Assignment 7
(Due Monday 17 October)

NOTE: This is a complicated assignment. The instructions must be followed carefully.

This assignment configures an elementary State Machine using LabView's existing design template. Download the temperature.vi from the class website and save it to disk. In LabView 2014, the State Machine is setup as a project. This is useful because the project automatically links to the Type Def Enum control file that is used to access the different states. Open LabView and create a project. Select the Simple State Machine template and click Next. Enter a project name of your choice and where it will be saved on disk. Click Finish.

You should now see the Project Explorer. Open Main.vi to take you to the State Machine template and open the Block Diagram. This is a very busy template that needs considerable simplification for the present assignment.

The template has five states, but only three are needed here. Go to "Wait for Event" and delete it (rightclick on edge of case structure). Also remove the "Exit" case. There is a Conditional Disable structure outside the While Loop that can be deleted. Delete the Simple Error Handler, the Error cluster, and its shiftregister. Keep the top shiftregister but delete the data strings in the remaining cases. You should also keep the shiftregister for the Enum state selector. At this point, clean out the orphaned code in the three remaining cases. If desired, you can remove the documentation text that is present throughout the template to give you more space. If you rightclick on the edge of the Case or While Loop structures, you can toggle the visibility of the Subdiagram labels. Configure the While Loop to stop only with a Front Panel Boolean control, i.e. the OR gate and Boolean constants should be removed. Add timing to make the loop run at 20 Hz.

Rightclick on the Enum constant for the shiftregister and Open Type Def. A control file only has a Front Panel. Rightclick on the Enum control, Edit Items, and configure it for three states: Acquire, Analyze, and Alarm (delete the two cases that were removed from the state machine). Click OK. Select File: Apply Changes, save the control, and close it. The Project Explorer keeps track of this file's location.

There should be a coercion dot at the point where the modified Enum constant initializes the shiftregister. This is due to the now inconsistent cases that it is pointing to in the State Machine. Remove the grayed out Enum constants inside each of the cases. Rightclick on the border of the Case Structure and select Add Case for Every Value. Scroll through the Case Structure and verify that all three desired cases (Acquire, Analyze, Alarm) are now present and delete any residual, unneeded cases. The initial state should be Acquire.

Now configure the three states. In the Acquire case, place the downloaded temperature VI (use Select a VI in the Block Diagram menu). The file temperature.vi is automatically added to the project as a dependency. Wire its output to i) a numeric indicator and ii) a Waveform Chart that displays individual points (not a continuous line). You can remove documentation text on the Front Panel. The Acquire case must transition to the Analyze case; this is easily done by simply

placing a copy of the Enum constant inside the Acquire case and wiring it to the shiftregister output terminal. Pass the temperature data out of the Acquire case with the top shiftregister. In the Analyze case, construct logic to set a Boolean TRUE condition if the temperature is above 25 or below 15 (access the temperature at its shift register input terminal). If TRUE, the next state is Alarm. If FALSE, the next state is Acquire. Here is a powerful feature of the State Machine: the subsequent state is chosen depending on a condition determined in the present state. Logical branching is not possible with a sequence structure. LabView's Select function is very useful for implementing the IFTHEN logic needed here. Be sure to pass the temperature data to the output port of its shiftregister.

Go to the Alarm case and write code to blink a red LED on the Front Panel three times at 2 Hz. Ensure that the LED remains dim when flashing is completed. Also set up an I32 Front Panel indicator to count the alarm events. This will require a third shiftregister. Exit the Alarm case to Acquire. Note that all output tunnels connecting to shiftregisters must be wired (or set to default if unwired) for the VI to run. It will run indefinitely until the Stop button is pressed.