

CSE 140 Week 6

Discussion

TA: Kanlin Wang

Announcements

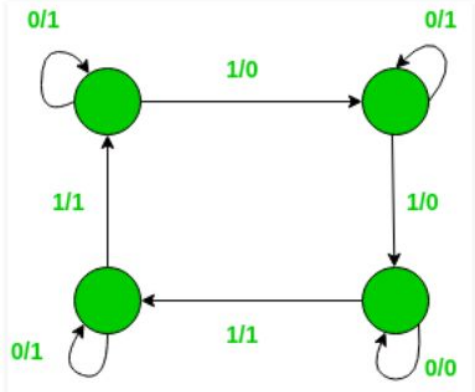
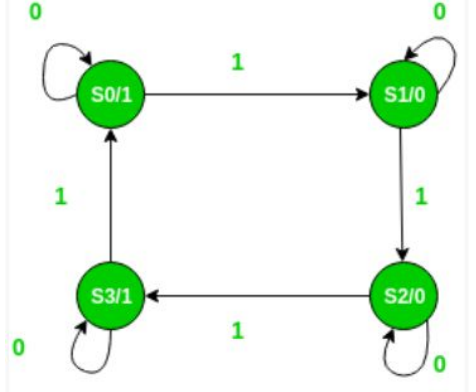
- HW #3 due next Wednesday 5/11 at 11:59 PM
- Midterm 2 coming up soon
- Next week discussion will be Midterm 2 review

Outline

- Mealy to Moore machine conversion
- Pattern Recognizer
- Sequential machine synthesis from State diagram to logic diagram — Sequential Circuit Analysis

Mealy to Moore machine conversion

Difference between Mealy machine and Moore machine:

Mealy Machine	Moore Machine
Output depends on present state as well as present input	Output depends only upon present state
 The diagram shows a Mealy machine with four states represented by green circles. Transitions are labeled with input/output pairs in green. Self-loops are labeled 0/1, 1/1, and 0/0. Transitions between states are labeled 1/0 and 1/1. Figure - Mealy machine	 The diagram shows a Moore machine with four states labeled S0/1, S1/0, S2/0, and S3/1, represented by green circles. Transitions are labeled with inputs in green. Self-loops are labeled 0. Transitions between states are labeled 1. Figure - Moore machine

3 Mealy and Moore Machine Conversion (25 Points)

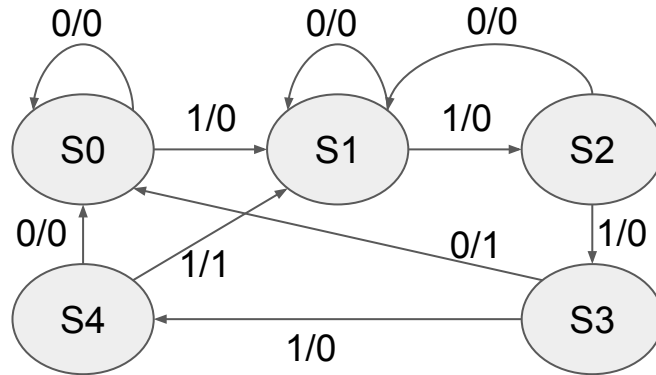
Given the state table below for a Mealy state machine with input x and output y ,

Present State	Next State, Output	
	$x(t) = 0$	$x(t) = 1$
S0	S0,0	S1,0
S1	S1,0	S2,0
S2	S1,0	S3,0
S3	S0,1	S4,0
S4	S0,0	S1,1

3 Mealy and Moore Machine Conversion (25 Points)

Given the state table below for a Mealy state machine with input x and output y ,

Present State	Next State, Output	
	$x(t) = 0$	$x(t) = 1$
S0	S0,0	S1,0
S1	S1,0	S2,0
S2	S1,0	S3,0
S3	S0,1	S4,0
S4	S0,0	S1,1



3 Mealy and Moore Machine Conversion (25 Points)

Given the state table below for a Mealy state machine with input x and output y ,

Present State	Next State, Output	
	$x(t) = 0$	$x(t) = 1$
S0	S0,0	S1,0
S1	S1,0	S2,0
S2	S1,0	S3,0
S3	S0,1	S4,0
S4	S0,0	S1,1

