3.10 inputs: Clk, J, K
outputs: Q

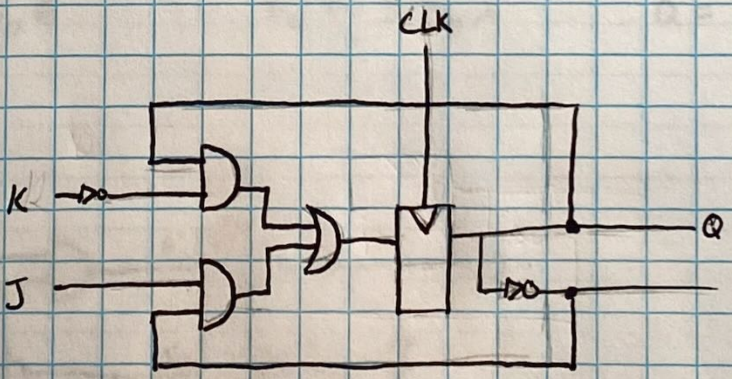
Clk	J	K	Q+
0	0	0	Q
0	0	1	Q
0	1	0	Q
0	1	1	Q
1	0	0	Q
1	0	1	0
1	1	0	1
1	1	1	$\bar{Q}$

0xx | Q

row reduction of

J	K	Q	Q+
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

$$Q+ = J\bar{Q} + \bar{K}Q$$



3.22 Each node in the finite state machine describes the circuit's state at an instance as a result of the previous state.

Figure 3.69 identifies subset AB from the given binary input set. This assumes A or $\bar{A}$ represents the zeroth and even positions while B or $\bar{B}$ represents the odd positions.

	S_1	S_0	Q
S0	0	0	0
S1	0	1	0
S2	1	0	1

Current State	A B	Next State	Q
0 0	0 X	0 0	0
0 0	1 X	0 1	0
0 1	X 0	0 0	0
0 1	X 1	1 0	1
1 0	X X	0 0	0

$S_1 S_0$ \ AB	00	01	11	10
00				
01		1	1	
11	X	X	X	X
10				

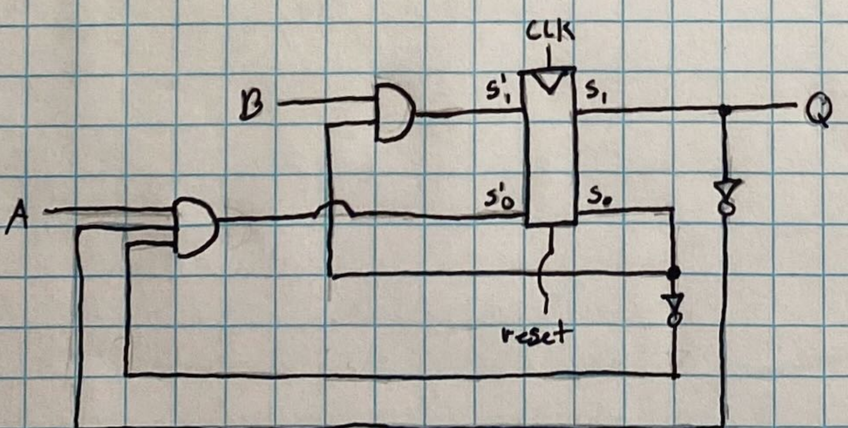
$S_1' = S_0 B$

$S_1 S_0$ \ AB	00	01	11	10
00			1	1
01				
11	X	X	X	X
10				

$S_0' = \bar{S}_1 \bar{S}_0 A$

S_1 \ S_0	0	1
0		
1	1	X

$Q = S_1$



3.23 Similar to the previous state machine, figure 3.70 identifies successions of AB within the binary input set; however, it uses a mealy machine as opposed to a moore machine.

