

**University of Colorado Boulder
ECEE Department**

ECEN 2350 - Digital Logic - Fall 2023

Location: Engineering Center, ECCR 1B40, MWF 1:25PM - 2:15PM

Instructor: Dr. Mona ElHelbawy

Lab #9: Designing a 1011 FSM

Date of Experiment: November 9th, 2023

Names: Connor Sorrell

Non-Overlapping Sequence Detector using Mealy-type Output

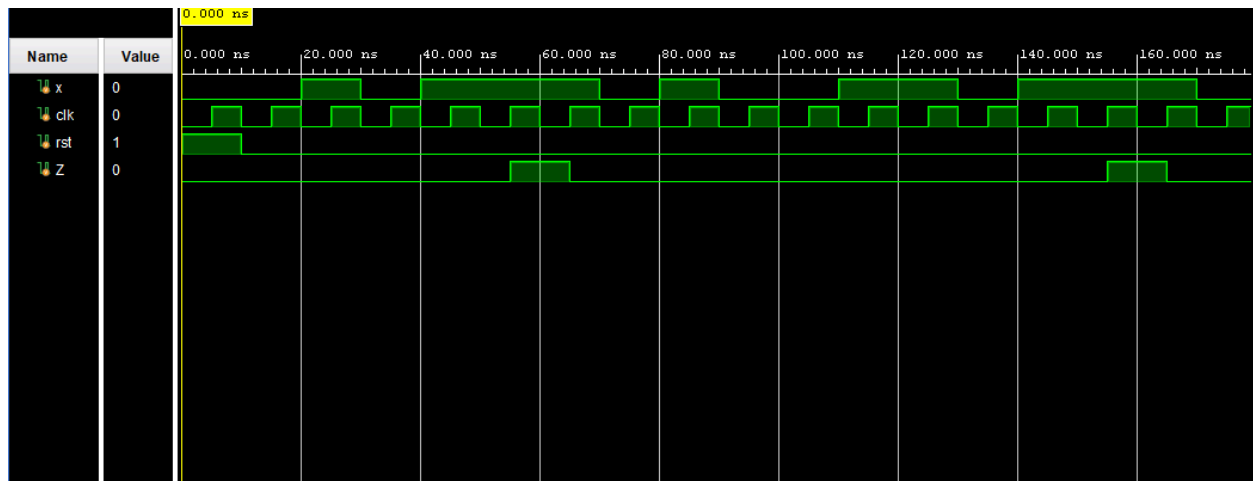


Figure 1.1.0: Timing Diagram of the Non-Overlapping Mealy FSM showing the present state and next state values.