1. Identify distinct (NS, y) pair
2. Replace each distinct (NS, y) pair with distinct new states
3. Insert rows of present state = new states

3.

s(t)	$x(t)=0$	$x(t)=1$	y
S0	S0	S1	0
S1	S1	S2	0
S2	S1	S3	0
S3			
S4			
S5			
S6			

3 Mealy and Moore Machine Conversion (25 Points)

Given the state table below for a Mealy state machine with input x and output y ,

Present State	Next State, Output	
	$x(t) = 0$	$x(t) = 1$
S0	S0,0	S1,0
S1	S1,0	S2,0
S2	S1,0	S3,0
S3	S0,1	S4,0
S4	S0,0	S1,1

1. Identify distinct (NS, y) pair
2. Replace each distinct (NS, y) pair with distinct new states
3. Insert rows of present state = new states

1. (S0,0),(S0,1),
(S1,0), (S1,1),
(S2,0),
(S3,0),
(S4,0)
2. (S0,0),(S5,1),
(S1,0), (S6,1),
(S2,0),
(S3,0),
(S4,0)

3.

s(t)	x(t)=0	x(t)=1	y
S0	S0	S1	0
S1	S1	S2	0
S2	S1	S3	0
S3	S5	S4	0
S4	S0	S6	0
S5	S0	S1	1
S6	S1	S2	1

4 Pattern Recognizer

A sequential network has one binary input $x(t)$ and one binary output $y(t)$. The network produces $y = 1$, whenever input pattern $x(t-3, t) = 0010$ or 0111 . Otherwise, the output $y = 0$.

- (i) Draw the state diagram.
- (ii) Write the state table.

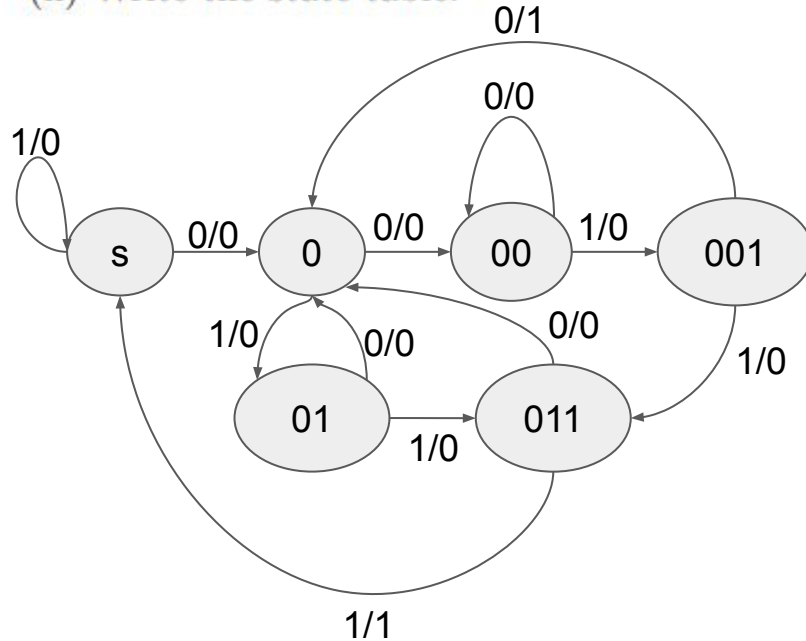
4 Pattern Recognizer

A sequential network has one binary input $x(t)$ and one binary output $y(t)$. The network produces $y = 1$, whenever input pattern $x(t-3, t) = 0010$ or 0111 . Otherwise, the output $y = 0$.

(i) Draw the state diagram.

(ii) Write the state table.

i)



PS	$x(t)=0$	$x(t)=1$	$y(t)$ $x(t)=0$	$y(t)$ $x(t)=1$
S				
0				
00				
01				
001				
011				

