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Course: BCSE (Lateral)

Group: A1

(Q) Design a counter which counts from 0 to 59?

→ The job of a counter is to count by advancing the contents of the counter by one count with each clock pulse. Counter which advance their sequence of numbers or states when activated by a clock input are said to operate in a "counting" mode likewise counters which decrease their sequence of numbers or states when activated by a clock input are said to operate in a "count down" mode. Counters can be operated in the both UP and down mode. For mode 60 counter, we design it by using a mode 10 counter that counts 0 to 9 and a mode 6 counter that counts 0 to 5. In designing of mode 60 counter, at low means 0 it represent low counting and at high means 1, it represent high counting. At high counting, it going 0 to 59 and at low counting, it going from 59 to 0. We design the counter by using JK flip flops. We also use the clock for updown counting of the clock pulse. A clear botton is wed for reset the counter. To represent the count, we use LED display for counting the pulse.

JK flip flop Transition Table

Q_N	Q_{N+1}	J	K
0	0	0	X
0	1	1	X
1	0	X	0
1	1	X	1

Designing mod 6 updown counter: →

mode	Initial state Q_2	Q_1	Q_0	Final state $\bar{Q}_2$	$\bar{Q}_1$	$\bar{Q}_0$
0	0	0	0	0	0	1
0	0	0	1	0	1	0
0	0	1	0	0	1	1
0	0	1	1	1	0	0
0	1	0	0	1	0	1
0	1	0	1	0	0	0
1	0	0	0	1	0	1
1	0	0	1	0	0	0
1	0	1	0	0	0	1
1	0	1	1	0	1	0
1	1	0	0	0	1	1
1	1	0	1	1	0	0

K map →

J_0	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2Q_1$	Q_2Q_1	$Q_2\bar{Q}_1$
$\bar{Q}_0$	1	1	X	1
Q_0	X	X	X	X

$J_0 = 1$

K_0	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2Q_1$	Q_2Q_1	$Q_2\bar{Q}_1$
$\bar{Q}_0$	X	X	X	X
Q_0	1	1	X	1

$K_0 = 1$

J_1	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2Q_1$	Q_2Q_1	$Q_2\bar{Q}_1$
$\bar{Q}_0$	0	X	X	1
Q_0	0	X	X	0

$J_1 = Q_2\bar{Q}_0$

K_1	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2Q_1$	Q_2Q_1	$Q_2\bar{Q}_1$
$\bar{Q}_0$	X	1	X	X
Q_0	X	0	X	X

$K_1 = \bar{Q}_0$

J_2	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2Q_1$	Q_2Q_1	$Q_2\bar{Q}_1$
$\bar{Q}_0$	1	0	X	X
Q_0	0	0	X	X

$J_2 = \bar{Q}_1\bar{Q}_0$

K_2	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2Q_1$	Q_2Q_1	$Q_2\bar{Q}_1$
$\bar{Q}_0$	X	X	X	1
Q_0	X	X	X	0

$K_2 = \bar{Q}_0$

Design a Up and Down (as selected by a control line) Decade Counter using JK-Flip Flop.

	Initial state				Final state				Input Given			
S	Q_4	Q_3	Q_2	Q_1	$\bar{Q_4}$	$\bar{Q_3}$	$\bar{Q_2}$	$\bar{Q_1}$	q_1	q_2	q_3	q_4
0	0	0	0	0	0	0	0	1	1	0	0	0
0	0	0	0	1	0	0	1	0	1	1	0	0
0	0	0	1	0	0	0	1	1	1	0	0	0
0	0	0	1	1	0	1	0	0	1	1	1	0
0	0	1	0	0	0	1	0	1	1	0	0	0
0	0	1	0	1	0	1	1	0	1	1	0	0
0	0	1	1	0	0	1	1	1	1	0	0	0
0	0	1	1	1	1	0	0	0	1	1	1	1
0	1	0	0	0	1	0	0	1	1	0	0	0
0	1	0	0	1	0	0	0	0	1	0	0	1
1	0	0	0	0	1	0	0	1	1	0	0	1
1	0	0	0	1	0	0	0	0	1	0	0	0
1	0	0	1	0	0	0	0	1	1	1	0	0
1	0	0	1	1	0	0	1	0	1	0	0	0
1	0	1	0	0	0	0	1	1	1	0	0	0
1	0	1	0	1	0	1	0	0	1	1	0	0
1	0	1	1	0	0	1	0	1	1	0	0	0
1	0	1	1	1	0	1	1	0	1	1	0	0
1	1	0	0	0	0	1	1	1	1	0	0	0
1	1	0	0	1	1	0	0	0	1	0	0	1