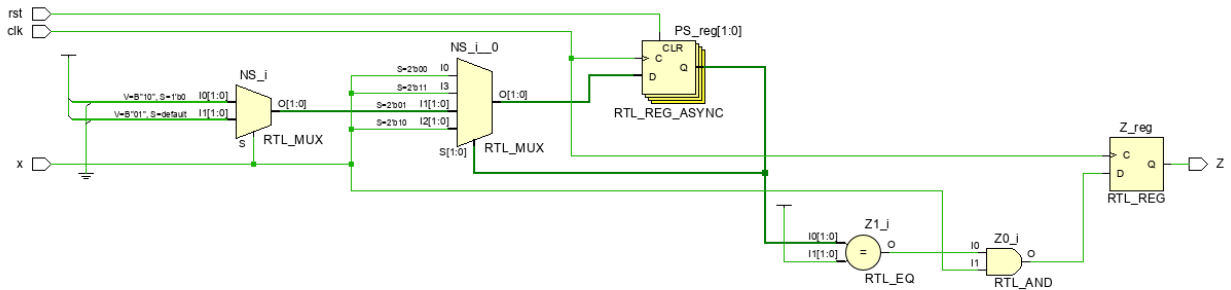


Figure 1.3.1: Circuit schematic of the Non-Overlapping Moore FSM

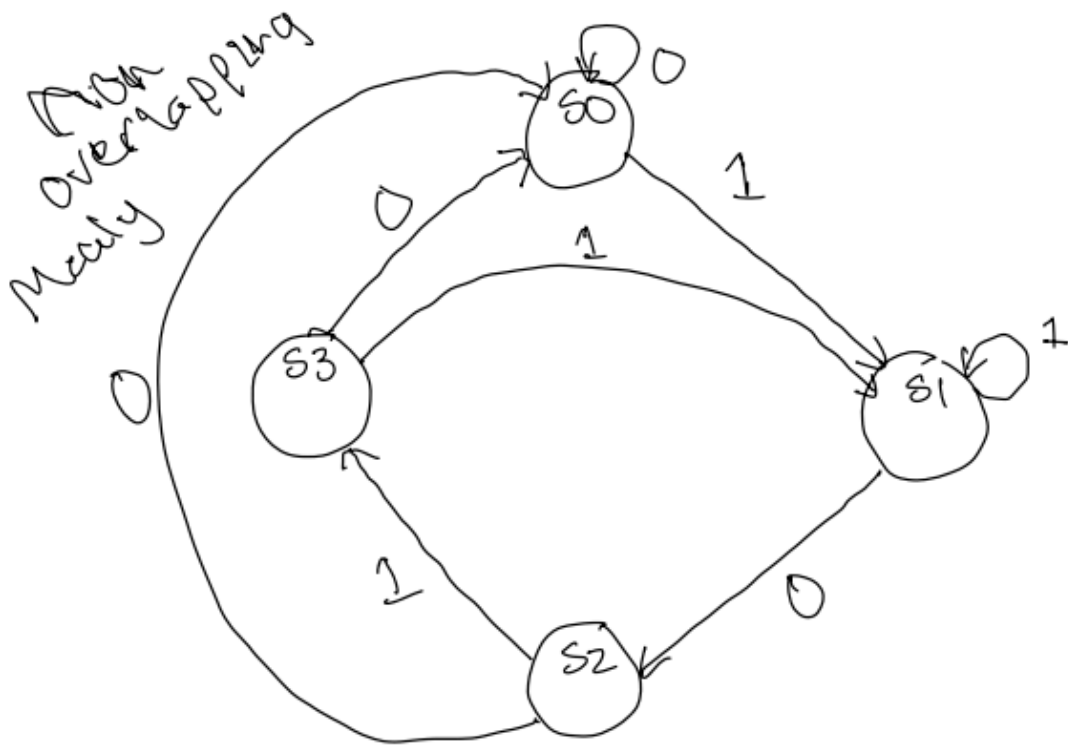


Figure 1.1.2: Finite State Transition Diagram for the Non-Overlapping Mealy-type FSM.

Input (x)	State 0 Transition:	State 1 Transition:	State 2 Transition:	State 3 Transition:
x=1	State 1	State 1	State 3	State 1
x=0	State 0	State 2	State 0	State 0

Sequence Detector using Mealy-type Output

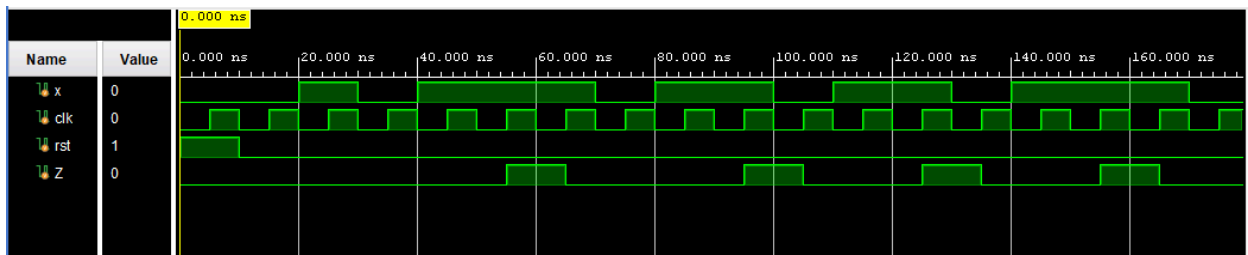


Figure 1.2.0: Timing Diagram of the Overlapping Mealy FSM showing the present state and next state values.

