

①

Q I

a)

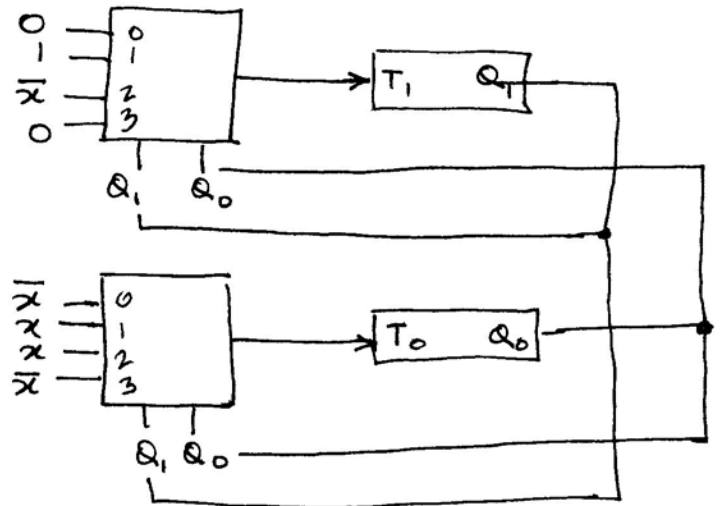
$Q_1 Q_0$	x	$T_1 T_0$	$T_1 T_0$
0 0	0 1	0 1	0 0
0 1	1 1	1 0	1 1
1 0	0 0	1 0	0 1
1 1	1 0	0 1	0 0

$x=0$ $x=1$

$Q_1(t+1) Q_0(t+1)$

b)

$Q_1 Q_0 x$	T_1	T_0
0 0 0	0	1
0 0 1	0	0
0 1 0	1	0
0 1 1	1	1
1 0 0	1	0
1 0 1	0	1
1 1 0	0	1
1 1 1	0	0



Q 3 a)

x	y	C_{in}	Sum
0	0	0	0
0	1	0	1
1	0	0	1
1	1	0	0

$-l_1$
 $-l_2$

x	y	C_{in}	Sum
0	0	0	0
0	1	0	1
1	0	0	1
1	1	0	0

$-l_3$
 $-l_4$

l_1

y	C_{in}	Sum
0	0	0
0	1	1
1	0	1
1	1	0

$-l_5$
 $-l_6$

l_2

y	C_{in}	Sum
0	0	0
0	1	1
1	0	1
1	1	0

$-l_7$
 $-l_8$

l_3

y	C_{in}	Sum
0	0	0
0	1	1
1	0	1
1	1	0

$-l_9$
 $-l_{10}$

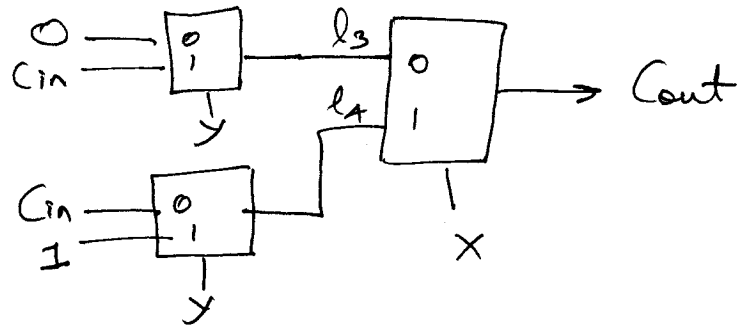
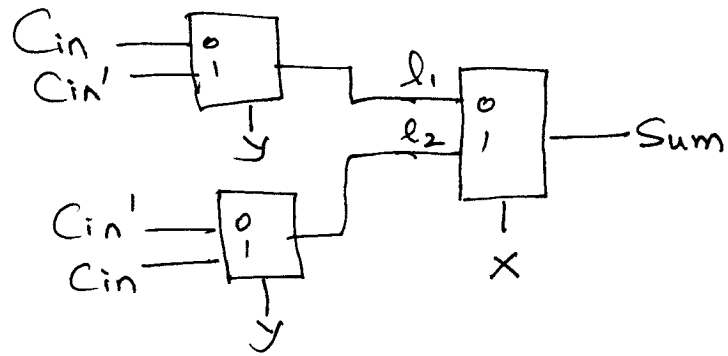
l_4

y	C_{in}	Sum
0	0	0
0	1	1
1	0	1
1	1	0

$-l_{11}$
 $-l_{12}$

C_{out}

(2)



