ELEC6236 State Machine Exercises

1. Explain the difference between a Mealy machine and a Moore machine.

2. Describe the symbols used in an ASM diagram.

3. Draw an ASM chart to describe a state machine that detects a sequence of three logic 1’s occurring at the input and that asserts a logic 1 at the output during the last state of the sequence. E.g. the sequence 00101101111 would produce an output 000000100011.

4. A state machine has two inputs, A, B, and one output, Z. If the sequence of input pairs: A=1 B=1, A=1 B=0, A=0 B =0 is detected, Z becomes 1 during the final cycle of the sequence, otherwise the output remains at 0. Draw an ASM chart of this state machine.

5. Design, using an ASM chart, a traffic signal controller for a crossroads. The signals change only when a car is detected in the direction with a red signal. The signals change in the sequence: Red, Yellow, Green, Red. Note that while the signals in one direction are Green, or Yellow, the signals in the other direction are Red (i.e. you need more than 3 states). Design an implementation that uses a minimal number of D flip-flops.

6. A counter is required to count people entering and leaving a room. The room has a separate entrance and exit. Sensors detect people entering and leaving. Up to seven people are allowed in the room at one time. Draw an ASM chart of a synchronous counter that counts the people in the room and that indicates when the room is empty and full. One person may enter and one person may leave during each clock cycle. The empty and full indicators should be asserted immediately the condition is true, i.e. before the next clock edge. Draw an ASM chart of this state machine.

7. Construct a state and output table for the state machine represented by Figure 1. Show that the number of states can be reduced. Derive the next state and output logic to implement the reduced state machine using a) a minimal number of D flip-flops and b) the “one hot” D flip-flop method. What are the relative advantages of each method? How has the reduction in the number of states helped in each case?

![ASM Chart for Exercise 7.](image-url)