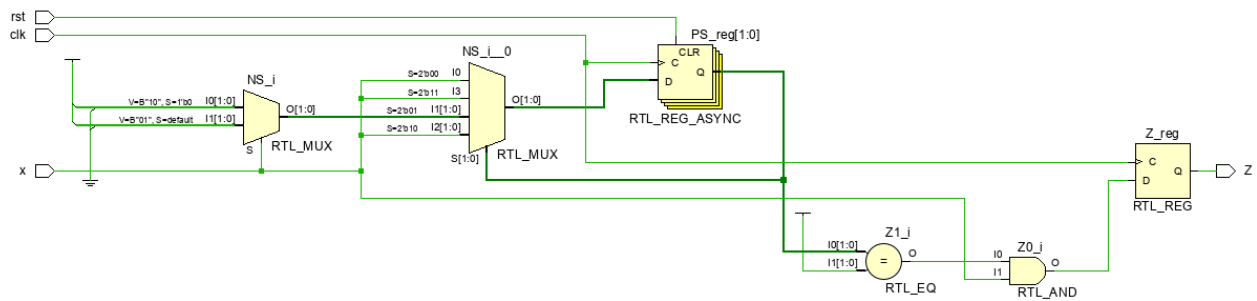


Figure 1.2.1: Circuit schematic of the Overlapping Mealy FSM

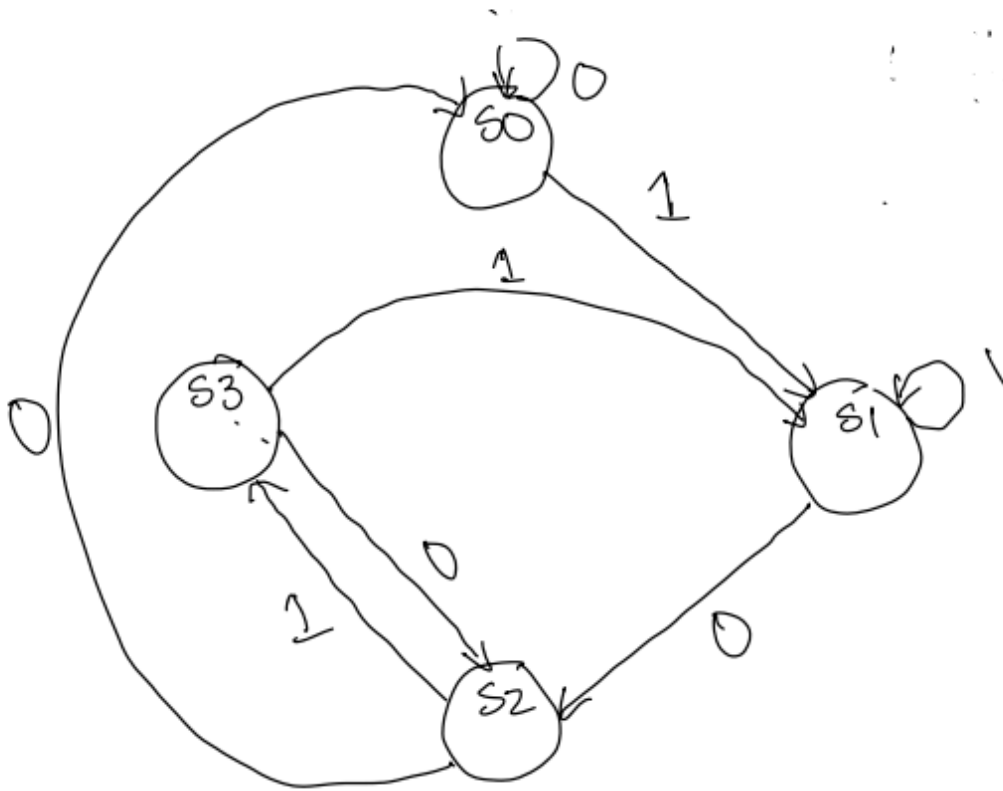


Figure 1.2.2: Finite State Transition Diagram of the Overlapping Mealy-type FSM.

Input (x)	State 0 Transition:	State 1 Transition:	State 2 Transition:	State 3 Transition:
x=1	State 1	State 1	State 3	State 1
x=0	State 0	State 2	State 0	State 2

Figure 1.3.3: Next-State Decoder Table for the Overlapping Mealy-type FSM.

