In this lab you will construct a multi-cycle datapath. You have learned that a single-cycle implementation is an inefficient use of resources and a multi-cycle datapath is an alternate implementation that increases the efficiency.

Part 1 – Control
The major difference between the single cycle datapath and the multi-cycle datapath is the control unit. In the previous lab, the control unit was entirely combinational logic. The multi-cycle datapath requires sequential logic to implement a state machine. The control signals are now dependant on both the instruction being executed and the stage of execution.

1. Implement a finite state machine shown in the following diagram to control the multi-cycle datapath. A shell of a verilog FSM is provided to get you started.
More information on the meaning of the various signals can be found in your book in Figure 5.29 on page 324.

2. Test your finite state machine for all state transitions to ensure that the proper control signals are asserted.

Part 2 – Complete Multi-Cycle Datapath

1. Combine the control you developed in Part 1 with the remaining components necessary to construct a complete multi-cycle datapath. Use the diagram in Figure 5.28 on page 323 in your book as a guide.

2. Test and evaluate the functionality of your multi-cycle datapath.