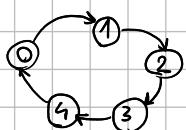


A1.

3-bitowy automat generujący cyklicznie stava NKB modulo 5.

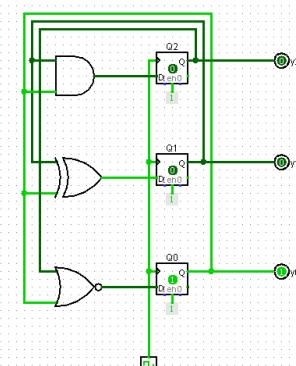
Automat ma tylko wyjście zegarowe.

Realizacja na przesztukach D i dodatkowych bramkach.



S	S'
0	1
1	2
2	3
3	4
4	0

Q ₂ Q ₀	S'
000	001
001	010
010	011
011	100
100	000



Q ₂ Q ₀	0	1	Q ₂ Q ₀	0	1	Q ₂ Q ₀	0	1
00	0	0	00	0	0	00	1	0
01	0	-	01	1	-	01	0	-
11	1	-	11	0	-	11	0	-
10	0	-	10	1	-	10	1	-

D₂, D₁, D₀

$$D_2 = Q_2 Q_0$$

$$D_1 = Q_1 \bar{Q}_0 + \bar{Q}_1 Q_0 = Q_1 \oplus Q_0$$

$$D_0 = \bar{Q}_2 \bar{Q}_0$$

$$y_2 = Q_2 \quad y_1 = Q_1 \quad y_0 = Q_0$$

A7.

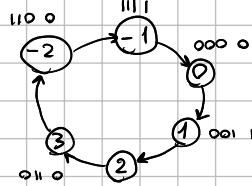
3-bitowy automat generujący cyklicznie kolejne stava U2 wyciąże od -3

Automat sygnalizuje na dodatkowym wyjściu wartości -1 i 1.

Automat ma tylko wyjście zegarowe.

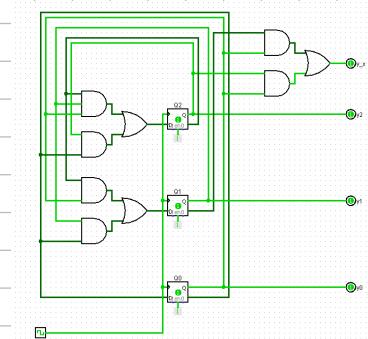
Realizacja na przesztukach D i dodatkowych bramkach

-4	1	0	0
-3	1	0	1
-2	1	1	0
-1	1	1	1
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1



Koduj stany zgodne z U2

S	S'	y	Q ₂ Q ₀	S'	y
-2	-1	0	110	111	0
-1	0	1	111	000	1
0	1	0	000	001	0
1	2	1	001	010	1
2	3	0	010	011	0
3	-2	0	011	110	0



Q ₂ Q ₀	00	01	11	10
0	0	0	1	0
1	-	-	0	1

D₂

Q ₂ Q ₀	00	01	11	10
0	0	1	1	1
1	-	-	0	1

D₁

Q ₂ Q ₀	00	01	11	10
0	1	0	0	1
1	-	-	0	1

D₀

Q ₂ Q ₀	00	01	11	10
0	0	1	0	0
1	-	-	1	0

y_x

$$D_2 = Q_2 \bar{Q}_0 + \bar{Q}_2 Q_0$$

$$D_1 = \bar{Q}_2 Q_0 + Q_2 \bar{Q}_0$$

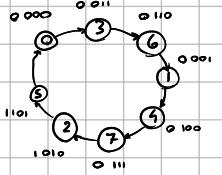
$$D_0 = \bar{Q}_0$$

$$y_x = \bar{Q}_1 Q_0 + Q_2 Q_0$$

A8.

