

Homework 3: Sequential Logic

Due Date: Before class on February 9th.

You will create two circuits for this homework: a modulo 5/modulo 8 counter, and a simple game control logic circuit.

Part One: The Counter

Create a Logisim file named *counter.circ*. In this circuit, use three JK flip-flops to implement a modulo 5/modulo 8 counter. This circuit has an input labeled COUNT and a 3-bit output labeled Q:

- If COUNT is zero, then the Q+ output should be $(Q + 1) \% 8$.
- If COUNT is one, then the Q+ output should be $(Q + 1) \% 5$.

You should do some work on paper before creating your circuit in Logisim:

1. Draw a state transition diagram for the circuit.
2. Write the state transition table, representing the state with three bits.
3. Add to the state transition table J and K inputs for JK flip-flops holding the state.
4. Make K-maps for all J and K inputs. Write the simplified logic expression for all six inputs.

Now you're ready to build your counter. In addition to the COUNT input, you will have a clock signal and a RESET input, which sets all JK flip-flops to 0 asynchronously.

Part Two: The Game Logic

I'll demonstrate this part in class. Start with the file *game.circ*, then add whatever flip-flops and gates to the `logic` subcircuit you need, so that:

- the direction buttons move the pixel around the "screen," and
- the reset button moves the pixel to the top-right.

You can use any of the built-in components of the Logisim library.

Turning it in

1. Go to your turn-in directory in gdrive.
2. Create a folder labeled "Homework 3" inside your turn-in directory.
3. Copy your Logisim files into the assignment folder.
4. Bring your written work to class. All pages should be labeled with your name and "CISS 420 Homework 3."