ESE-2005 Lab 3 Finite State Machines

Exercise

1. You are designing an elevator controller for a building with 25 floors. The controller has two inputs: UP and DOWN. It produces an output indicating the floor that the elevator is on. There is no floor 13. What is the minimum number of bits of state in the controller?

2. You are designing an FSM to keep track of the mood of four students working in the digital design lab. Each student's mood is either HAPPY (the circuit works), SAD (the circuit blew up), BUSY (working on the circuit), CLUELESS (confused about the circuit), or ASLEEP (face down on the circuit board). How many states does the FSM have? What is the minimum number of bits necessary to represent these states?
   How would you factor the FSM into multiple simpler machines? How many states does each simpler machine have? What is the minimum total number of bits necessary in this factored design?

3. Describe in words what the state machine in Figure 1. Using binary state encodings, complete a state transition table and output table for the FSM. Write Boolean equations for the next state and output and sketch a schematic of the FSM.

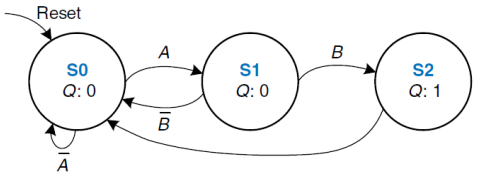

Figure 1: State transition diagram

4. Accidents occurring at the intersection of Academic Avenue and Bravado Boulevard in Figure 2. The football team is rushing into the intersection the moment light B turns green. They are colliding with sleep-deprived CS majors who stagger into the intersection just before light A turns red. Extend the traffic light controller from our course so that both lights are red for 5 seconds before either light turns green again. Sketch your improved Moore machine state transition diagram, state encodings, state transition table, output table, next state and output equations, and your FSM schematic.

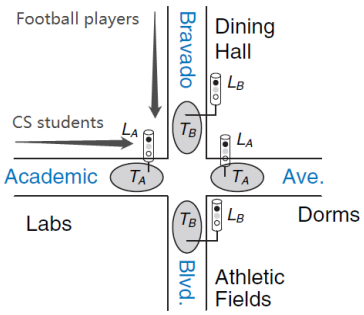

Figure 2: Intersection map

5. The snail from our course has a daughter with a Mealy machine FSM brain. The daughter snail smiles whenever she slides over the pattern 1101 or the pattern 1110. Sketch the state transition diagram for this happy snail using as few states as possible. Choose state encodings and write a combined state transition and output table using your encodings. Write the next state and output equations and sketch your FSM schematic.

Figure 3: The smile snail with a Mealy machine FSM brain