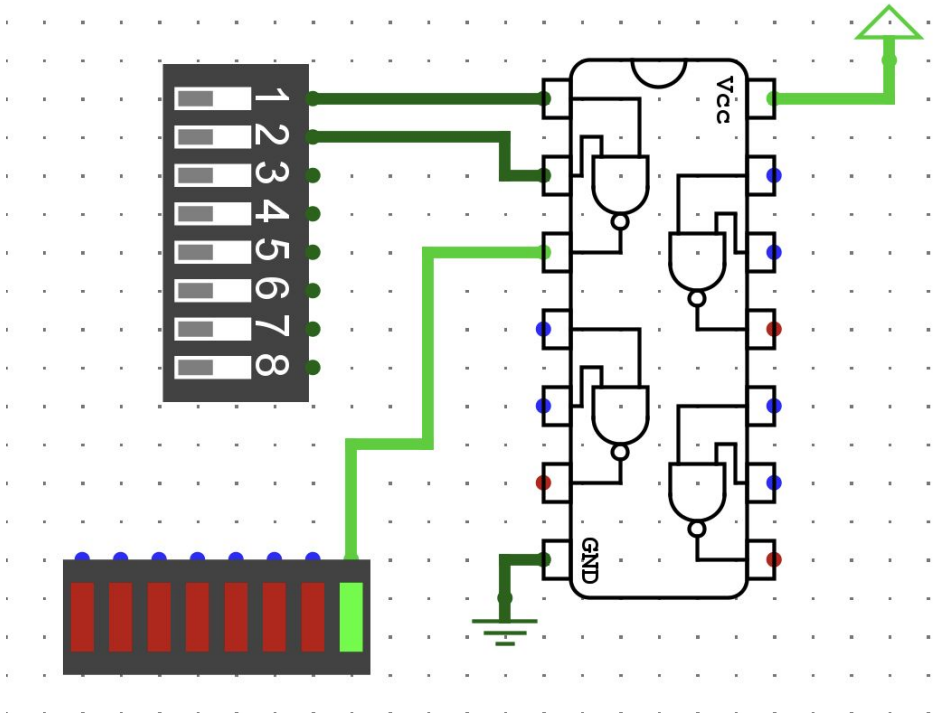


Note: Click on the IC, and enable Vcc and Gnd pins

Intro to Circuits and Breadboarding

Viewing Internal IC structure

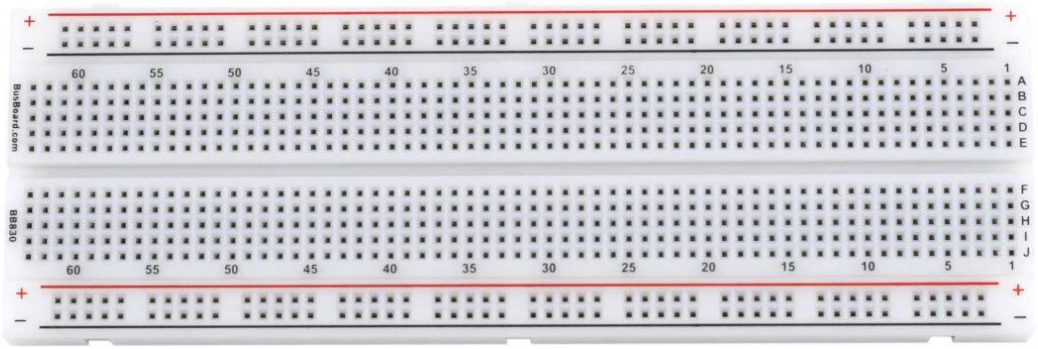
You can click “View Internal Structure” in the bottom left to see how the IC is laid out (or search online for the *pinout*)



Breadboarding/DAD Time!

Video: Watch up to 6:05

You will build this circuit/probe it with the DAD.



40 points

DE10 Time!