Kmaps

For S = 0;

q_2	$\bar{Q_2}\bar{Q_1}$	$\bar{Q_2}Q_1$	Q_2Q_1	$Q_2\bar{Q_1}$
$\bar{Q_4}\bar{Q_3}$	0 (0)	1 (1)	1 (3)	0 (2)
$\bar{Q_4}Q_3$	0 (4)	1 (5)	1 (7)	0 (6)
Q_4Q_3	d (12)	d (13)	d (15)	d (14)
$Q_4\bar{Q_3}$	0 (8)	0 (9)	d (11)	d (10)

JK for $q_2 = Q_1\bar{Q_4}$

For S = 1,

q_2	$\bar{Q_2}\bar{Q_1}$	$\bar{Q_2}Q_1$	Q_2Q_1	$Q_2\bar{Q_1}$
$\bar{Q_4}\bar{Q_3}$	0 (0)	0 (1)	0 (3)	1 (2)
$\bar{Q_4}Q_3$	1 (4)	0 (5)	0 (7)	1 (6)
Q_4Q_3	d (12)	d (13)	d (15)	d (14)
$Q_4\bar{Q_3}$	1 (8)	0 (9)	d (11)	d (10)

JK for $q_2 = \bar{Q}_1Q_2 + \bar{Q}_1Q_3 + \bar{Q}_1Q_4$

For S=0

Q_3	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2 Q_1$	$Q_2 Q_1$	$Q_2\bar{Q}_1$
$\bar{Q}_4\bar{Q}_3$	0 (0)	0 (1)	1 (3)	(2)
$\bar{Q}_4 Q_3$	0 (4)	0 (5)	1 (7)	0 (6)
$Q_4 Q_3$	d (12)	d (13)	d (15)	d (14)
$Q_4\bar{Q}_3$	0 (8)	0 (9)	d (11)	d (10)

JK for $Q_3 = Q_1 Q_2$

Q_4	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2 Q_1$	$Q_2 Q_1$	$Q_2\bar{Q}_1$
$\bar{Q}_4\bar{Q}_3$	0	0	0	0
$\bar{Q}_4 Q_3$	0	0	1	0
$Q_4 Q_3$	d	d	d	d
$Q_4\bar{Q}_3$	0	1	d	d