Non-Overlapping Sequence Detector using Moore-type Output

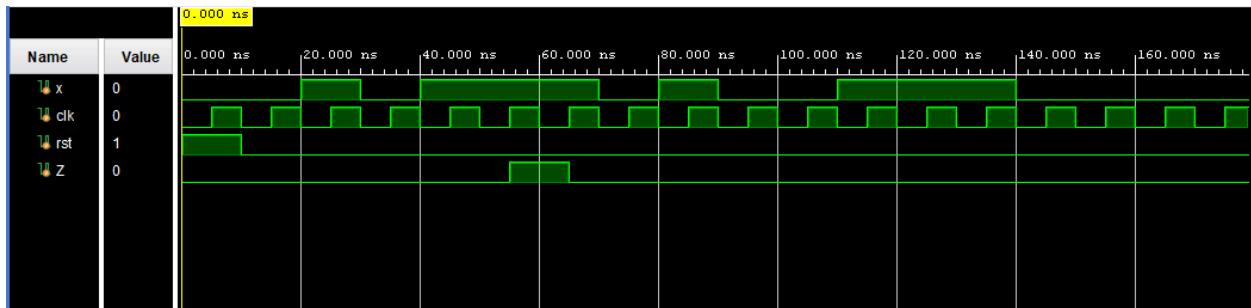


Figure 1.3.0: Timing Diagram of the Non-Overlapping Moore FSM showing the present state and next state values.

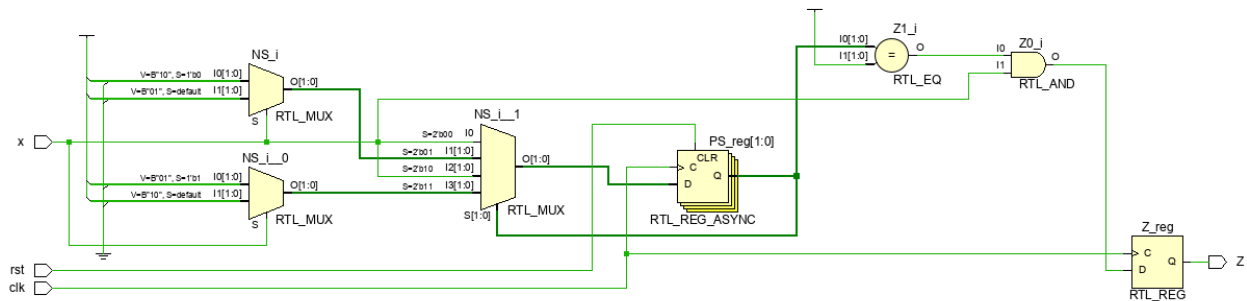


Figure 1.3.1: Circuit schematic of the Non-Overlapping Moore FSM

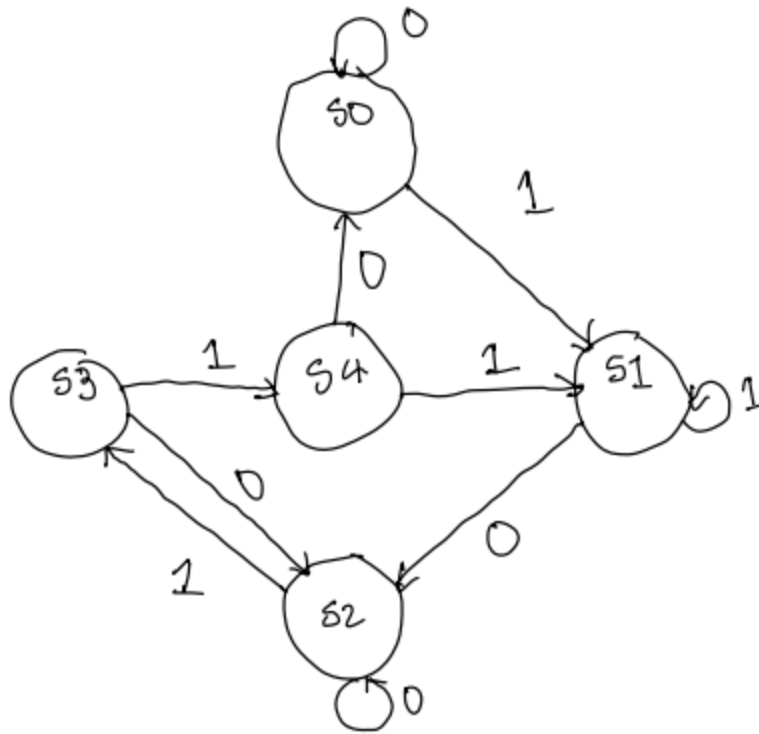


Figure 1.3.2: Finite State Transition Diagram of the Non-Overlapping Moore-type FSM.

