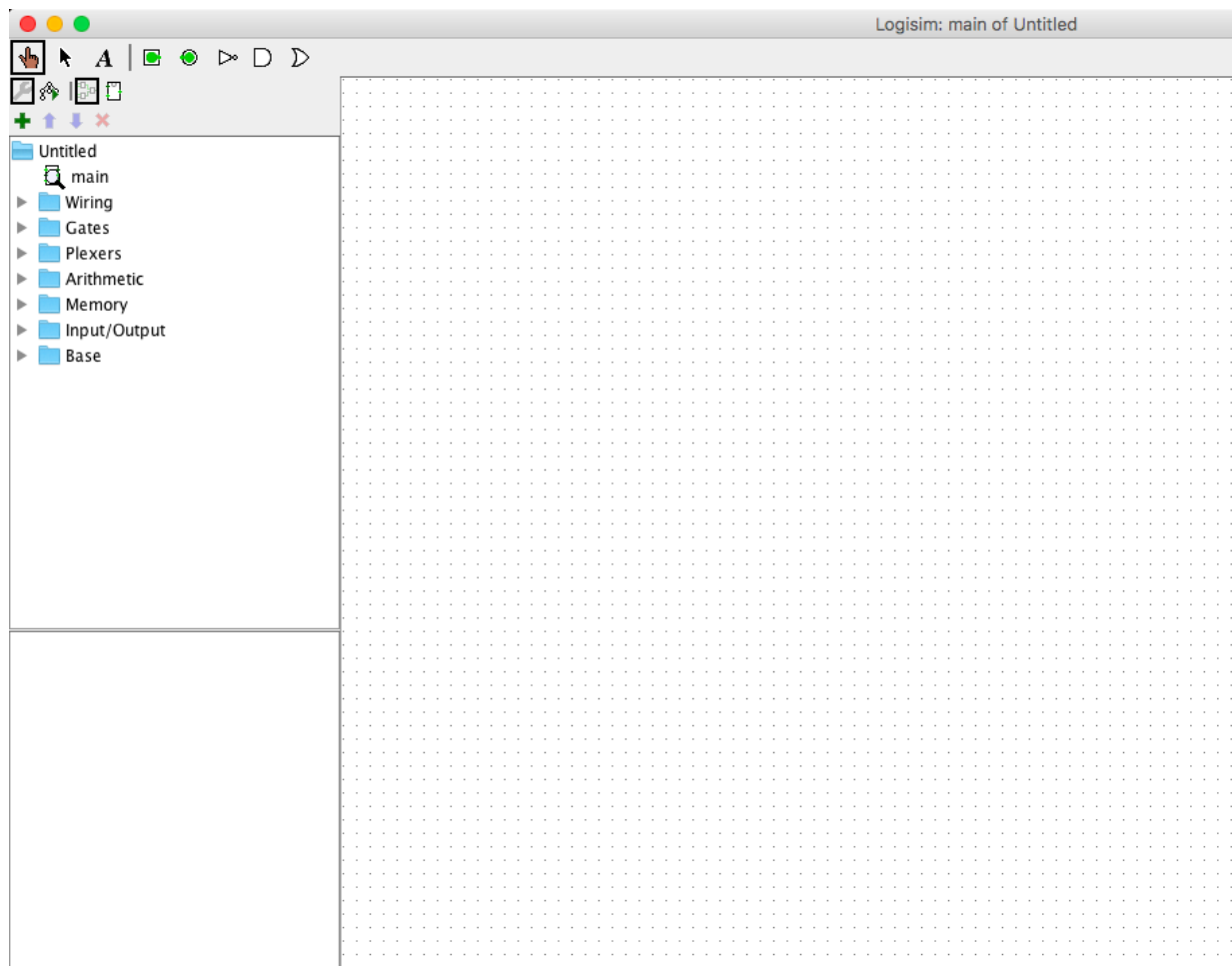# ← Lab 7: Logisim is fun!

Finish by midnight on Sunday, 11/4

> **Download Logisim if you haven't already!**

The Logisim Interface

When you run Logisim, it looks like this:

On the top is the toolbar. The folders hold all the parts you can put in your circuit. The circuit view is on the right. The bottom left is the **properties panel** where you can change properties of parts in the circuit.

These two tools are the ones you'll be using more than anything else:

The hand is **the poke tool.** It's used for looking at your circuit, changing inputs, and pushing buttons, but **you can't change the circuit with it.**

The arrow is **the edit tool.** This is what you change your circuit with. You can select things, move them around, copy and paste them, all kinds of stuff.

There's also the **text tool,** the *A* to the right of those. You can use it to make "comments" on your circuits. It's a good idea!

Zooming in

Chances are, everything is really tiny. In the **bottom left corner, you'll find the zoom control.**


Zoom in. You're welcome.

Inputs and outputs

To the right of those 3 tools, you see:

These are shortcuts for the **input and output** components. The square is an input, and the circle is an output.