JK for $Q_4 = Q_1 Q_2 Q_3 + Q_1 Q_4$

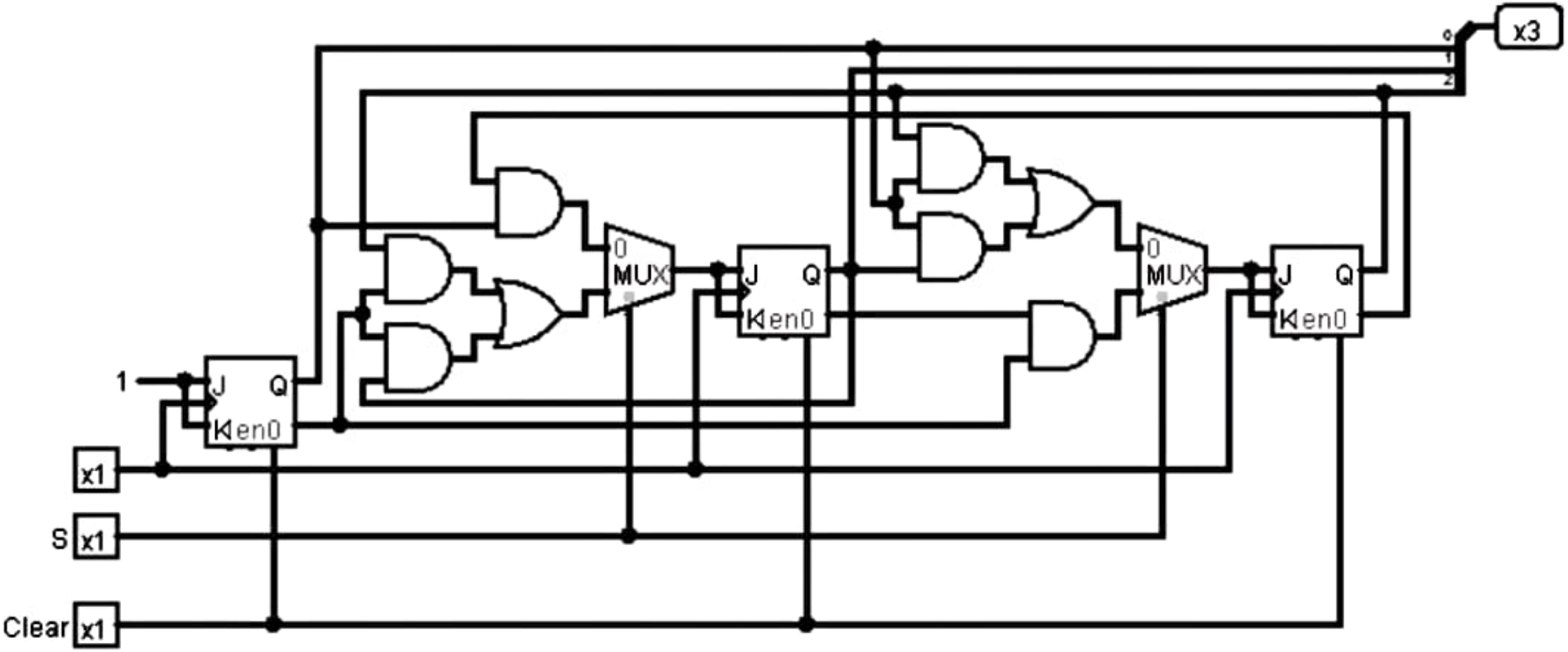
For S=1

Q_3	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2 Q_1$	$Q_2 Q_1$	$Q_2\bar{Q}_1$
$\bar{Q}_4\bar{Q}_3$	0 (0)	0 (1)	0 (3)	0 (2)
$\bar{Q}_4 Q_3$	1 (4)	0 (5)	0 (7)	0 (6)
$Q_4 Q_3$	d (12)	d (13)	d (15)	d (14)
$Q_4\bar{Q}_3$	1 (8)	0 (9)	d (11)	d (10)

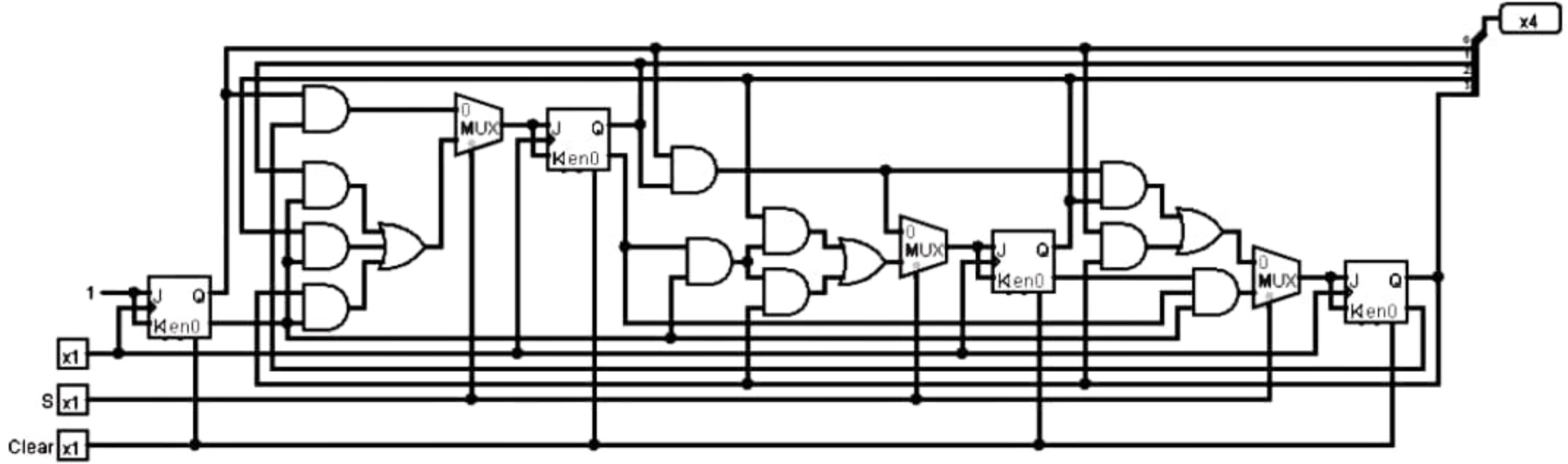
JK for $Q_3 = \bar{Q}_1\bar{Q}_2 Q_3 + \bar{Q}_1\bar{Q}_2 Q_4$