	S_1	S_0
S0	0	0
S1	0	1
S2	1	0

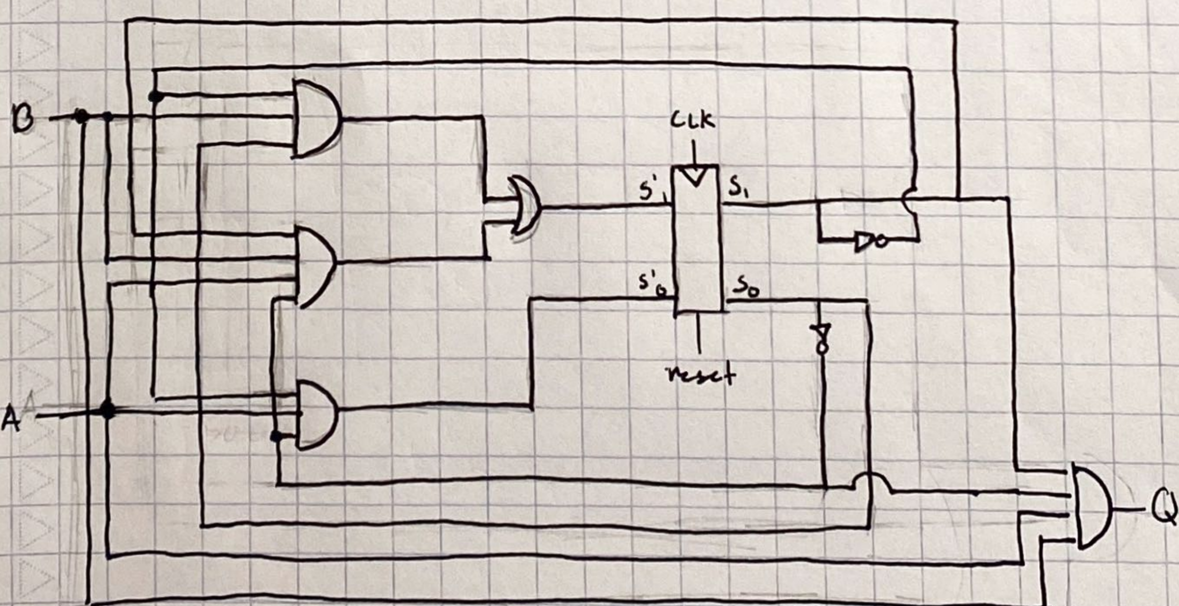
Current State	A B	Next State	Q
0 0	0 x	0 0	0
0 0	1 x	0 1	0
0 1	x 0	0 0	0
0 1	x 1	1 0	0
1 0	0 0	0 0	0
1 0	0 1	0 0	0
1 0	1 0	0 0	0
1 0	1 1	1 0	1

S_1S_0 \ AB	00	01	11	10
00				
01		1	1	
11				
10			1	

S_1S_0 \ AB	00	01	11	10
00			1	1
01				
11				
10				

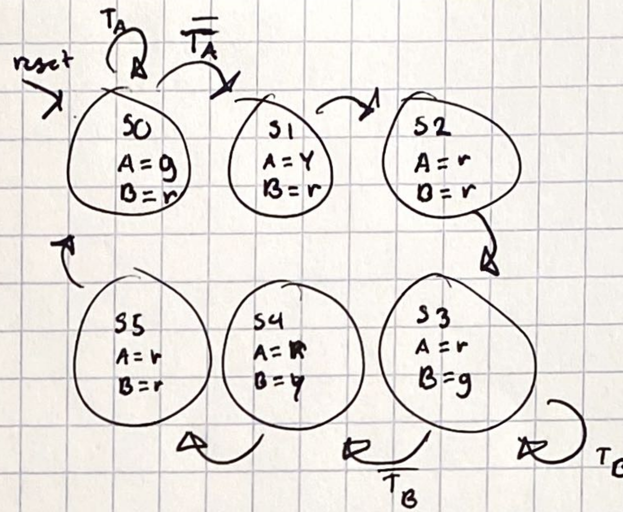
S_1S_0 \ AB	00	01	11	10
00				
01				
11				
10			1	

