In this assignment, you will use the Altera text editor to enter a VHDL design, and then combine your own VHDL modules with others using the Altera graphical tool.

1. "10 minute VHDL Entry Tutorial" (Sections 1.5 and 1.6 of your book). Do the tutorial, then download and test the circuit. Turn in a copy of the VHDL source code, signed by me or a TA to show that it worked correctly.

2. As I demonstrated in class, most remote controls can be created as relatively simple state machines. In this assignment, you will develop a controller for a simplified vcr. This vcr has only two buttons - play/stop and fast-forward. (For the moment, we will ignore the fact that real vcr's have to rewind also). The VCR can play at 4 speeds: 0 (stopped), 1 (normal play), 2 (speed play), and 3 (fast forward). The difference between speed play and fast forward is that speed play shows the picture on the screen, but moving fast, and fast forward displays no picture.

The buttons work as follows:

- If the vcr is (normal) playing or fast-forwarding and the play/stop button is pushed, we treat it as a stop button, and the vcr stops.
- If the vcr is stopped and the play/stop button is pushed, we treat it as a play button and the vcr plays.
- If the vcr is stopped and the fast forward button is pushed, it fast forwards.
- If the vcr is (normal) playing and the fast forward button is pushed, it speed plays.
- If the vcr is speed playing, and the play/stop button is pushed, we treat it as play, and the vcr plays.
- If the vcr is fast forwarding, and the play/stop button is pushed, we treat it as stop, and the VCR stops.

Your design will also need a clock and a reset button. Use one of the dip switches for the reset button.

Design and implement a VCR controller that works in this way. Use the pushbuttons for the inputs, and one of the 7 segment displays for the output (speed value 0-3). Turn in a written document that completely explains your design, including a state diagram for your controller, any design decisions that you made, a
1. Submit a readable printout of your schematic, and the VHDL code for this state machine module (signed by me or a TA to verify that it worked on the board), and a printout of test inputs and simulation to explain how the circuit works. Be sure the simulation is complete enough to show that the controller works in this way.

3. Design a second module that will create a more “realistic” output for your VCR. It should take a two-bit input, with 0 indicating stopped, and 1-3 indicating speeds as above. If the VCR is stopped, then the top segment of the LED should be lit solid. If the VCR is going, then the top four segments should light up sequentially so that it appears that a small square is rotating in a clockwise direction. The speed of rotation should reflect the speed of the VCR (2 being twice as fast as 1, and 3 being twice as fast as 2). Again, include a document that describes your design, a state machine diagram (if any), an annotated simulation that proves that your design works, and a signed schematic that indicates that I (or a TA) saw your system working. (Hint: you might be able to use a counter instead of a state machine for this module. Consider which segment should be on for each value of the counter. Can you use one counter for all 3 speeds?)

4. Put parts 2 and 3 together so that your VCR controller controls the “virtual VCR display”. For testing purposes, you might want to use one digit for the speed value and the second digit for the virtual VCR. Include a signed schematic of the entire system to verify that I or a TA saw it working on the board.