ELE307 Spring2009 LAB4

What's new in this lab:

VHDL	Multiple processes, enumeration type for non-FSM use, case-when inside case-when.
EDA	Compilation report.
FPGA	7-seg alphabet display.
RTL	Customized conversion, shared memory.

Exercise

- Download lab4_1.qar from ftp://ele.uri.edu/outgoing/jcl/306/lab4_1.qar.
- Restore, and compile the project. Print out the compilation report (flow summary). Select Timing Analyzer and print out the summary. Both printouts are needed for the report.
- Program the DE2 board; you need keyboard for this exercise. From the keyboard: "g" for go, which will start the ticker display rolling; "s" for stop; "L" and "R" will control the ticker display shifting direction. Notice that the change of direction will not occur until the display is back at its initial position.
- Examine "sevenseg_mod.vhd" and found out how the sevenseg conversion circuit is modified to accommodate for the new patterns. Note that the total number of patterns is still 16.
- In lab4_1.vhd, there are three processes. In VHDL process is itself a concurrent statement; and as such, these three sequential circuits are running concurrently.
- The first process (display_clock between lines 58 and 84) is almost identical to that found in lab2. It slows down the 50MHz input clock and allows the user to select the display shifting speed via switches.
- The second process (Receive_from_Keyboard between lines 86 and 148) is a finite state machine (FSM) with KEYIN as its state variable. This FSM receives inputs from keyboard and update the two shared signals (or memory; but actually registers): "*go*" and "*direction*". The signal "go" is defined as a Boolean type while "direction" is defined using the enumeration with user defined values. These two signals are updated by this FSM and will be used by the other FSM. In this design, the FSM did not try to make distinction between make and break code. Explain in your report why this will work? Use State Machine Viewer to print out the state diagram of this FSM and mark the edges by hand.
- The third process (Ticker_display between lines 150 and 201) is the second FSM. Use State Machine Viewer to print out the state diagram of this FSM and mark the edges by hand. In the report, explain how the two shared signals: "go" and "direction" are used to decide on the behavior? Also explain how the display will not change direction until it is back in its initial position?

Assignment#1 (lab4_2)

- Create two more phrases no more than 16 character long (including spaces). These two will be added to the one in the above exercises. Your assignment is to run the ticker display from one of these three on user's input. Besides g for "go", s for "stop", r for "right", and l for "left", use 1, 2, and 3 from keyboard to select different phrases. Tow switch to a new phrase, you will have to wait until the current phrase is at its initial position when shifting right, or until the old

phrase is at its last character on the right when shifting left. To simplify the design, you should try finding phrases such that the total number of different characters is no more than 16.

Assignment#2 (lab4_3)

- Extended upon your design from assignment #1, user will now use switches 17 downto 14 to select which one of the character in a phrase to blink. For any character other than space, blinking means blank out momentarily and back at displaying the character. For space, blinking has no meaning. To make the proper visual effect, the blinking is not synchronized with the shifting speed!

Lab 4 Report:

Title page: Lab title, section number, your name, student ID and email address.

The body of your report should include a one paragraph introduction. Descriptions of your experiences from the exercise parts which associated with the items required below. The following required items should be embedded with the text explanation not aggregated at the end of your report. Approaches and thinking behind your solution to the assignment. Lesson learned from this lab.

From the Exercise:

1. Printout of the compilation report (flow summary) and Select Timing Analyzer summary.
2. State Machine Viewer printout with hand annotations for KEYIN.
3. State Machine Viewer printout with hand annotations for TICKER.
4. One paragraph each for the following questions:
    a. Unlike Lab3_3, the FSM KEYIN did not try to make distinction between make and break code from keyboard. Why this will work?
    b. How the two shared signals: “go” and “direction” are used to decide on the behavior of the ticker display? Point out the VHDL code (or code segment) that does this.
    c. How the display will not change direction until it is back in its initial position?

From the Assignment#1:

5. The list of the 16 characters in your design and their 7-segment representation. Include your modified seven segment conversion circuit VHDL description.
6. Flowchart or state diagram.
7. VHDL listing.

From the Assignment#2:

8. Use flowchart, algorithm, or a paragraph of explanation to describe how the blinking is accomplished in your design.
9. VHDL listing.

Also, send the followings to TA:

1. Lab4_2.qar (assignment#1)
2. Lab4_3.qar (assignment#2)