Digital Electronics

EEEN 20050

HOMEWORK 2

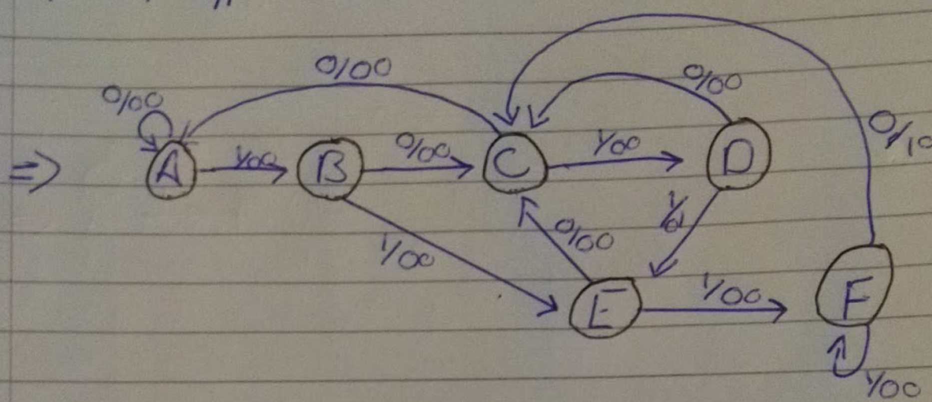
Fergal Lonergan

13456938

Mealy Machine

Sequences: 1011 & 1110

Flip Flop Type: JK



A: No digits for either sequence have been seen.
B: We have seen a (1) beginning of both sequences.
C: We have seen the first two digits of the first sequence (10)
D: We have seen the first three digits of the first sequence (101)
E: We have seen the first two digits of the second sequence (11)
F: We have seen the first three digits of the second sequence.

C: Is also where we return to if we have detected all of sequence two (1110)
E: Is also where we return to if we have detected all of sequence one (1011)

Present State	Input	Next State	Output
A	0	A	0 0
A	1	B	0 0
B	0	C	0 0
B	1	E	0 0
C	0	A	0 0
C	1	D	0 0
D	0	C	0 0
D	1	E	0 1
E	0	C	0 0
E	1	F	0 0
F	0	C	1 0
F	1	F	0 0

	Present State	Input	Next State	Output
A	0 0 0	0	0 0 0	0 0
	0 0 0	1	0 0 1	0 0
B	0 0 1	0	0 1 0	0 0
	0 0 1	1	1 0 0	0 0
C	0 1 0	0	0 0 0	0 0
	0 1 0	1	0 1 1	0 0
D	0 1 1	0	0 1 0	0 0
	0 1 1	1	1 0 0	0 1
E	1 0 0	0	0 1 0	0 0
	1 0 0	1	1 0 1	0 0
F	1 0 1	0	0 1 0	1 0
	1 0 1	1	1 0 1	0 0

PRESENT STATE Q_2	Q_1	Q_0	INPUT (X)	NEXT STATE Q_2	Q_1	Q_0	FLIP-FLOP INPUTS J_2	K_2	J_1	K_1	J_0	K_0	OUTPUT (Z) Z_1	Z_0
0	0	0	0	0	0	0	0	X	0	X	0	X	0	0
0	0	0	1	0	0	1	0	X	0	X	1	X	0	0
0	0	1	0	0	1	0	0	X	1	X	X	1	0	0
0	0	1	1	1	0	0	1	X	0	X	X	1	0	0
0	1	0	0	0	0	0	0	X	X	1	0	X	0	0
0	1	0	1	0	1	1	0	X	X	0	1	X	0	0
0	1	1	0	0	1	0	0	X	X	0	X	1	0	0
0	1	1	1	1	0	0	1	X	X	1	X	1	0	1
1	0	0	0	0	1	0	X	1	1	X	0	X	0	0
1	0	0	1	1	0	1	X	0	0	X	1	X	0	0
1	0	1	0	0	1	0	X	1	1	X	X	1	0	0
1	0	1	1	1	0	1	X	0	0	X	X	0	1	0