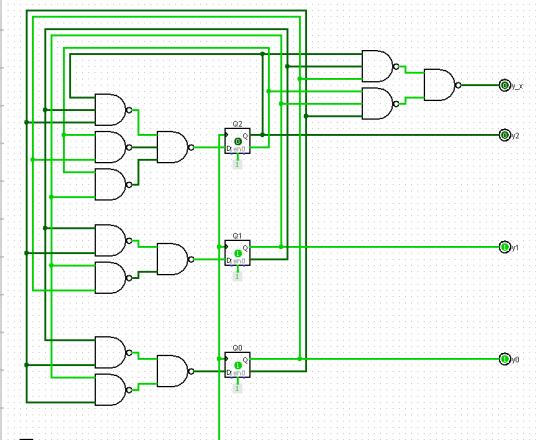
3-bitowy automat generujący cykliczne stanów NKB zakończone o 3 ($0, 3, 6, 1, 4, 7, 2, 5$). Na dodatkowym wyjściu sygnałuje 2:5. Automat ma tylko rejestr zegarowy.

Reakcja na prezentacjach D i dalszych brzmkoach.



S'	y _x
3	0
4	0
5	1
6	0
7	0
0	1
1	0
2	0

$Q_2 Q_1 Q_0$	S'	y_x
000	011	0
001	100	0
010	101	1
011	110	0
100	111	0
101	000	1
110	001	0
111	010	0



Q_1, Q_2	00	01	11	10
Q_2	0	1	1	1
0	1	0	0	0
1	1	0	0	0

Q_1, Q_2	00	01	11	10	
Q_2	0	1	0	1	0
1	1	0	1	0	

Q_1, Q_0	00	01	11	10	
Q_2	0	1	0	0	1
	1	1	0	0	1

Q_1, Q_0	00	01	11	10	
Q_2	0	0	0	0	1
	1	0	1	0	0

$$D_2 = Q_2 \bar{Q}_1 \bar{Q}_0 + \bar{Q}_2 Q_0 + \bar{Q}_2 Q_1$$

$$D_1 = \bar{Q}_1 \bar{Q}_0 + Q_1 Q_0$$

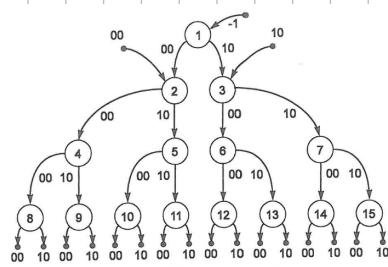
$$D_0 = \bar{Q}_1 \bar{Q}_0 + Q_1 \bar{Q}_0$$

$$y = Q_2 \bar{Q}_1 Q_0 + \bar{Q}_2 Q_1 \bar{Q}_0$$

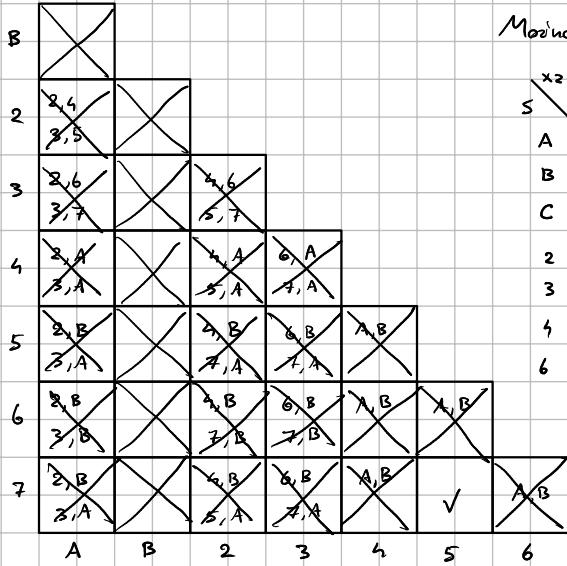
B1.

S	∞	01	11	10	y
1	2	1	1	3	0
2	4	1	1	5	0
3	6	1	1	7	0
4	8	1	1	9	0
5	10	1	1	11	0
6	12	1	1	13	0
7	14	1	1	15	0
8	2	1	1	3	0
9	2	1	1	3	0
10	2	1	1	3	1
11	2	1	1	3	0
12	2	1	1	3	1
13	2	1	1	3	1
14	2	1	1	3	1
15	2	1	1	3	0

Stany zgodne
A (1, 3, 5, 7, 9, 11, 15)
B (10, 12, 13, 14)



S	∞	01	11	10	y
A	2	A	A	3	0
B	2	A	A	3	1
2	4	A	A	5	0
3	6	A	A	7	0
4	A	A	A	A	0
5	B	A	A	A	0
6	B	A	B	B	0
7	B	A	A	A	0



Miejsca połączeń C (5,7)

