Finite State Machines

1. (Exercise 3.29 from H&H RISC-V Edition Book)

Your company, Detect-o-rama, would like to design an FSM that takes two inputs, A and B, and generates one output, Z. The output on cycle n, Z_n , is either the Boolean AND or OR of the corresponding input A_n and the previous input A_{n-1} , depending on the other input, B_n .

$$\begin{aligned} Z_n &= A_n A_{n-1} \quad if \ B_n = 0\\ Z_n &= A_n + A_{n-1} \ if \ B_n = 1 \end{aligned}$$

a. Sketch the waveform for Z, given the inputs shown in the waveform below.

b. Is this FSM a Moore or Mealy machine. Explain.

c. Design the FSM. Show your state transition diagram, encoded state transition table, next state and output state equations, and schematic.

- 2. Design an FSM with one input *A* and two outputs *Y* and *Z* that monitors the inputs and sets *Y* if the pattern 101 is seen and sets both *Y* and *Z* to one when the pattern 10101 has been seen. If the pattern 111 is seen at any point, both outputs should be reset and the FSM returns to its initial state.
 - a. Step 1: Understand problem statement, determine inputs and outputs

b. Step 2: Choose Moore vs Mealy, identify states, create state diagram

c. Step 3: Determine state encoding

d. Create FSM state transition and output tables

e. Step 5: Determine FSM state transition and output functions

3. (Exercise 3.31 from H&H RISC-V Edition Book)

Analyze the FSM shown below. Write the state transition and output tables and sketch the state transition diagram.

4. (Exercise 3.32 from H&H RISC-V Edition Book)

Analyze the FSM shown below. Write the state transition and output tables and sketch the state transition diagram. Recall that the *s* and *r* inputs indicate set and reset, respectively.

5. For the FSM below do the following:



a. Provide expressions for next state and output.

- b. Is this a Moore or Mealy machine? Explain.
- c. From the table derived in (a), draw the state diagram. What is the functionality of this FSM?

6. For the FSM below do the following:



a. Provide expressions for next state and output.

- b. Is this a Moore or Mealy machine? Explain.
- c. From the table derived in (a), draw the state diagram. What is the functionality of this FSM?