Q(t)	Q(t+1)	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

J_0

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	0	1	X	X
0 1	0	1	X	X
1 1	X	X	X	X
1 0	0	1	X	X

$J_0 = X$

K_0

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	X	X	1	1
0 1	X	X	1	1
1 1	X	X	X	X
1 0	X	X	0	1

$K_0 = \overline{Q_2} + \bar{X}$

Z_1

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	0	0	0	0
0 1	0	0	0	0
1 1	X	X	X	X
1 0	0	0	1	0

$Z_1 = Q_2 Q_0 X$

Z_0

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	0	0	0	0
0 1	0	0	1	0
1 1	X	X	X	X
1 0	0	0	0	0

$Z_0 = Q_1 Q_0 X$

J_2

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	0	0	1	0
0 1	0	0	1	0
1 1	X	X	X	X
1 0	X	X	X	X

$J_2 = Q_0 X$

K_2

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	X	X	X	X
0 1	X	X	X	X
1 1	X	X	X	X
1 0	1	0	0	1

$K_2 = \bar{X}$

J_1

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	0	0	1	0
0 1	X	X	X	X
1 1	X	X	X	X
1 0	1	0	0	1

$J_1 = \bar{Q}_2 Q_0 X + Q_2 \bar{X}$

K_1

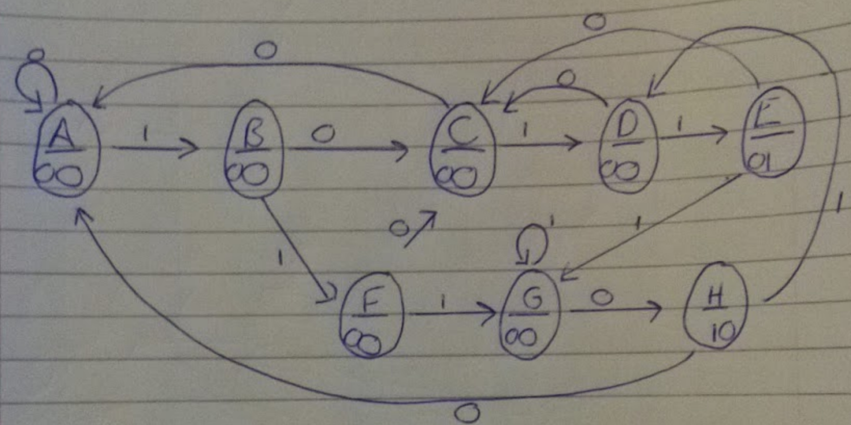
Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	X	X	X	X
0 1	1	0	1	0
1 1	X	X	X	X
1 0	X	X	X	X

$K_1 = \bar{Q}_0 \bar{X} + \bar{Q}_2 Q_0 X$

Moore

Sequences: 1011 & 1110

Flip Flop type: JK



A: None of either of our desired patterns have been read yet
B: The first bit (1) of both our sequences has been read
C: The first two bits (10) of our first sequence has been read
D: The first three bits of our first sequence (101) has been read
E: We have read all bits (1011) of our first sequence
F: The first two bits of our second sequence (11) have been read
G: The first three bits (111) of our second sequence have been read
H: We have read all the bits for our second sequence (1110)

PRESENT STATE	INPUT	NEXT STATE	OUTPUT
A	0	A	0 0
A	1	B	
B	0	C	0 0
B	1	F	
C	0	A	0 0
C	1	D	
D	0	C	0 0
D	1	E	
E	0	C	0 1
E	1	G	
F	0	C	0 0
F	1	G	
G	0	H	0 0
G	1	G	
H	0	A	1 0
H	1	D	

	PRESENT STATE	INPUT	NEXT STATE	OUTPUT
A	0 0 0	0	0 0 0	0 0
	0 0 0	1	0 0 1	
B	0 0 1	0	0 1 0	0 0
	0 0 1	1	1 0 1	
C	0 1 0	0	0 0 0	0 0
	0 1 0	1	0 1 1	
D	0 1 1	0	0 1 0	0 0
	0 1 1	1	1 0 0	
E	1 0 0	0	0 1 0	0 1
	1 0 0	1	1 1 0	
F	1 0 1	0	0 1 0	0 0
	1 0 1	1	1 1 0	
G	1 1 0	0	1 1 1	0 0
	1 1 0	1	1 1 0	
H	1 1 1	0	0 0 0	1 0
	1 1 1	1	0 1 1	

