ANSWER KEY

UF Herbert Wertheim College of Engineering
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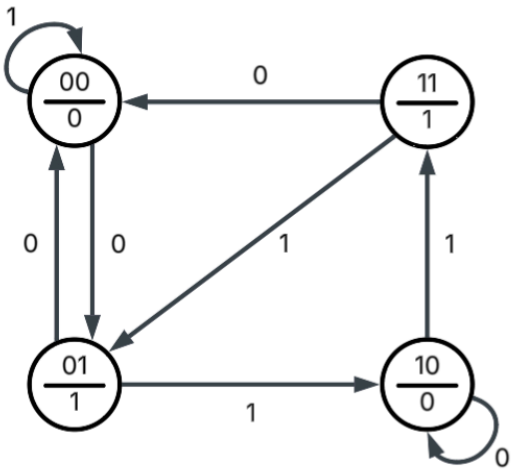
EEL3701C - Fall 2025

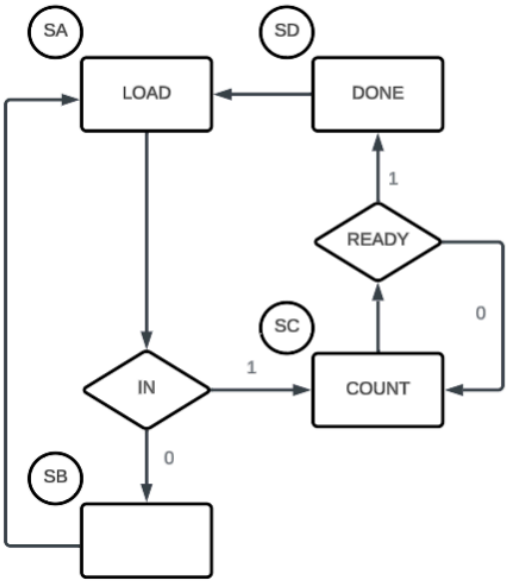
HW5: State Machine Behavior

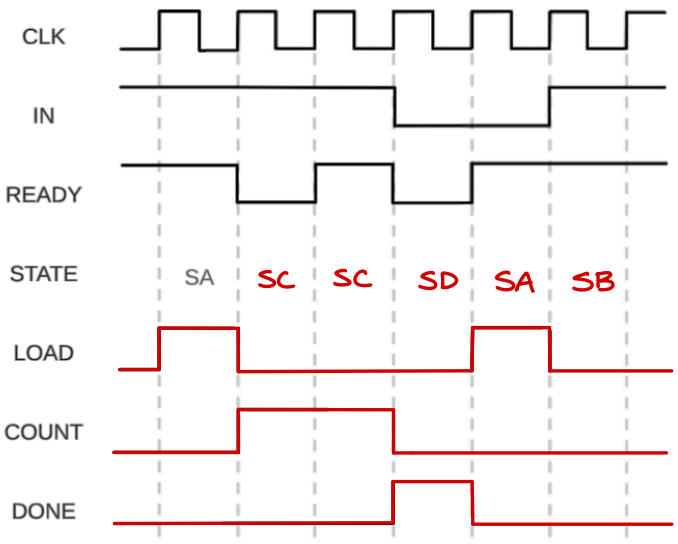
1. Complete the next state truth table for the following FSM diagram. Begin at S0.