> *Note: Inputs and outputs are not interchangeable. To keep things straight, I like to put all my inputs on one side - like the left - and all my outputs on the other. Then if you have an output where you should have an input, it will visually stand out as being incorrect.*

Click the button, then click in your circuit to place it. Put one input and one output, like this:
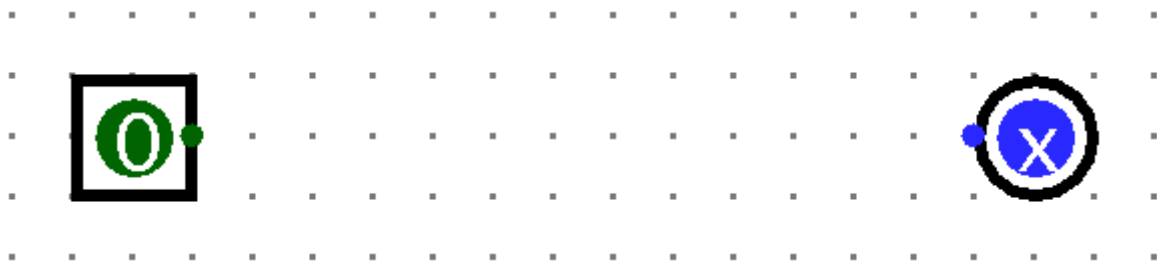
You'll see they have dots on their sides. Those are the **pins,** where you can connect **wires.**

Click and drag from the pin on the input to the pin on the output to connect them with a wire.

Now **switch to the poke tool** and poke the input (square). This will toggle it between 0 and 1.

This is the most exciting circuit. 😴

Making a real circuit

Use the **edit tool** to drag a box around everything to select it, and hit *delete* on your keyboard to get rid of it.

Place 3 inputs and 1 output. You can give an input or output a name by clicking it, and then editing the "Label" in the properties. **Name the three inputs `A` , `B` , and `Op` , and the output `Out` .**

Now select the `A` and `B` inputs and the `Out` output. You can select multiple things by holding **shift** and clicking on them, or by dragging a rectangle around them.

In the properties on the left, change the **Data bits** to 8. This makes them 8-bit.

Finally, select the `Op` input and change its **Data bits** to 2.

Now you should have something like this:

Your task

You're going to make a sort of "4 function calculator" circuit. It will be able to add, subtract, multiply, and divide two 8-bit numbers.

Ingredients

You will need:

- One **adder**, one **subtractor**, one **multiplier**, and one **divider**, all from the "Arithmetic" folder
  - These do exactly what they say!
- A **multiplexer** from the "Plexers" folder
  - Remember what this does?
- Three **probes** from the "Wiring" folder
  - These are good for looking at values in something other than binary.

Just place them all in the circuit without hooking anything up yet.
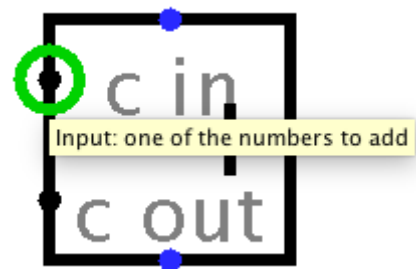
Prep

- Select the adder, subtractor, multiplier, divider, and multiplexer, and set their **Data bits** to 8.
- Set the multiplexer's **Select bits** to 2.
  - Woah, it got bigger!
  - With 2 select bits, we can choose one of 4 options.
- Set the three probes' **Radix** property to "Signed Decimal."

Recipe

1. Hook up the A input to the first input of **all four** mathematical operations.

  - They're the top ones on the left sides:
  - You can click and drag on an existing wire to draw another "branch" of the same wire.
2. Hook up the B input to the second input of **all four** mathematical operations.
3. Hook the **outputs** of the mathematical operations up to the **inputs** of the multiplexer.
  - Put them in this order, top to bottom: add, subtract, multiply, divide.
4. Hook the **mux output** to the Out output.
5. Hook the Op input to the **mux select pin.**
  - The pins are the little black or blue or green dots on the outside edges.

     ○ Wires must be connected to the pins for the connection to be made.
6. Connect the probes to the wires that carry the `A` and `B` inputs and the `Out` output.
     ○ This way you can see the values going into and coming out of the circuit in base-10.

When building and testing your circuit, the **poke tool** will be handy for changing the inputs and looking at what values are on the wires. Poke a wire to see what it's carrying:
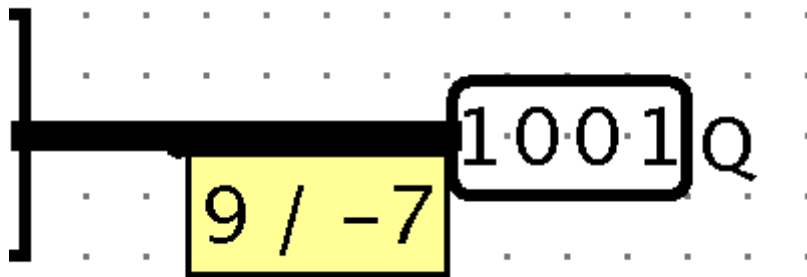
Play around with it

Use the Poke tool to change the inputs. You can choose which operation it does with the `Op` input.

- 00 will add
- 01 will subtract
- 10 will multiply
- 11 will divide

See what happens when you multiply or add large numbers! See what happens when you toggle the inputs' sign bits (MSBs)!

Submitting

Once you're sure your circuit works, **and you named the inputs and outputs exactly as I said,** you can submit.

Name your circuit file `username_lab7.circ`, **like** `jfb42_lab7.circ`.

Submit here.

Drag your asm file into your browser to upload. **If you can see your file, you uploaded it correctly!**

You can also re-upload if you made a mistake and need to fix it.

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