

## Laboratory Instructions

CS 210  
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Through the quarter, we will implement digital circuits using a (Java-based) software simulator called Logisim to construct and test circuit designs. Logisim is available for free download and is fully documented at

<http://ozark.hendrix.edu/~burch/proj/logisim/>

The Logisim documentation includes a tutorial that describes how to start a circuit, add circuit components, connecting wires and text labels, and test a circuit.

### *Circuit Components and General Instructions*

The following digital circuit components are provided by Logisim, and can be added to any circuit:

input switch	light-emitting diode (LED) output
NOT gate (1-input inverter)	D flip-flop (1-bit memory)
AND gate (2- to 5-input)	JK flip-flop (1-bit memory)
OR gate (2- to 5-input)	clocked pulse generator (.25 Hz, 1 Hz, 4 Hz)

The following digital circuit components are (surprisingly) not provided by Logisim, but will be needed and can be imported into Logisim by downloading and opening the file `lab.logic` from the course web site:

NAND gate (2- to 4-input)      NOR gate (2- to 4-input)

Input values to a circuit are connected from input switches, which should be labeled by the variable name representing the input. Output values from a circuit are connected to light-emitting diode (LED) outputs, which should be labeled by the name of the output. When adding NAND and NOR gates, they're not displayed using standard gate symbols; rather, they're displayed as rectangular block diagrams, since they are imported components. Any block diagrams appearing in a circuit should be labeled by the name of the component.

### *Laboratory Reports*

For each circuit you construct, include the following information:

- The name of the circuit.
- A logic diagram, including
  - input variables
  - output name(s)
  - Standard symbols for NAND, NOR, NOT, AND, OR and XOR gates
  - Block diagrams with labeled names for other integrated circuits (ICs)
  - Connecting wires
- A Minimized Boolean expression for each circuit output.
- A truth table showing input value assignments and output values.