$S'_1 = \bar{S}_1 S_0 B + S_1 \bar{S}_0 AB$ $\quad S'_0 = \bar{S}_1 \bar{S}_0 A$ $\quad Q = S_1 \bar{S}_0 AB$



3.24

Current State	A B	Next State
0 0 0	0 x	0 0 1
0 0 0	1 x	0 0 0
0 0 1	x x	0 1 0
0 1 0	x x	0 1 1
0 1 1	x 0	1 0 0
0 1 1	x 1	0 1 1
1 0 0	x x	1 0 1
1 0 1	x x	0 0 0

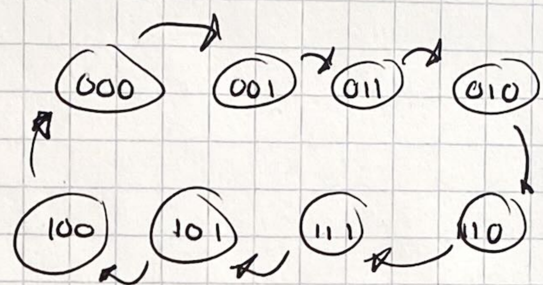


	S_2	S_1	S_0	A: L_1	A: L_0	B: L_1	B: L_0
S0	0	0	0	0	0	1	0
S1	0	0	1	0	1	1	0
S2	0	1	0	1	0	1	0
S3	0	1	1	1	0	0	0
S4	1	0	0	1	0	0	1
S5	1	0	1	1	0	1	0

	L_1	L_0
g	0	0
y	0	1
r	1	0

3.27

Current state			Next state		
s_2	s_1	s_0	s_2'	s_1'	s_0'
0	0	0	0	0	1
0	0	1	0	1	1
0	1	1	0	1	0
0	1	0	1	1	0
1	1	0	1	1	1
1	1	1	1	0	1
1	0	1	1	0	0
1	0	0	0	0	0

