# CS270 Recitation 5
## "Digital Logic Simulation"

**Goals**

To understand how to design and debug combinatorial circuits using the Logisim logic simulator.

**The Assignment**

Make a subdirectory called R5 for this recitation assignment, all files should reside in this subdirectory. Logisim can be found in the ~cs270/logisim/ directory, and can be run with the command below. See http://www.cs.colostate.edu/~fsieker/misc/cs270.html for instructions on how to modify the $PATH variable so that you only need to type `logisim` in the future.

```
~cs270/logisim/logisim
```

You should see the window shown below. Icons for AND, OR, and NOT gates are along the top. More gates can be found by expanding the Gates section in the tree on the left side. Outputs are the circles, and inputs are the squares. Select any of the icons by clicking and you will be able to drop it in the circuit area. Once you have components placed, click the black arrow icon and connect the components with wires by dragging the mouse from one component to another. Drag a wire onto another to make a connection, indicated by a dot. Outputs and inputs can be named by double clicking on them and entering a label on the bottom left.
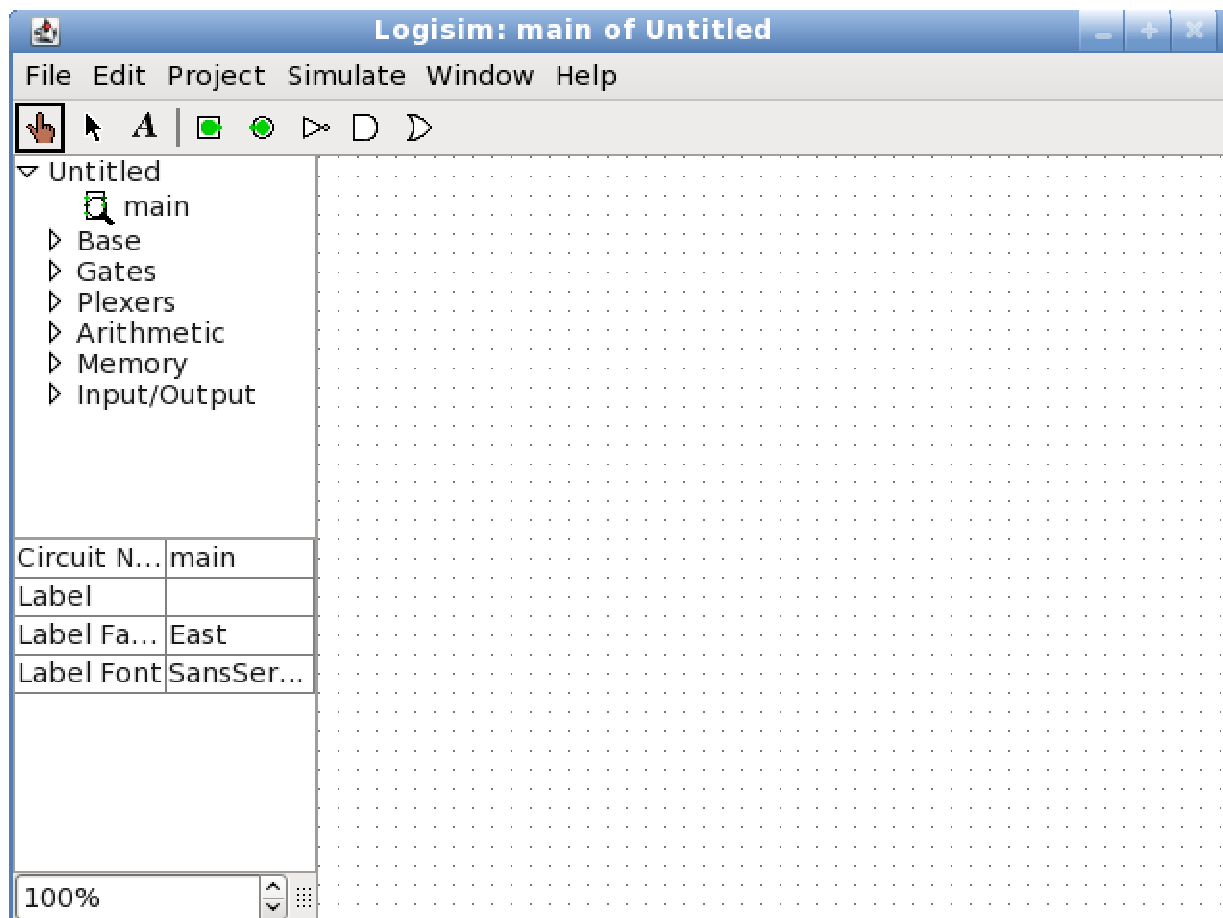
