Cpr E 281 HW 11

ELECTRICAL AND COMPUTER ENGINEERING
IOWA STATE UNIVERSITY

Synchronous Sequential Circuits
Assigned Date: Fourteenth Week
Due Date: Apr. 21, 2014

P1. (10 points) Problem 6.3 in textbook. In addition to the state diagram, please also give the state table.

P2. (20 points) Problem 6.7 in textbook. Please try your best to minimize the cost of your implementations.

P3. (15 points) For the vending machine control design in Example 6.7 of textbook, consider the following input sequence: DN=01, 00, 01, 00, 10, 00, 10, 00, 10, 00, 01, 00.

(a) For the design in Figure 6.54 / Figure 6.55, report the sequence of states and outputs for the given input sequence.
(b) For the design in Figure 6.56 / Figure 6.57, report the sequence of states and outputs for the given input sequence.
(c) For the design in Figure 6.58, report the sequence of states and outputs for the given input sequence.

P4. (15 points) Problem 6.37 in textbook.

P5. (20 points) Design a three-bit counter-like circuit controlled by the input w. If w=0, then the counter subtracts 1 from its contents (acting like a normal down-counter). If w=1, then the counter adds 2 to its contents, wrapping around if the count has to become 8 or 9. Thus if the current state is 6 (or 7) and w=1, then the next state is 0 (or 1). Use T flip-flops in your circuit. (Note that we have worked on a similar problem in HW 10 Problem 10 but we are using T flip-flops instead of D flip-flops here.)

P6. (20 points) You are required to design a device to test one's reaction. The device has two inputs, G and R. G is controlled by the operator of the device, and R is controlled by the person under test. The device also has a single output, Z, which is equal to 0 when the device is not being used. The operator will push and then release G, which will turn a green light ON and then OFF. Once the person under test observes the green light coming ON, he/she is supposed to push and release R before the green light is turned OFF. In this case, the output Z becomes 1 until G is released. If the person under test fails to push *and* release R before the green light turns OFF, Z will not change.

(a) Draw the state transition diagram of a Moore-type machine which describes the behavior of the device.
(b) For the following input sequence, find out the state and the output of the machine in part (a) after each clock edge:
    - At 1st clock edge, GR = 00
    - At 2nd clock edge, GR = 10
    - At 3rd clock edge, GR = 11
    - At 4th clock edge, GR = 01

- At 5th clock edge, GR = 00
- At 6th clock edge, GR = 10
- At 7th clock edge, GR = 10
- At 8th clock edge, GR = 11
- At 9th clock edge, GR = 10
- At 10th clock edge, GR = 11
- At 11th clock edge, GR = 10
- At 12th clock edge, GR = 00

(c) Draw the state transition diagram of a Mealy-type machine which describes the behavior of the device.