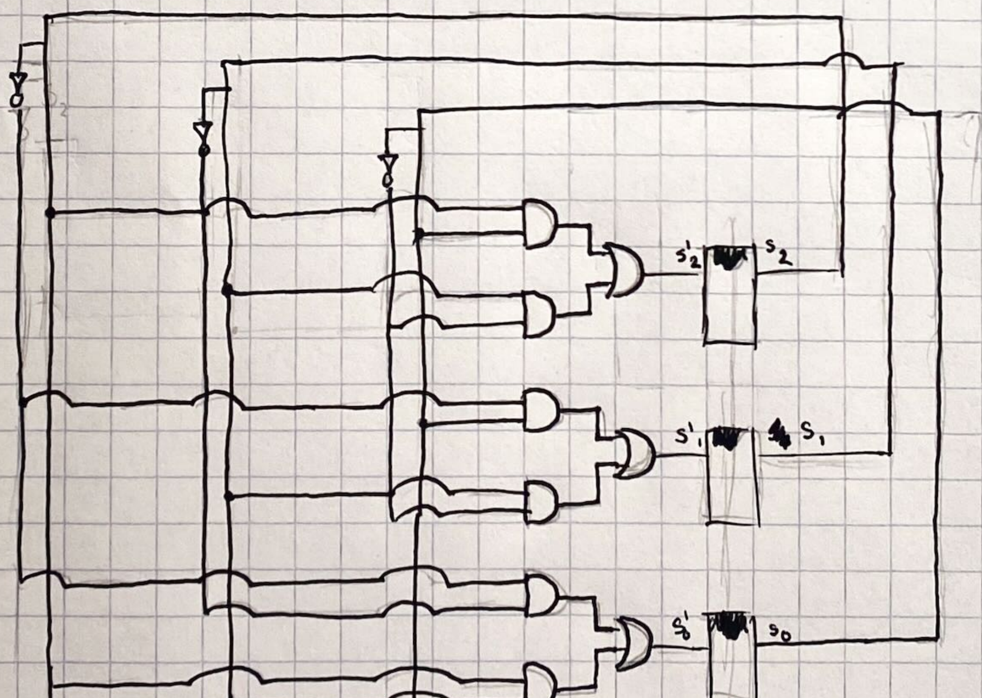


s_2 \ s_1s_0	00	01	11	10
0				1
1		1	1	1

s_2 \ s_1s_0	00	01	11	10
0		1	1	1
1				1

s_2 \ s_1s_0	00	01	11	10
0	1	1		
1			1	1

$s_2' = s_2 s_0 + s_1 \bar{s_0}$ $\quad$ $s_1' = \bar{s_2} s_0 + s_1 \bar{s_0}$ $\quad$ $s_0' = \bar{s_2}\bar{s_1} + s_2 s_1$



3.31 $Q = S_1 + S_0$

$S_1' = X\overline{S_1}$

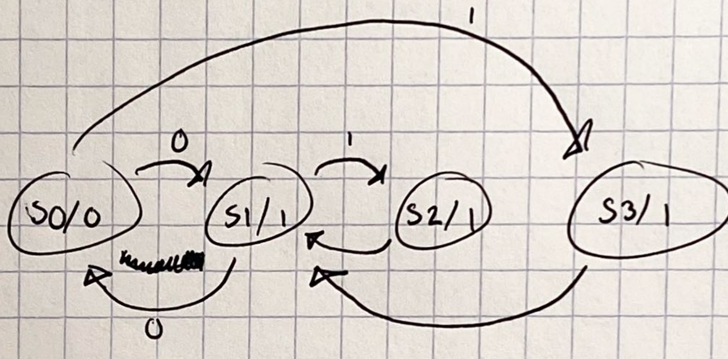
$S_0' = S_1 + \overline{S_0}$

*because Q depends only on states, it is a moore machine

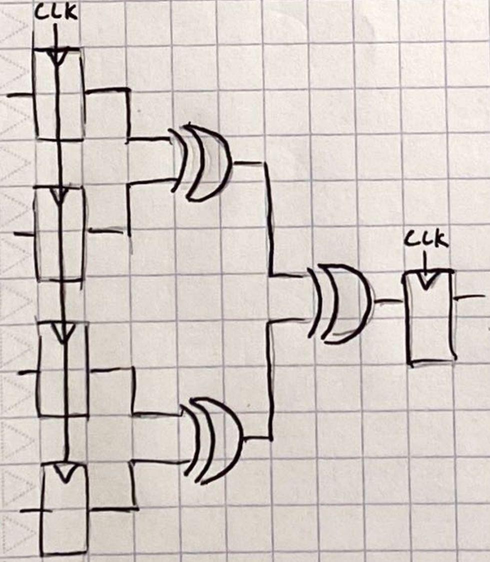
S_1	S_0	X	S_1'	S_0'	Q
0	0	0	0	1	0
0	0	1	0	1	0
0	1	0	0	0	1
0	1	1	1	0	1
1	0	0	0	1	1
1	0	1	0	1	1
1	1	0	0	1	1
1	1	1	0	1	1

	S_1	S_0
S0	0	0
S1	0	1
S2	1	0
S3	1	1

given a binary input set, the state machine identifies substrings that contain a minimum of two elements in which the last element is not a 0.



3.33



$t_{pd} = 2 \times (100\ ps) = 200\ ps$

$t_{cd} = 2 \times (55\ ps) = 110\ ps$

$T_c \geq (70 + 200 + 60) = 330\ ps$

$f = 1/330ps = 3.03\ GHz$

$t_{skew} < [(50 + 110) - 20] = 140\ ps$