

PRIORITY ENCODER

9.1 PURPOSE

Often a circuit will receive data from several sources at one time and there must be a way to prioritize those inputs. This circuit creates a simple priority encoder for nine different inputs. This is a fairly simple circuit but is best explained by building and “playing around” with it rather than attempting to understand a printed text; thus, the explanation for this lab is somewhat limited.

9.2 PROCEDURE

Start *Logisim-Evolution* and create a subcircuit named **Encoder**. Open that subcircuit and place 12 AND gates as illustrated in Figure 9.1.

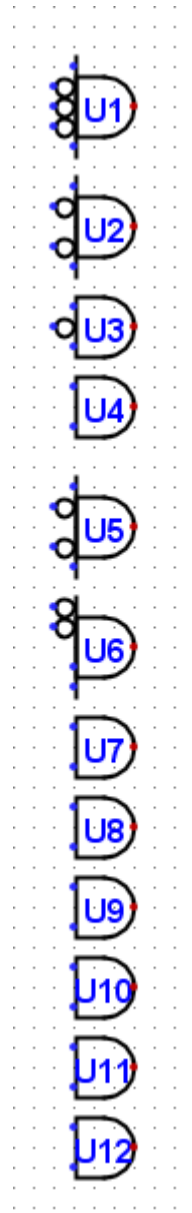


Figure 9.1: AND Gates

The gates have one data bit and these properties:

- U1: Five inputs, numbers two, three, and four negated.
- U2: Four inputs, numbers two and three negated.
- U3: Three inputs, number two negated.
- U4: Two inputs, none negated.
- U5: Four inputs, numbers two and three negated.
- U6: Four inputs, numbers one and two negated.
- U7-U12: Two inputs, none negated.

Many of the output signals need to be combined with OR gates and those should be added next, as in Figure 9.2. Note: U16 is a NOR (*Gates library*) gate.

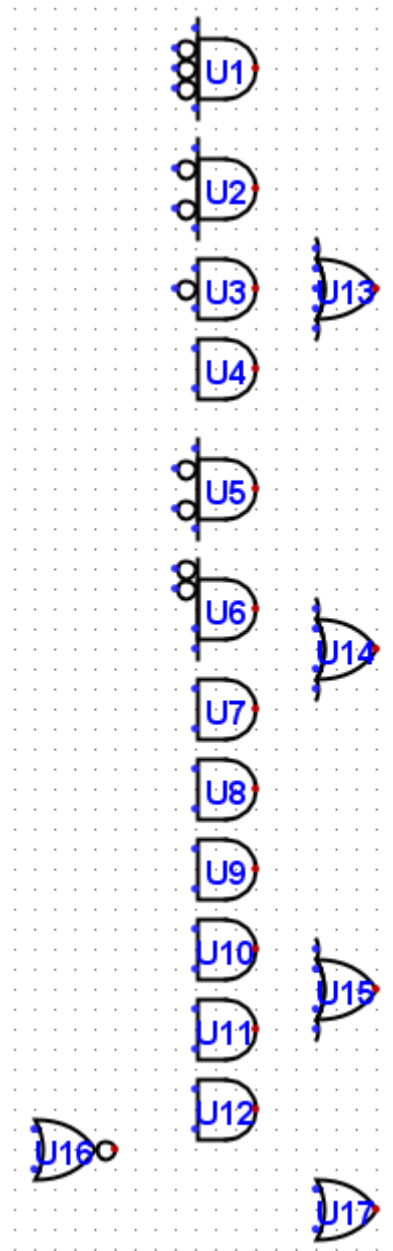


Figure 9.2: OR Gates Added

This encoder is designed to prioritize nine input lines so nine inputs must be added, as illustrated in Figure 9.3.

