Chapter 8

Exercise 8.6:
The pattern generator for the sequence *abcaba* is described by the following transition table:

PS	NS/z
A	B/a
B	C/b
C	D/c
D	E/a
E	F/b
F	A/a

Let us define the following encoding:

$y_2y_1y_0$	State
000	A
001	B
010	C
011	D
100	E
101	F

z_1z_0	
00	a
01	b
10	c

From the state table and the previous encoding we get the following table and K-maps:

PS	NS/z_1z_0
000	001/00
001	010/01
010	011/10
011	100/00
100	101/01
101	000/00
101	- - -/- -
101	- - -/- -

Y_2: (y_0 over columns 2–3, y_1 under columns 3–4, y_2 beside row 2)

	0	0	1	0
y_2	1	0	-	-

Y_1:

	0	1	0	1
y_2	0	0	-	-

Y_0:

	1	0	0	1
y_2	1	0	-	-

z_1:

	0	0	0	1
y_2	0	0	-	-

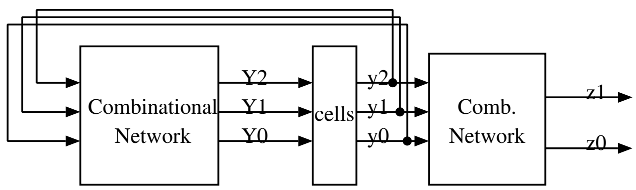
z_0:

	0	1	0	0
y_2	1	0	-	-

The expressions we get from the K-maps are:

$$
\begin{aligned}
Y_2 &= y_1 y_0 + y_2 y_0' \\
Y_1 &= y_2' y_1' y_0 + y_1 y_0' \\
Y_0 &= y_0' \\
z_1 &= y_1 y_0' \\
z_0 &= y_2' y_1' y_0 + y_2 y_0'
\end{aligned}
$$

The network that implements a canonical version of this sequential network is presented in Figure ?? on page ??.



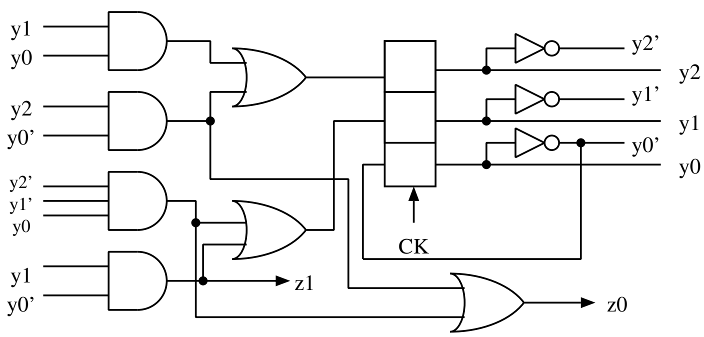


Figure 8.1: Pattern generator of Exercise 8.6

Exercise 8.8

We need a 3-bit vector to represent the six states and a 2-bit vector to represent the output. Let us define the following encoding:

$y_2y_1y_0$	State
000	A
001	B
010	C
011	D
100	E
101	F

z_1z_0	
00	a
01	b
10	c

From the state table and the encoding we get the following K-maps.

Y_2:

		y_0	y_0		
	0	0	1	0	
	1	0	-	-	y_2
x	0	1	-	-	y_2
x	1	0	0	0	
			y_1	y_1	

Y_1:

		y_0	y_0		
	0	1	0	1	
	0	0	-	-	y_2
x	1	0	-	-	y_2
x	0	0	1	0	
			y_1	y_1	

Y_0:

		y_0	y_0		
	1	0	0	1	
	1	0	-	-	y_2
x	1	0	-	-	y_2
x	1	0	0	1	
			y_1	y_1	

z_1:

		y_0	y_0		
	0	0	0	0	
	0	1	-	-	y_2
x	0	1	-	-	y_2
x	0	1	1	0	
			y_1	y_1	

z_0:

		y_0	y_0		
	0	0	1	0	
	1	0	-	-	y_2
x	1	0	-	-	y_2
x	1	0	0	1	
			y_1	y_1	

The corresponding switching expressions are

$Y_0 = y_0'$

$Y_1 = x'y_2'y_1'y_0 + x'y_1y_0' + xy_2y_0' + xy_1y_0$

$Y_2 = x'y_2y_0' + x'y_1y_0 + xy_2y_0 + xy_2'y_1'y_0'$

$z_1 = y_2y_0 + xy_0$

$z_0 = x'y_1y_0 + y_2y_0' + xy_0'$

The sequential network is shown in Figure **??** on page **??**.