3b

a_i	b_i	C_i	C_{i+1}	S	R
0	0	0	0	0	1
0	0	1	0	0	1
0	1	0	1	0	1
0	1	1	1	1	0
1	0	0	1	1	0
1	0	1	1	1	0
1	1	0	1	0	0
1	1	1	1	0	0

$Q(t) \quad Q(t+1)$

$$S \Rightarrow a_i \cdot b_i$$

	C_i		
a_i	0	0	1
	0	1	1
	b_i		

$$R \Rightarrow a_i' \cdot b_i'$$

	C_i		
a_i	1	1	0
	1	0	0
	b_i		

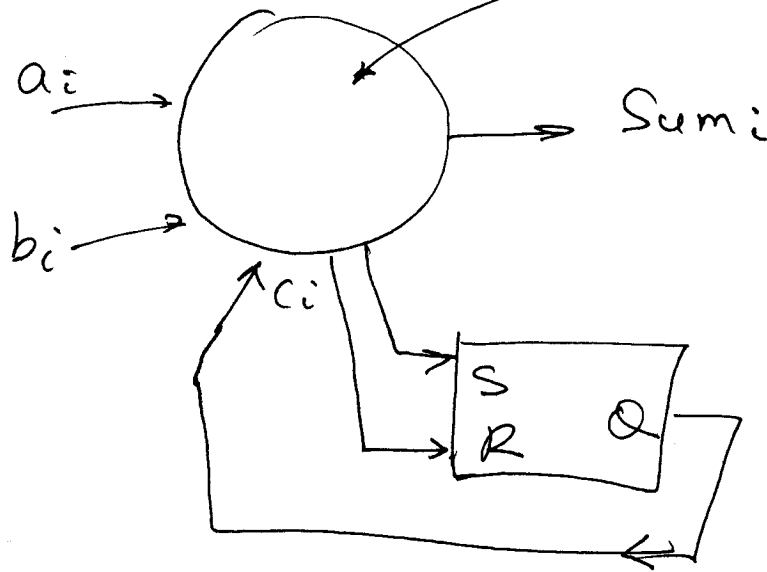
$$S = a_i \cdot b_i$$

$$R = a_i' \cdot b_i'$$

$$Sum_i = a_i \oplus b_i \oplus C_{in_i}$$

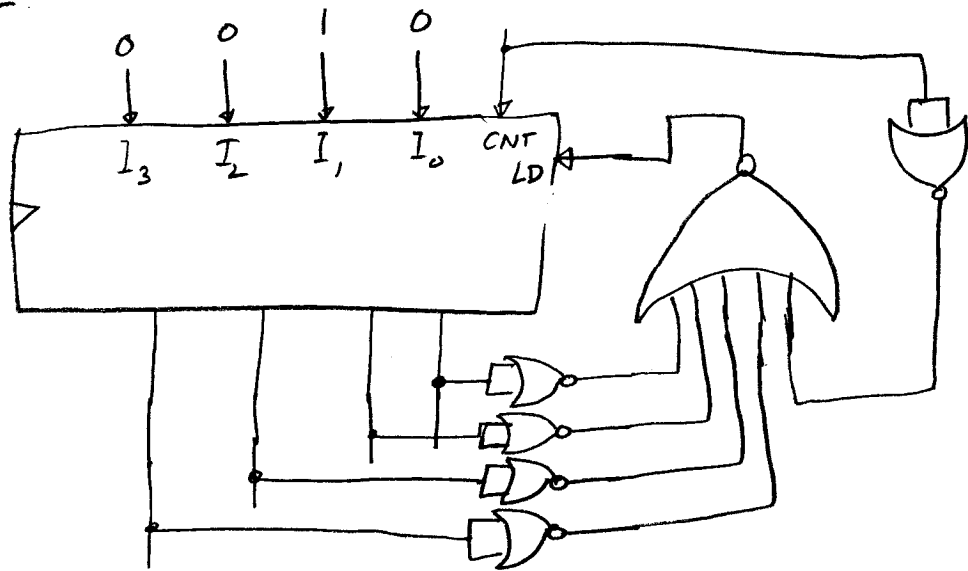
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Equations go in
here (in terms
of NOR
Gates)



(4)

II (i) To make a 2-to-15 Counter with modulo-16 Counter, we need to initially load the Counter with 2 as well as detect when it reaches 15 and rotate it back to 2.