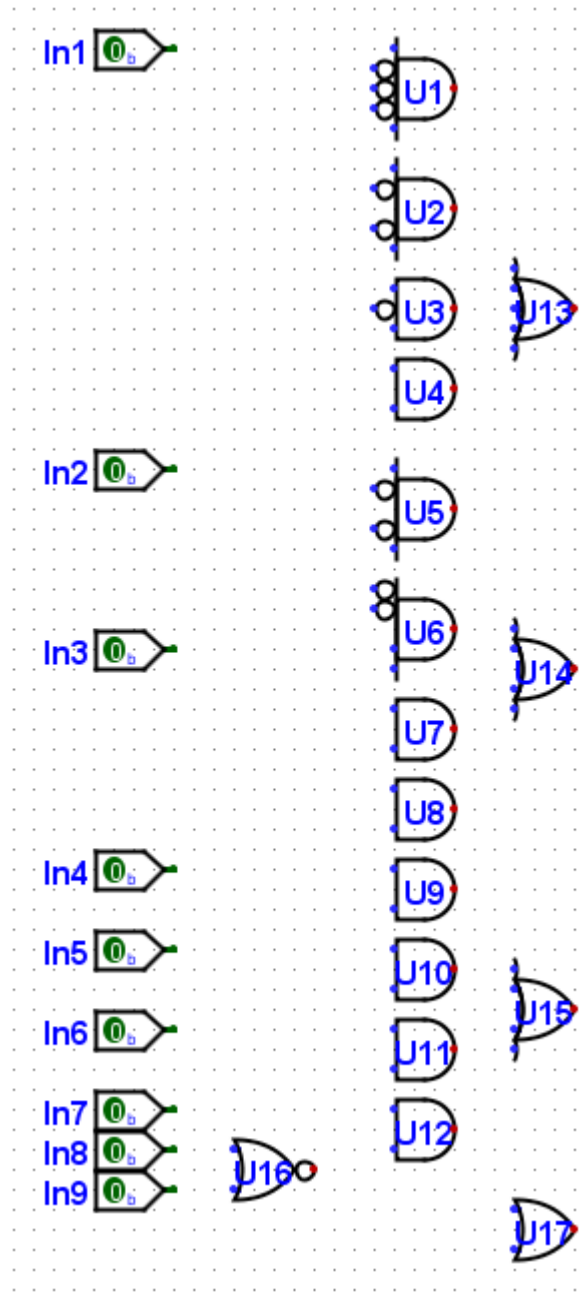


Figure 9.3: Inputs Added

Wiring this circuit is the most challenging part of the build. As illustrated in Figure 9.4, the inputs are wired to several different AND gates.

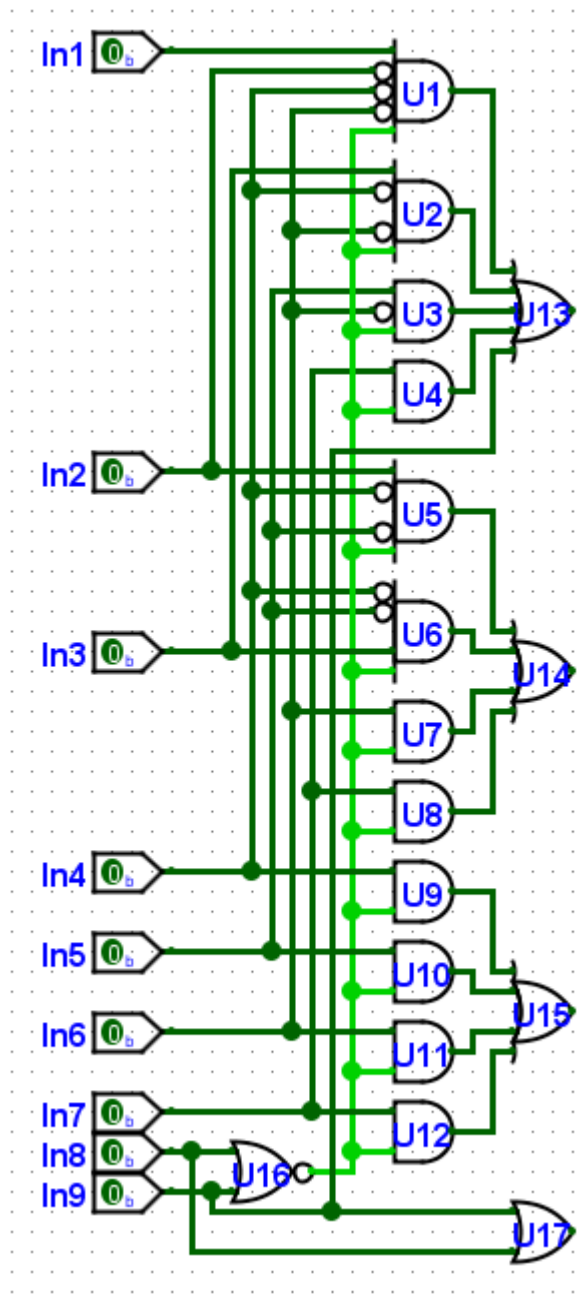


Figure 9.4: Wiring the Encoder

Finally, four output ports are added, as illustrated in Figure 9.5.