Q_4	$\bar{Q}_2\bar{Q}_1$	$\bar{Q}_2 Q_1$	$Q_2 Q_1$	$Q_2\bar{Q}_1$
$\bar{Q}_4\bar{Q}_3$	1	0	0	0
$\bar{Q}_4 Q_3$	0	0	0	0
$Q_4 Q_3$	d	d	d	d
$Q_4\bar{Q}_3$	1	0	d	d

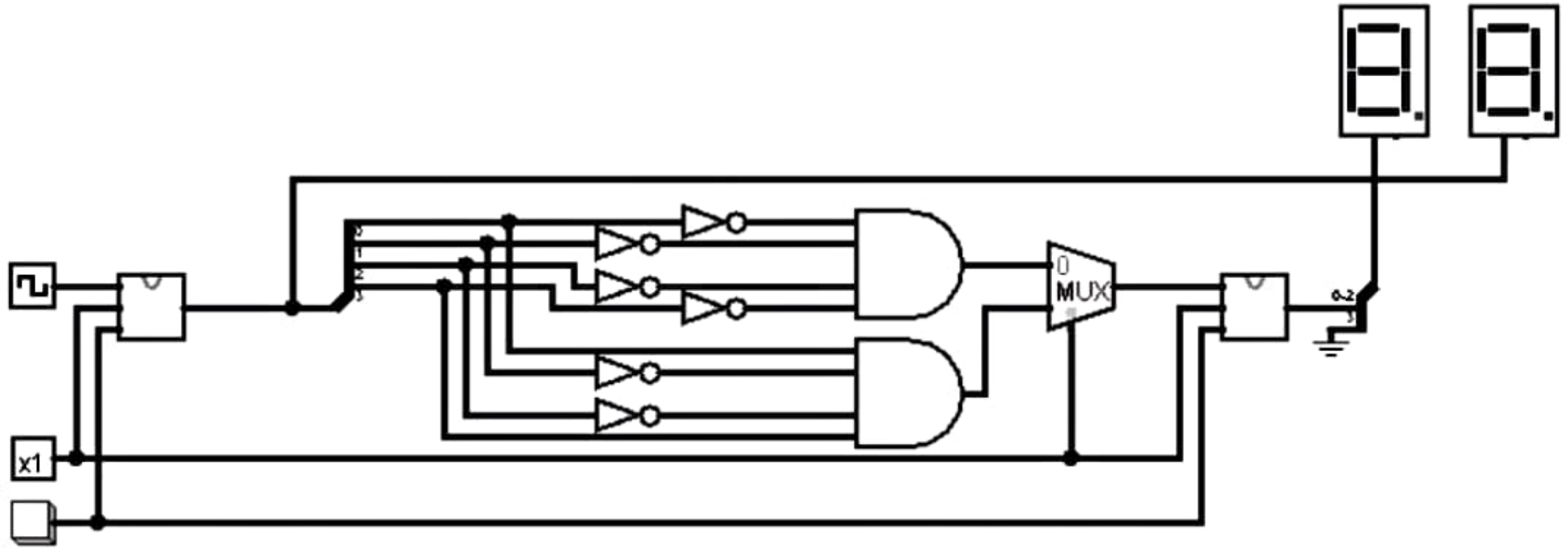
JK for $Q_4 = \bar{Q}_1\bar{Q}_2\bar{Q}_3$



Mod 6 counter



Mod 10 counter



Mod 60 counter