Input (x)	State 0 Transition:	State 1 Transition:	State 2 Transition:	State 3 Transition:	State 4 Transition:
x=1	State 1	State 1	State 3	State 4	State 1
x=0	State 0	State 2	State 2	State 2	State 0

Figure 1.3.3: Next-State Decoder Table for the Non-Overlapping Moore-type FSM.

Sequence Detector using Moore-type Output

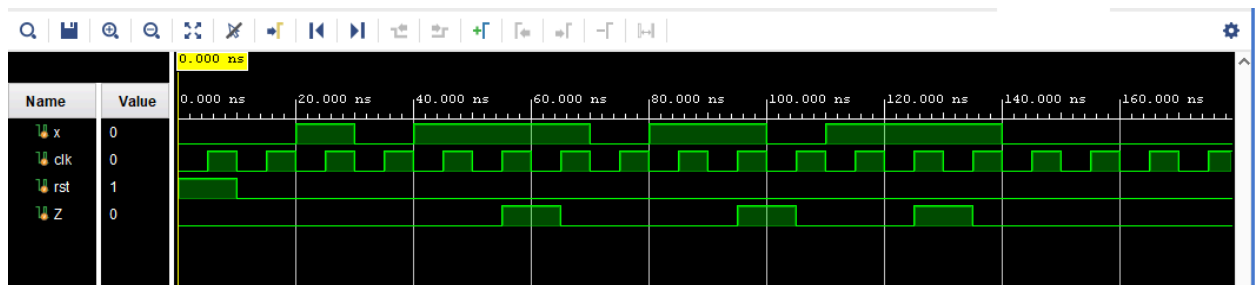


Figure 1.4.0: Timing Diagram of the Overlapping Moore FSM showing the present state and next state values.