Q1	Q0	IN	D1	D0	OUT
0	0	0	0	1	0
0	0	1	0	0	0
0	1	0	0	0	1
0	1	1	1	0	1
1	0	0	1	0	0
1	0	1	1	1	0
1	1	0	0	0	1
1	1	1	0	1	1



2. Given the ASM chart, complete the corresponding timing diagram.





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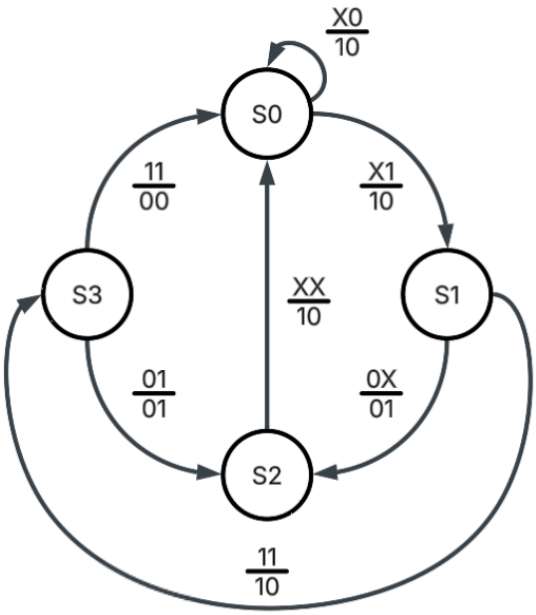
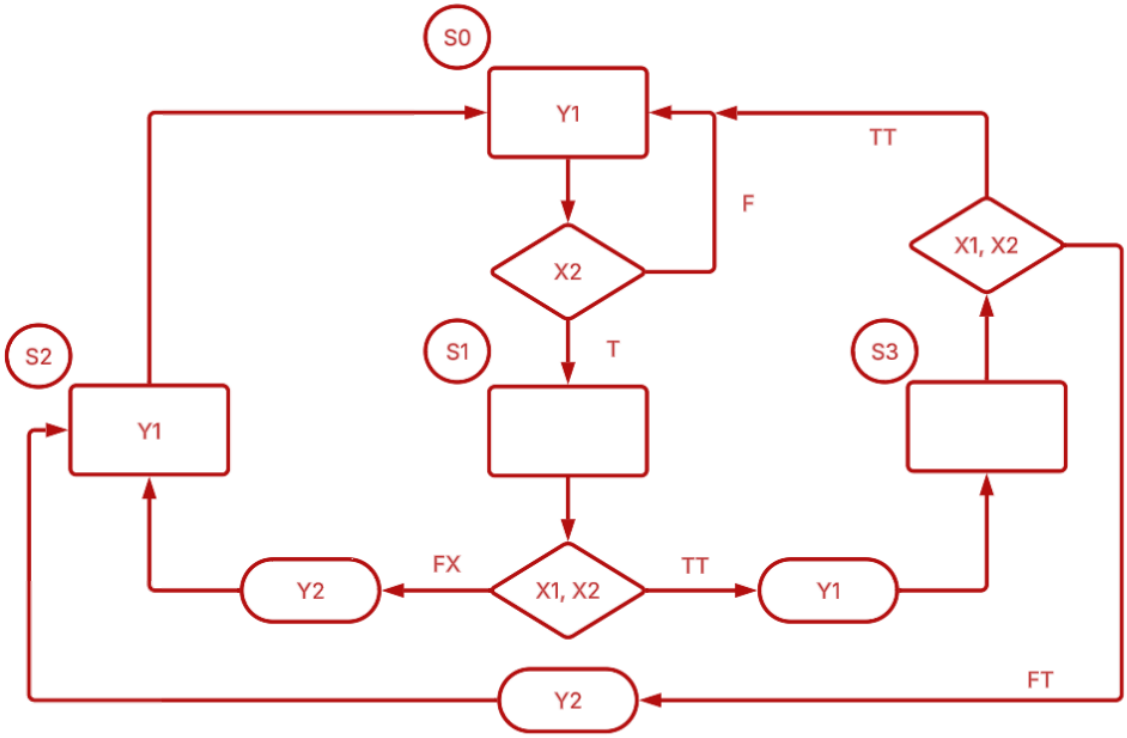
3. Convert the Mealy state graph into an ASM chart given the following:
   - Inputs: X1, X2
   - Outputs: Y1, Y2