1) Design the following circuit, and save it as r5.circ in your R5 directory:
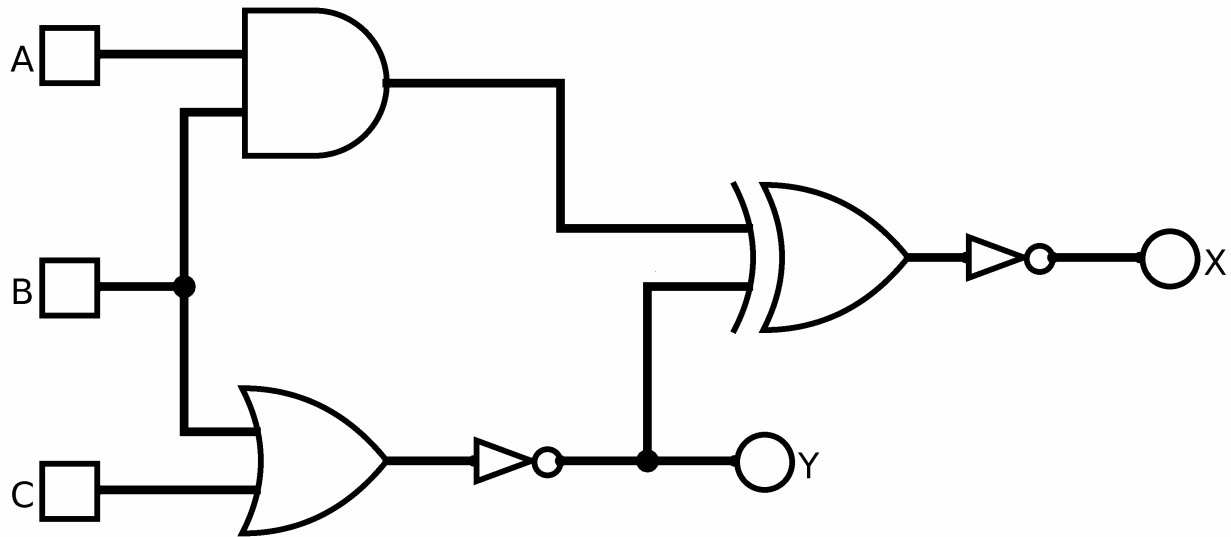


2) Export (File menu) the circuit as a PNG file called r5.png and save it to your R5 directory.

3) Fill in the rest of the truth table for the circuit manually by looking at the circuit:

| A | B | C | Y | X |
|---|---|---|---|---|
| 0 | 0 | 0 | 1 | |
| 0 | 0 | 1 | | |
| 0 | 1 | 0 | | |
| 0 | 1 | 1 | | |
| 1 | 0 | 0 | | |
| 1 | 0 | 1 | | |
| 1 | 1 | 0 | | |
| 1 | 1 | 1 | | 0 |

4) Play around with generating truth table values by manually toggling the input values and examining the output values. This is done in Logisim by selecting the hand icon and then clicking on each input.  Next, generate the complete truth table with Logisim by selecting "Analyze Circuit" from the Project menu and then viewing the "Table" tab. Does it match the one you filled in above? If not, check your answers (or circuit).

5) Build a circuit that implements the following truth table, and verify it by checking against the truth table made with Logisim. What kind of circuit does this represent?

| A | B | W | X | Y | Z |
|---|---|---|---|---|---|
| 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 | 1 |

6) Show both of your circuits and truth tables to the TA.