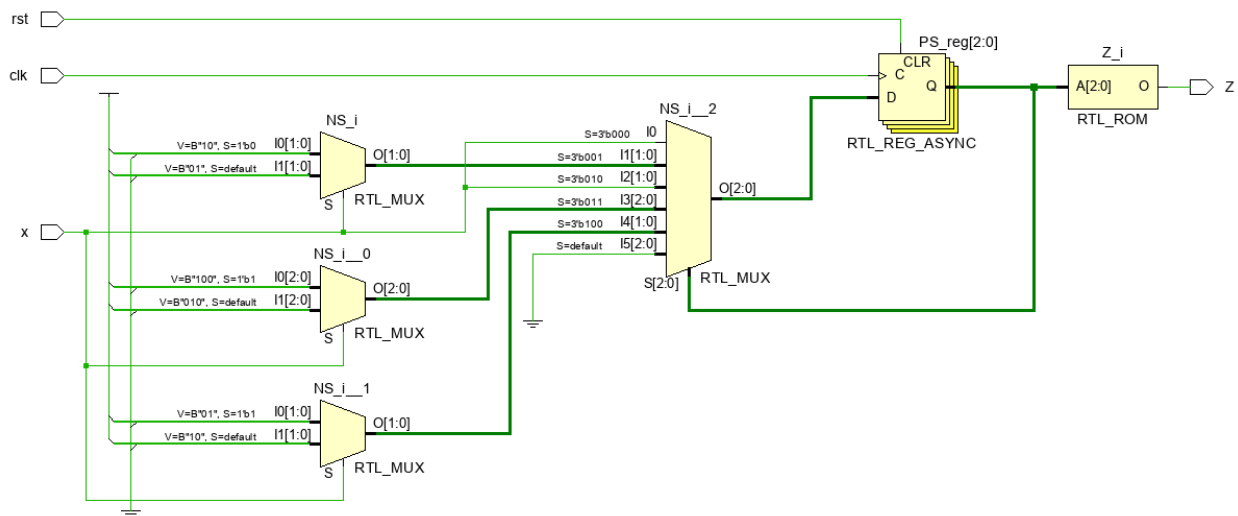


Figure 1.3.1: Circuit schematic of the Overlapping Moore FSM

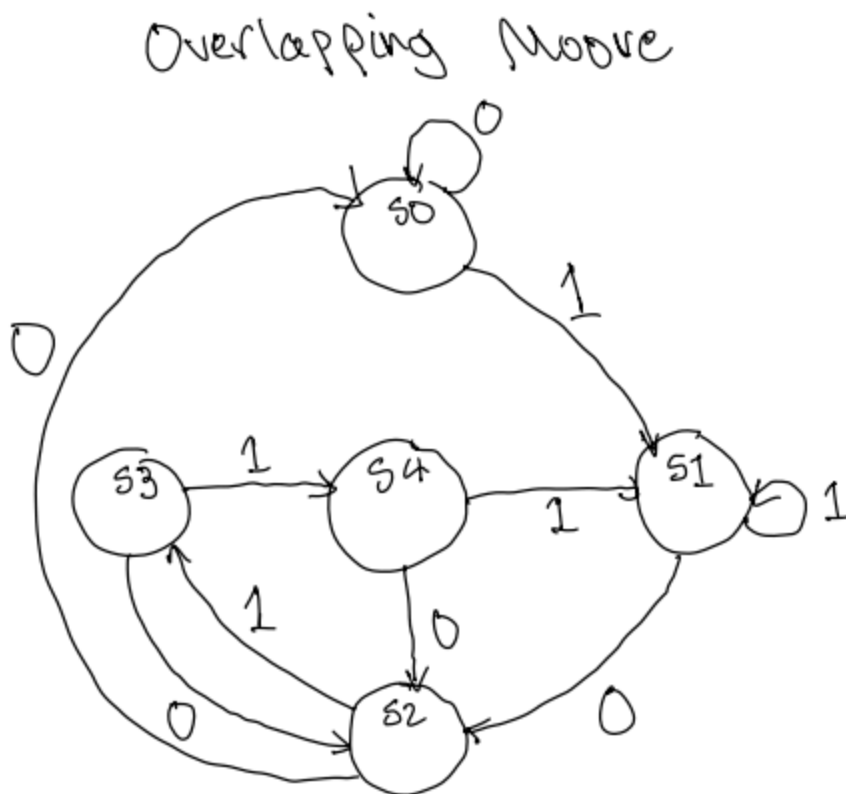


Figure 1.3.2: Finite State Transition Diagram of the Overlapping Moore-type FSM.

Input (x)	State 0 Transition:	State 1 Transition:	State 2 Transition:	State 3 Transition:	State 4 Transition:
x=1	State 1	State 1	State 3	State 4	State 1
x=0	State 0	State 2	State 0	State 2	State 2

Figure 1.3.3: Next-State Decoder Table for the Overlapping Moore-type FSM.

Discussion:

The difference between the Mealy and Moore is that the Mealy-type has one less state than the Moore-type. This shows the functioning difference between different FSMs with Mealy or Moore type outputs.

An FSM with Mealy-type outputs has generally less states than its equivalent with a Moore-type output. This is because Mealy-type outputs can change in the middle of a state, while Moore-type outputs can only change when the state changes. An FSM with Moore outputs must have more states that will be required to generate the correct outputs in states that have Mealy type outputs.

Another difference between the two is that Mealy-type outputs can change with external input changes, meaning that they “react” faster. This is because Moore-type outputs need to wait until the next clock edge to change the output.

Overall, my timing diagrams and schematics looked as expected. I am still learning this subject so the lab was a bit complicated for me, but once I understood FSM's at a basic level, the lab became much simpler. I believe my timing diagrams are all correct, as they show the expected output based on each input.

Though the Mealy uses fewer states and may be faster, the Moore seems simpler to implement. The Moore also has a synchronous output, compared to the Mealy's asynchronous output. I am sure there are advantages and disadvantages to these, when it comes to speed, reliability and other factors. I am excited to continue learning about FSM's so that in the future I will be able to determine whether or not the use of the Moore or Mealy will be more practical for my application.