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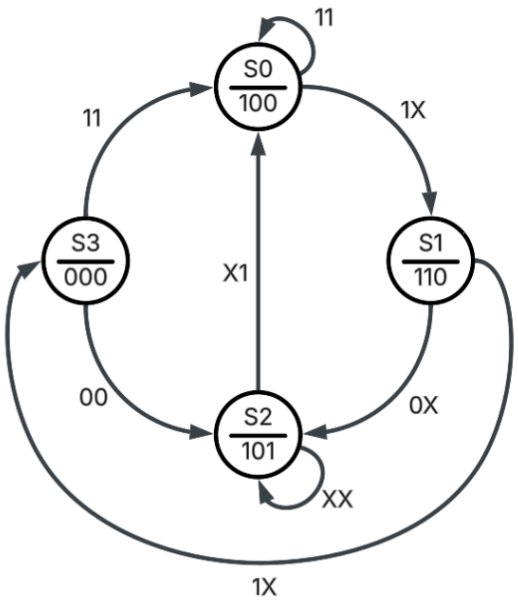
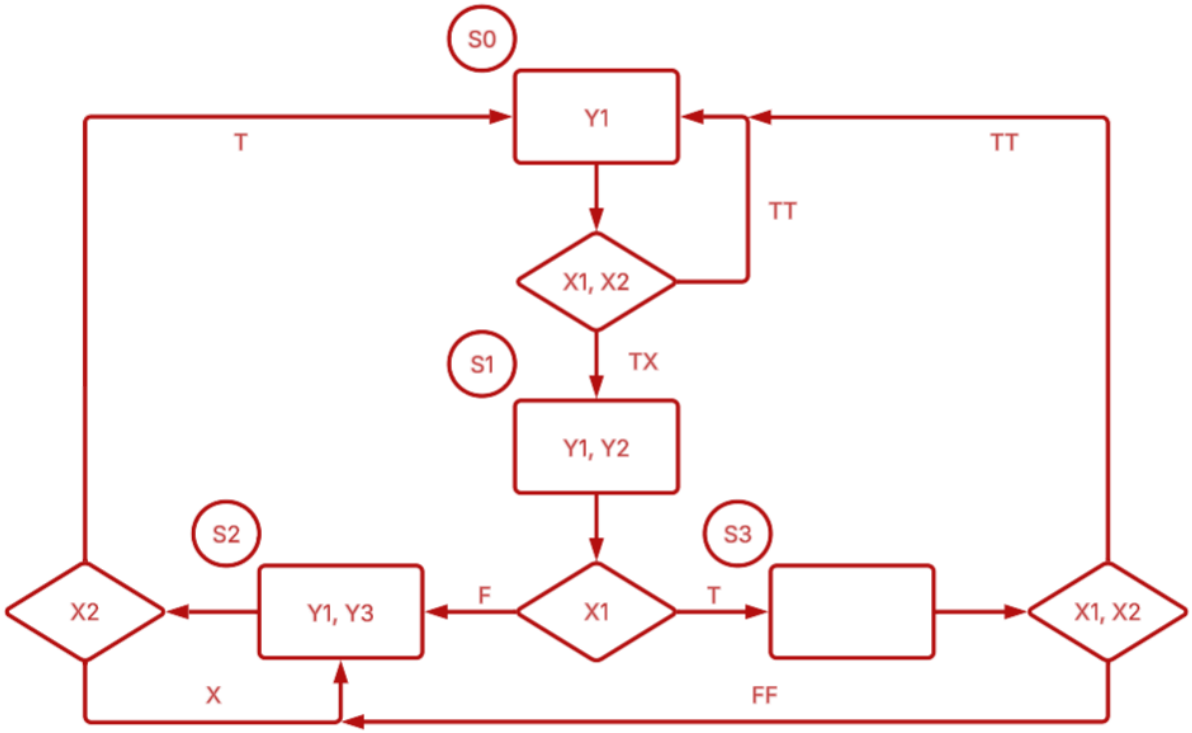
4. Convert the Moore state graph into an ASM chart given the following:
   - Inputs: X1, X2
   - Outputs: Y1, Y2, Y3





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5. A lock is controlled by a Mealy FSM and unlocks when a code is entered in the correct sequence. The system uses the following inputs and outputs:
   - Inputs: A, B, C
   - Outputs: U, R (U = 1 means the safe unlocks, R = 1 means the sequence is invalid)

   If at any point the sequence is incorrect, the FSM will reset and output to X to indicate an invalid code. The safe unlocks when the buttons A, B, C are pressed in that exact order.

   a. Calculate the total ROM size.