(2) To generate a sequence 0, 1, 2, 10, 11, 3, 14, 15. we need to detect state 2 and load 10, state 11 and load 3 and so on we will form a table.

Q_3	Q_2	Q_1	Q_0	LD	I_3	I_2	I_1	I_0
0	0	0	0	0				
0	0	0	1	0				
0	0	1	0	1	1	0	1	0
0	0	1	1	1	1	1	1	0
0	1	0	0	1				
0	1	0	1	1				
0	1	1	0	1				
0	1	1	1	1				
1	0	0	0	0	0	0	1	1
1	0	0	1	0				
1	0	1	0	0				
1	0	1	1	0				
1	1	0	0	0				
1	1	0	1	0				
1	1	1	0	0				
1	1	1	1	0				

We will now minimize the expressions by (5)
 finding out appropriate expressions for LD , I_3 , I_2 , I_1
 and I_0 .

LD

	$s_1 s_0$	00	01	11	10
s_3	00	0	0	1	1
	01	-	-	-	-
	11	-	-	0	0
	10	-	-	1	0

I_3

$$I_3 = S_3'$$

I_2

	s_1	0	1
s_3	0	-	1
	1	-	0
s_0	0	-	0
	1	-	-

I_1

$$I_1 = 1$$

$$LD = S_1 S_3' + S_1 S_0 S_2'$$

I_2

$$I_2 = S_0 S_3'$$

I_0

$$I_0 = S_3$$

We get the following expressions

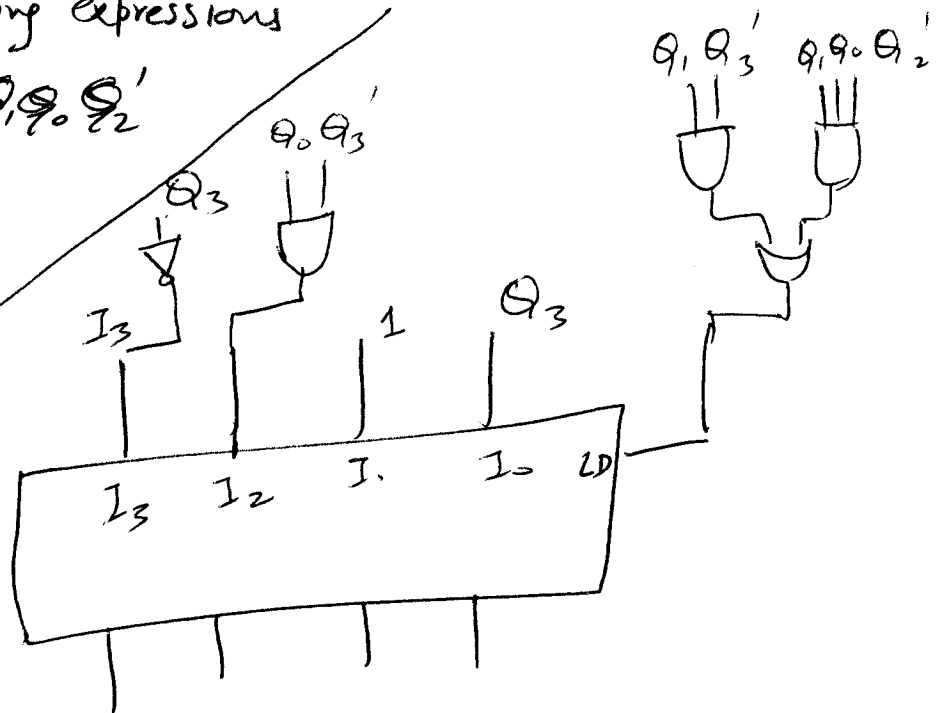
$$LD = Q_1 Q_3' + Q_1 Q_0 Q_2'$$

$$I_3 = Q_3'$$

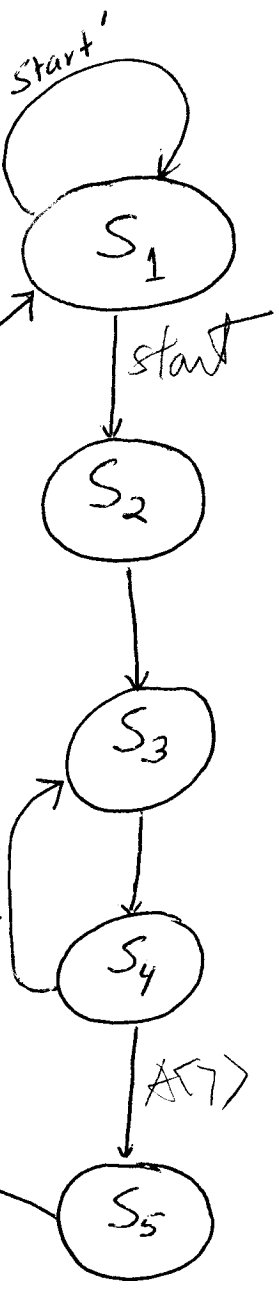
$$I_2 = Q_0 Q_3'$$

$$I_1 = 1$$

$$I_0 = Q_3$$

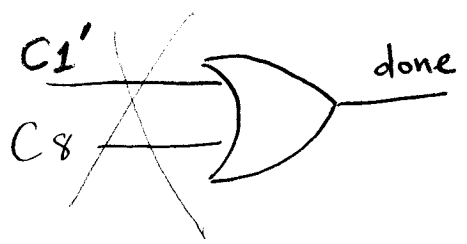
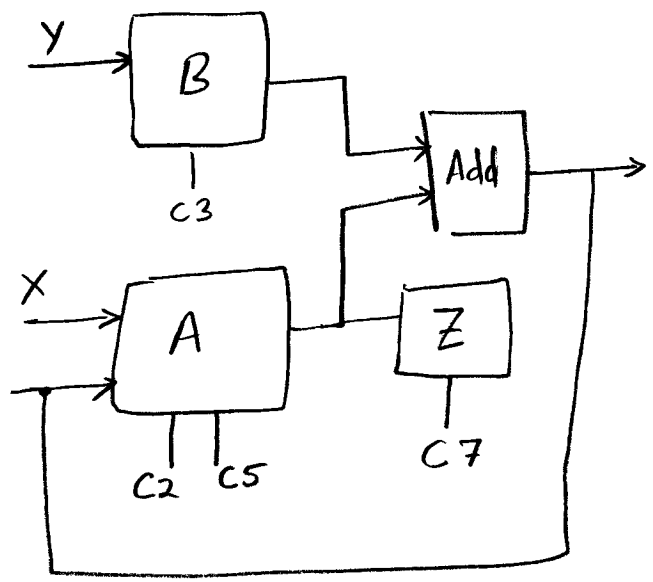


4.

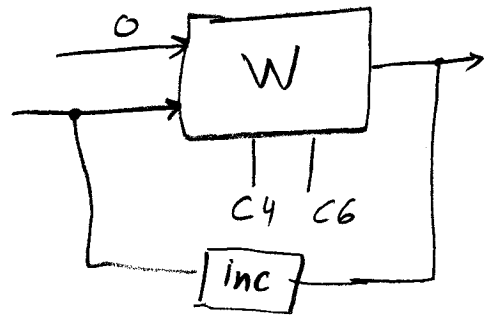


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operation	Control Signal	State
done = 0	C ₁	S ₂
A = X	C ₂	S ₂
B = Y	C ₃	S ₂
W = 0	C ₄	S ₂
A = Add(A, B)	C ₅	S ₃
W = Inc(W)	C ₆	S ₃
Z = A	C ₇	S ₅
done = 1	C ₈	S ₅
		S ₁



S₅



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