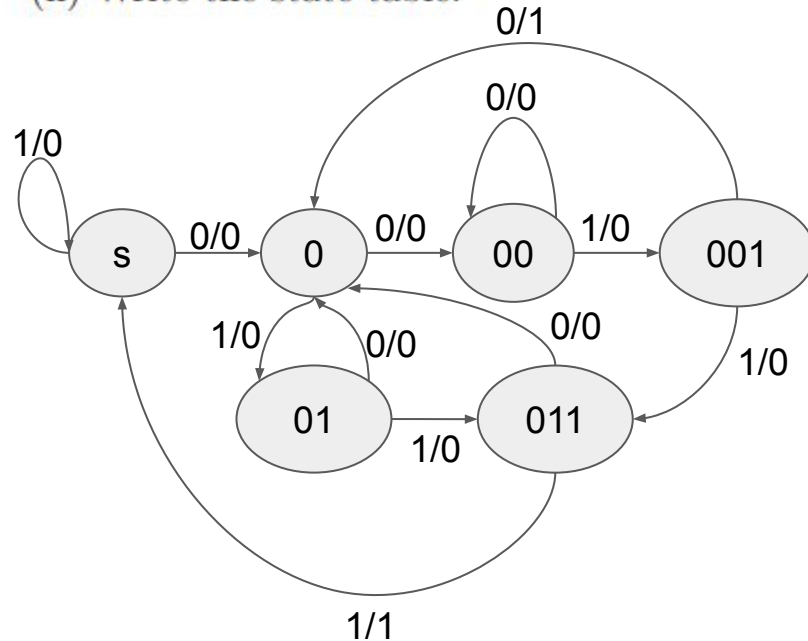
4 Pattern Recognizer

A sequential network has one binary input $x(t)$ and one binary output $y(t)$. The network produces $y = 1$, whenever input pattern $x(t-3, t) = 0010$ or 0111 . Otherwise, the output $y = 0$.

(i) Draw the state diagram.

(ii) Write the state table.

i)



PS	$x(t)=0$	$x(t)=1$	$y(t)$ $x(t)=0$	$y(t)$ $x(t)=1$
S	0	S	0	0
0	00	01	0	0
00	00	001	0	0
01	0	011	0	0
001	0	011	1	0
011	0	S	0	1

5 Sequential Circuit Analysis

Given a state machine has one input $x(t)$ and two-bit state $(Q_1(t), Q_0(t))$. The machine is described by the following state equations.

$$Q_1(t+1) = x(t)Q_0'(t) + Q_1(t),$$

$$Q_0(t+1) = x(t)Q_1'(t)Q_0(t) + x'(t)Q_1(t).$$

Use two D flip-flops and a minimal sum-of-products network to implement the machine.

- Write the state table of the system.
- Describe the design using a logic diagram. Show your derivation using K maps.

i)

5 Sequential Circuit Analysis

Given a state machine has one input $x(t)$ and two-bit state $(Q_1(t), Q_0(t))$. The machine is described by the following state equations.

$$Q_1(t+1) = x(t)Q_0'(t) + Q_1(t),$$

$$Q_0(t+1) = x(t)Q_1'(t)Q_0(t) + x'(t)Q_1(t).$$

Use two D flip-flops and a minimal sum-of-products network to implement the machine.

(i). Write the state table of the system.

(ii). Describe the design using a logic diagram. Show your derivation using K maps.

i)

Q1Q0	x(t)=0	x(t)=1
00	00	10
01	00	01
10	11	10
11	11	10

ii)

(ii). Describe the design using a logic diagram. Show your derivation using K maps.

i)

Q1Q0	x(t)=0	x(t)=1
00	00	10
01	00	01
10	11	10
11	11	10

ii) K-map for Q1(t+1)

K-map for Q0(t+1)

(ii). Describe the design using a logic diagram. Show your derivation using K maps.

i)

Q1Q0	x(t)=0	x(t)=1
00	00	10
01	00	01
10	11	10
11	11	10

ii) K-map for Q1(t+1)

x(t)\Q1(t)Q2(t)	00	01	11	10
0	0	0	1	1
1	1	0	1	1

$$Q1(t+1) = Q1(t) + x(t)Q0(t)'$$

K-map for Q0(t+1)

x(t)\Q1(t)Q2(t)	00	01	11	10
0	0	0	1	1
1	0	1	0	0

$$Q0(t+1) = x(t)Q1(t)'Q0(t) + x(t)'Q1(t)$$

(ii). Describe the design using a logic diagram. Show your derivation using K maps.

ii) $D1 = Q1(t+1) = Q1(t) + x(t)Q0(t)'$

$$D0 = Q0(t+1) = x(t)Q1(t)'Q0(t) + x(t)'Q1(t)$$