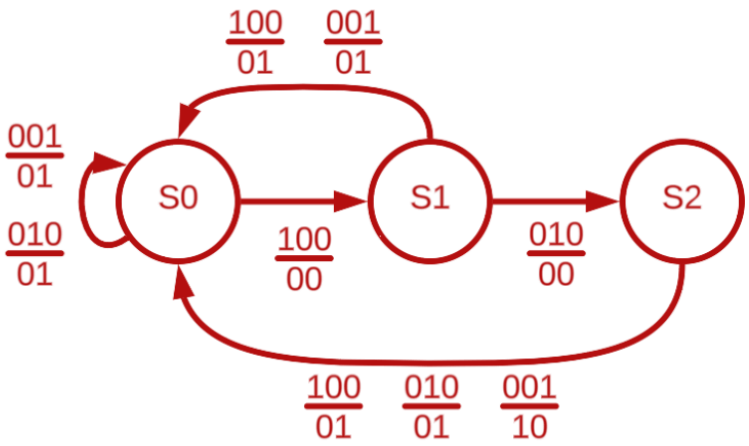
   2 bits for current state (00, 01, 10)
   ROM address size = 5
   $2^5 = 32$ ← ROM size/entries
   2 bits for current state + 2 bits for U & R
   4 bits/word

   total ROM = 32 (4) = 128 bits

   b. How many flip-flops are required for the register?

   3 states → 00, 01, 10
   2 flip-flops

   c. Design the corresponding Mealy FSM.



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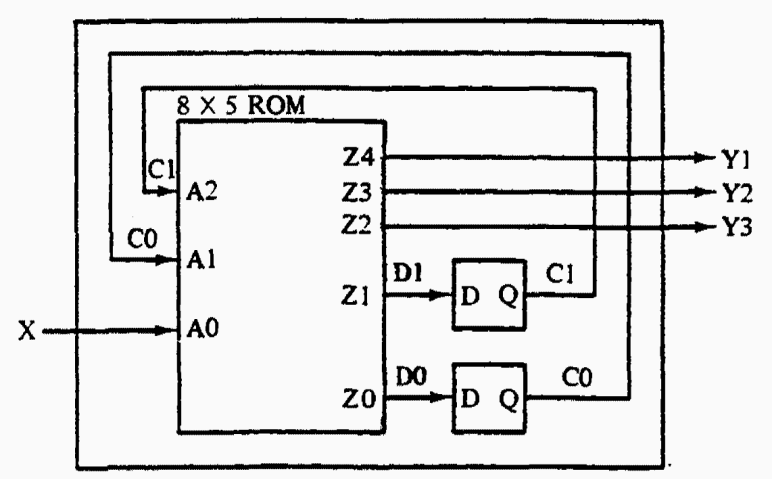
6. Given the block diagram design of a controller based on the ROM method and with D flip-flops, derive the corresponding ASM chart.



Contents of the ROM

Location	Contents
0	11H
1	11H
2	16H
3	0FH
4	00H
5	00H
6	04H
7	04H

A2 C1	A1 C0	A0 X	ROM location	content	Z4 Y1	Z3 Y2	Z2 Y3	Z1 C1+	Z0 C0+
0	0	0	0	11H	1	0	0	0	1
0	0	1	1	11H	1	0	0	0	1
0	1	0	2	16H	1	0	1	1	0
0	1	1	3	0FH	0	1	1	1	1
1	0	0	4	00H	0	0	0	0	0
1	0	1	5	00H	0	0	0	0	0
1	1	0	6	04H	0	0	1	0	0
1	1	1	7	04H	0	0	1	0	0