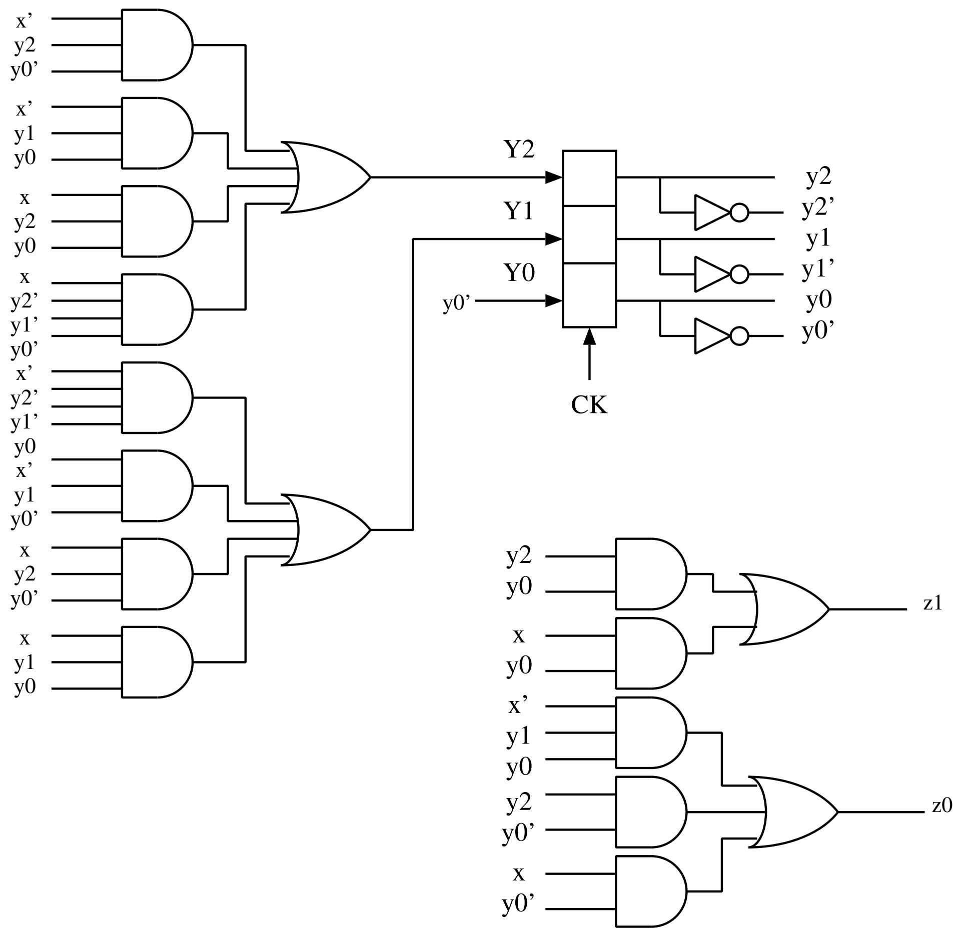


Figure 8.2: Sequential network for Exercise 8.8

Exercise 8.16 From the network we obtain the following table, based on the expressions below:

$$J_A = K_A = xQ_B$$

$$J_B = K_B = x$$

PS	Input		Input	
Q_AQ_B	$x = 0$	$x = 1$	$x = 0$	$x = 1$
00	0000	0011	00	01
01	0000	1111	01	10
10	0000	0011	10	11
11	0000	1111	11	00
	$J_AK_AJ_BK_B$		NS	

The outputs are expressed as:

$$z_3 = Q_AQ_B$$

$$z_2 = Q_AQ'_B$$

$$z_1 = Q'_AQ_B$$

$$z_0 = Q'_AQ'_B$$

Giving the following names to the states:

State Name	Code
S_0	00
S_1	01
S_2	10
S_3	11

we get the transition table:

PS	Input		Output
Q_AQ_B	$x = 0$	$x = 1$	
S_0	S_0	S_1	0
S_1	S_1	S_2	1
S_2	S_2	S_3	2
S_3	S_3	S_0	3
	NS		

The state diagram for the given network is presented in Figure **??**, and corresponds to a modulo-4 counter with decoded output.

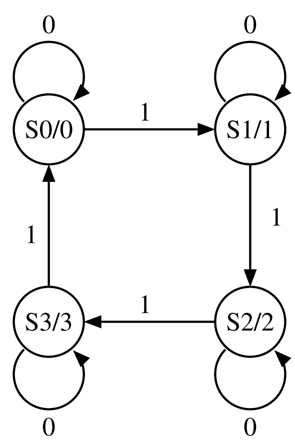


Figure 8.3: State diagram for Exercise 8.16