Sequential Logic and Control

Background

For this project, you will be using Logisim 2.3.5 to create two sequential circuits. Neither circuit requires anything but basic logic gates, input and output pins, wires, flip-flops, and some 1 by 1 LED matrix units. You may use any components from the Logisim Base, Gates, and Plexers libraries; you may not use any components from the Logisim Memory library except for the flip-flops.

You should review the course notes on counters and the traffic control example carefully before starting this assignment.

Mod-32 Parallel Counter

Extend the Mod-8 Parallel Counter shown in the course notes to create a Mod-32 Parallel Counter. You must provide the following interface elements:

- a Logisim clock component
- a 1-bit Enable input that controls whether the counter updates its state when the clock ticks
- five 1-bit outputs, labeled b4, b3, b2, b1 and b0, representing the 16's, 8's, 4's, 2's and 1's digits of the counter value, respectively; these should be oriented in the correct bit order from left to right (as shown in the course notes)

Implement this circuit on a panel in Logisim and call the circuit Mod-32 Parallel Counter.

Timed Traffic Controller

Begin by implementing the traffic controller circuit as described in the course notes, on a Logisim panel and call the circuit Traffic Controller. Follow the interface shown in the course notes exactly:

- a Logisim clock component
- a 1-bit Enable input that controls whether the controller actually updates its state (and so changes the lights)
- 1-bit NSCar and EWCar inputs that indicate whether a car is present on the NS or EW road, respectively
- 4 1 by 1 LED matrix elements representing the traffic lights

Test this thoroughly to be sure it conforms to the operational description in the course notes.

Now, add a timer unit to Traffic Controller so that there is a delay of at least 16 clock ticks between the occurrences of traffic light changes (from green one way to green the other way). This should not alter the input and output interface components at all.

The timer can be implemented by creating an altered version of the Mod-32 Parallel Counter (on a new Logisim panel) and then incorporating that into the Traffic Controller. Be careful of one thing: there must only be one clock component in your solution, otherwise you may have sub-components that are not synchronized with each other.

What to submit

You must implement both circuits in a single Logisim file, following the given instructions for naming the circuits and organizing the circuit interfaces. It is fine to have additional helper circuits.

The *Student Guide* and other pertinent information, such as the link to the proper submit page, can be found at:

http://www.cs.vt.edu/curator/