PRESENT STATE			INPUT (x)	NEXT STATE			JK FLIP FLOPS						OUTPUT	
							J_2	K_2	J_1	K_1	J_0	K_0	Z_1	Z_0
0	0	0	0	0	0	0	0	X	0	X	0	X	0	0
0	0	0	1	0	0	1	0	X	0	X	1	X		
0	0	1	0	0	1	0	0	X	1	X	X	1	0	0
0	0	1	1	1	0	1	1	X	0	X	X	0		
0	1	0	0	0	0	0	0	X	X	1	0	X	0	0
0	1	0	1	0	1	1	0	X	X	0	1	X		
0	1	1	0	0	1	0	0	X	X	0	X	1	0	0
0	1	1	1	1	0	0	1	X	X	1	X	1		
1	0	0	0	0	1	0	X	1	1	X	0	X	0	1
1	0	0	1	1	1	0	X	0	1	X	0	X		
1	0	1	0	0	1	0	X	1	1	X	X	1	0	0
1	0	1	1	1	1	0	X	0	1	X	X	1		
1	1	0	0	1	1	1	X	0	X	0	1	X	0	0
1	1	0	1	1	1	0	X	0	X	0	0	X		
1	1	1	0	0	0	0	X	1	X	1	X	1	1	0
1	1	1	1	0	1	1	X	1	X	0	X	0		

J_2

$Q_2 \; Q_1$ \ $Q_0 \; X$	00	01	11	10
0 0	0	0	1	0
0 1	0	0	1	0
1 1	X	X	X	X
1 0	X	X	X	X

$J_2 = Q_0 X$

K_2

$Q_2 \; Q_1$ \ $Q_0 \; X$	00	01	11	10
0 0	X	X	X	X
0 1	X	X	X	X
1 1	0	0	1	1
1 0	1	0	0	1

$K_2 = Q_1 Q_0 + Q_2 \bar{Q}_1 \bar{X}$

J_1

$Q_2 \; Q_1$ \ $Q_0 \; X$	00	01	11	10
0 0	0	0	0	1
0 1	X	X	X	X
1 1	X	X	X	X
1 0	1	1	1	1

$J_1 = Q_2 + Q_0 \bar{X}$

K_1

$Q_2 \; Q_1$ \ $Q_0 \; X$	00	01	11	10
0 0	X	X	X	X
0 1	1	0	1	0
1 1	0	0	0	1
1 0	X	X	X	X

$K_1 = \bar{Q}_2 Q_0 \bar{X} + \bar{Q}_2 \bar{Q}_0 \bar{X} + \bar{Q}_2 X Q_0$

J_0

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	0	1	X	X
0 1	0	1	X	X
1 1	1	0	X	X
1 0	0	0	X	X

$J_0 = \overline{Q_2} X + Q_2 Q_1 \overline{X}$

K_0

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	X	X	0	1
0 1	X	X	1	1
1 1	X	X	1	1
1 0	X	X	0	1

$K_0 = Q_1 + \overline{X}$

Z_1

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	0	0	0	0
0 1	0	0	0	0
1 1	0	0	1	1
1 0	0	0	0	0

$Z_1 = Q_2 Q_1 Q_0$

Z_0

Q_2 Q_1 \ Q_0 X	00	01	11	10
0 0	0	0	0	0
0 1	0	0	0	0
1 1	0	0	0	0
1 0	1	1	0	0

$Z_0 = Q_2 \overline{Q_1} \overline{Q_0}$

Difference

In a Moore Model State machine the output of a transition is determined by the current state alone whereas in a Mealy Model state machine the output is determined by the combination of the current input and the current state.
Due to this a Moore machine often needs More hardware to design the circuit however it is more robust as it does not depend on inputs.