Ve270 Introduction to Logic Design

Homework 7

Assigned: November 1, 2018

Due: November 8, 2018, 4:00pm.

The homework should be submitted in hard copies.

1. Problem 3.24. (10 points)

> 3.24 Draw a state diagram for an FSM that has an input X and an output Y. Whenever X changes from 0 to 1, Y should become 1 for two clock cycles and then return to 0—even if X is still 1. (Assume for this problem and all other FSM problems that an implicit rising clock is ANDed with every FSM transition condition.)

2. Implement a circuit for the FSM designed in Problem 3.24. (15 points)

3. Problem 3.25 (10 points)

> 3.25 Draw a state diagram for an FSM with no inputs and three outputs x, y, and z. xyz should always exhibit the following sequence: 000, 001, 010, 100, repeat. The output should change only on a rising clock edge. Make 000 the initial state.

4. Problem 3.26. (10 Points)

> 3.26 Do Exercise 3.25, but add an input I that can stop the sequence when set to 0. When input I returns to 1, the sequence resumes from where it left off.

5. Problem 3.27. (10 Points)

> 3.27 Do Exercise 3.25, but add an input I that can stop the sequence when set to 0. When I returns to 1, the sequence starts from 000 again.

6. Implement a circuit for the FSM designed in Problem 3.27. (15 points)

7. Problem 3.28, show design steps, equations, and draw schematics. (20 points)

> 3.28 A wristwatch display can show one of four items: the time, the alarm, the stopwatch, or the date, controlled by two signals s1 and s0 (00 displays the time, 01 the alarm, 10 the stopwatch, and 11 the date—assume s1 and s0 control an N-bit mux that passes through the appropriate register). Pressing a button B (which sets B = 1) sequences the display to the next item. For example, if the presently displayed item is the date, the next item is the current time. Create a state diagram for an FSM describing this sequencing behavior, having an input bit B, and two output bits s1 and s0. Be sure to only sequence forward by one item each time the button is pressed, regardless of how long the button is pressed—in other words, be sure to wait for the button to be released after sequencing forward one item. Use short but descriptive names for each state. Make displaying the time be the initial state.

8. Problem 3.42 (10 points)

3.42 Using the process for designing a controller, convert the FSM you created for Exercise 3.28 to a controller, implementing the controller using a state register and logic gates.