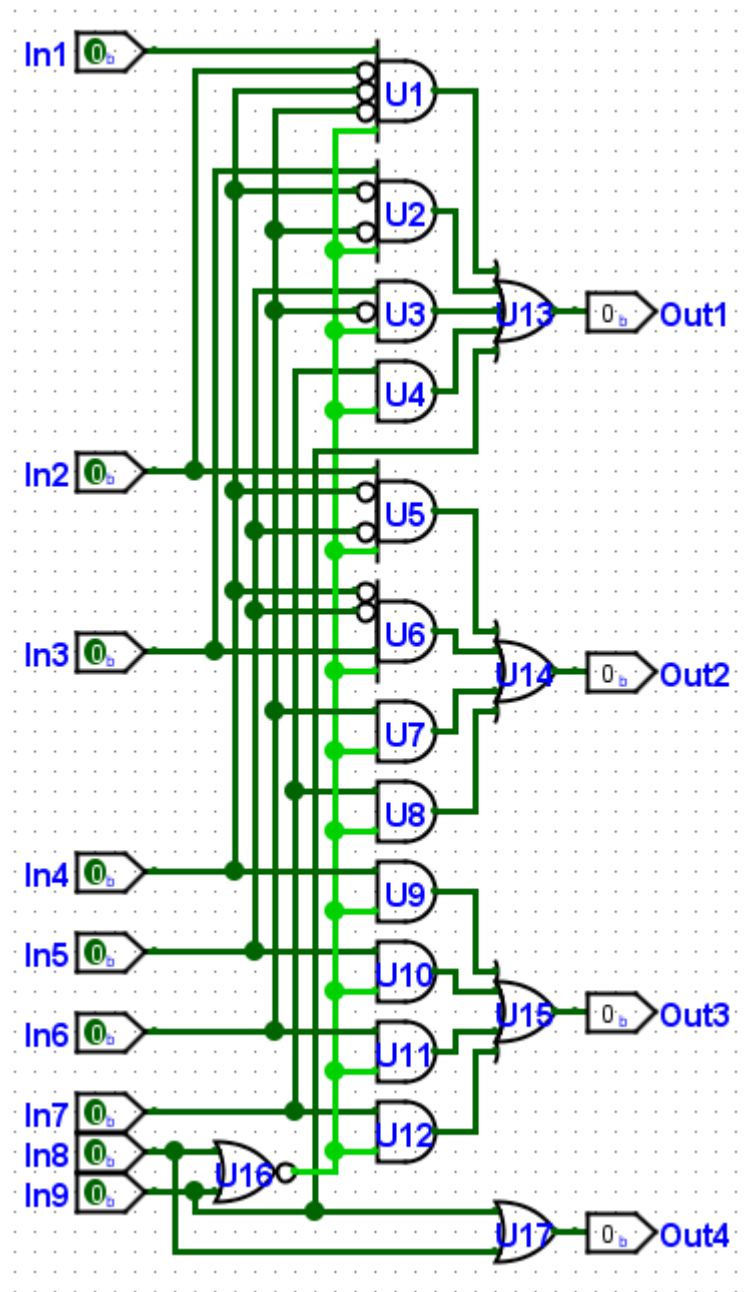


Figure 9.5: Nine-line Priority Encoder

This circuit is designed to output a Binary Coded Decimal (BCD) number, so no further conversion is needed to be able to read the highest priority input line. At this point, the circuit is complete and the *poke* tool can be used to change the inputs and observe how that high input bit drives the outputs.

To finish the project, open the **main** circuit and drop the **Encoder** on the drawing canvas. Add nine inputs and label them *In1* through *In9*. Place a four-bit output labeled *PriOut* and wire the four outputs through a splitter to that output port. To make it easier to read the BCD number, connect a Hex Digit Display (*Input/Output* library) to

the four-bit bus between the splitter and output port. The completed **main** circuit is illustrated in Figure 9.6.

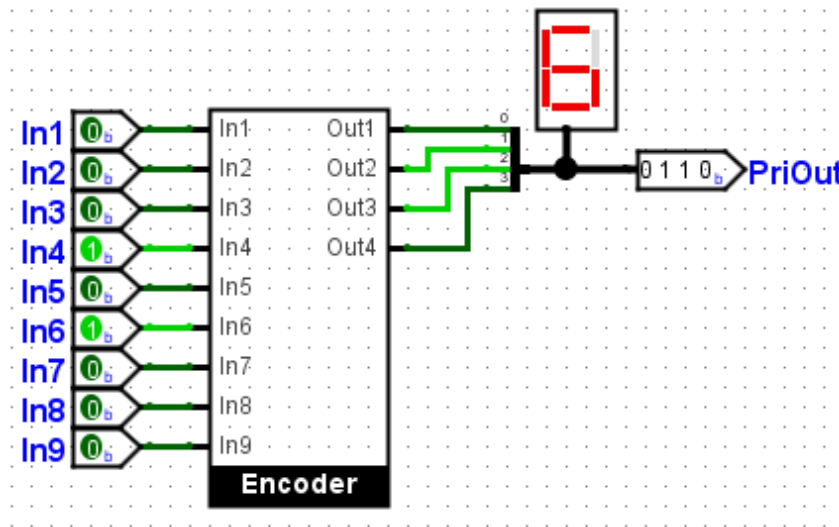


Figure 9.6: Main Circuit

In Figure 9.6, notice that two inputs are selected, *In4* and *In6*. Since *In6* is a higher priority (it is a larger number), the output is set for six and *In4* is ignored.

9.2.1 Testing the Circuit

The circuit is now complete. It should be tested by entering various combinations of inputs and observing that the output always displays the highest numbered input.

9.3 DELIVERABLE

To receive a grade for this lab, create the Nine-line Priority Encoder circuit as defined in this lab. Be sure the standard identifying information is at the top left of the circuit, similar to this:

George Self
Lab 09: Nine-line Priority Encoder
February 18, 2018

Save the file with this name: *Lab09_Encoder* and submit that file for grading.