S	∞	01	11	10	y
A	2	A	A	3	0
B	2	A	A	3	1
C	B	A	A	A	0
2	4	A	A	C	0
3	6	A	A	C	0
4	A	A	A	A	0
5	B	A	B	B	0
6	B	A	B	B	0

$Q_2 Q_1 Q_0$	00	01	11	10	y
000	0	0	0	1	0
001	0	0	0	1	1
011	0	0	0	0	0
010	1	0	0	0	0
110	1	0	0	0	0
111	0	0	0	0	0
101	0	0	0	0	0
100	-	-	-	-	-

Realizacja na D

$Q_2 Q_1 Q_0$	00	01	11	10	D_2
000	0	0	0	1	
001	0	0	0	1	
011	0	0	0	0	
010	1	0	0	0	
110	1	0	0	0	
111	0	0	0	0	
101	0	0	0	0	
100	-	-	-	-	

$Q_2 Q_1 Q_0$	00	01	11	10	D_1
000	1	0	0	0	
001	1	0	0	0	
011	0	0	0	0	
010	1	0	0	1	
110	0	0	0	1	
111	0	0	0	0	
101	1	0	0	1	
100	-	-	-	-	

$Q_2 Q_1 Q_0$	00	01	11	10	D_0
000	0	0	0	0	
001	0	0	0	0	
011	1	0	0	0	
010	1	0	0	1	
110	1	0	0	1	
111	0	0	0	0	
101	1	0	0	1	
100	-	-	-	-	

$$D_2 = Q_2 \bar{Q}_1 \bar{Q}_0 + \bar{Q}_2 Q_1 \bar{Q}_0 + \bar{Q}_2 \bar{Q}_1 Q_0$$

$$D_1 = \bar{Q}_2 \bar{Q}_1 \bar{Q}_0 + \bar{Q}_2 Q_1 \bar{Q}_0 + Q_2 \bar{Q}_1 Q_0 + Q_2 \bar{Q}_1 \bar{Q}_0$$

$$D_0 = \bar{Q}_2 Q_1 \bar{Q}_0 + Q_2 \bar{Q}_1 \bar{Q}_0 + Q_2 \bar{Q}_1 Q_0$$

$$y = \bar{Q}_2 \bar{Q}_1 Q_0$$

Koszt: 13 bramki, 46 wejść

Realizacja na JK

x^2	Q ₂ Q ₁ Q ₀	00	01	11	10
000	0 0 0	1			
001	0 0 0		1	0 0	1
011	0 0 0			—	—
010	1 0 0			—	—
110	—	—	—	—	—
111	—	—	—	—	—
101	—	—	—	—	—
100	—	—	—	—	—

x^2	Q ₂ Q ₁ Q ₀	00	01	11	10
000	1 0 0	1			
001	1	0 0	1		
011	—	—	—	—	—
010	—	—	—	—	—
110	—	—	—	—	—
111	—	—	—	—	—
101	0 0 0	0	0	0	0
100	—	—	—	—	—

x^2	Q ₂ Q ₁ Q ₀	00	01	11	10
000	0 0 0	0	0	0	0
001	—	—	—	—	—
011	—	—	—	—	—
010	1 0 0	1	0	0	1
110	1 0 0	1	0	0	1
111	—	—	—	—	—
101	—	—	—	—	—
100	—	—	—	—	—

Q_2, Q_0	00	01	11	10
Q ₂	0	0	1	0 0
Q ₀	1	—	0 0	0

$$y = \bar{Q}_2 \bar{Q}_1 Q_0$$

$$Q_2 Q_1 Q_0 \times z$$

$$J_2 = \bar{Q}_1 \bar{x}^2 + Q_2 \bar{Q}_0 \bar{x}^2$$

$$\bar{Q}_1 \times \bar{z}$$

$$0 \cdot 1 \cdot 1 + 1 \cdot 0 \cdot 0 \cdot 1 = 0$$

$$J_0 = Q_1 \bar{z}$$

$$K_2 = Q_0 + z + x$$

$$K_1 = Q_0 + z + Q_2 \bar{x}$$

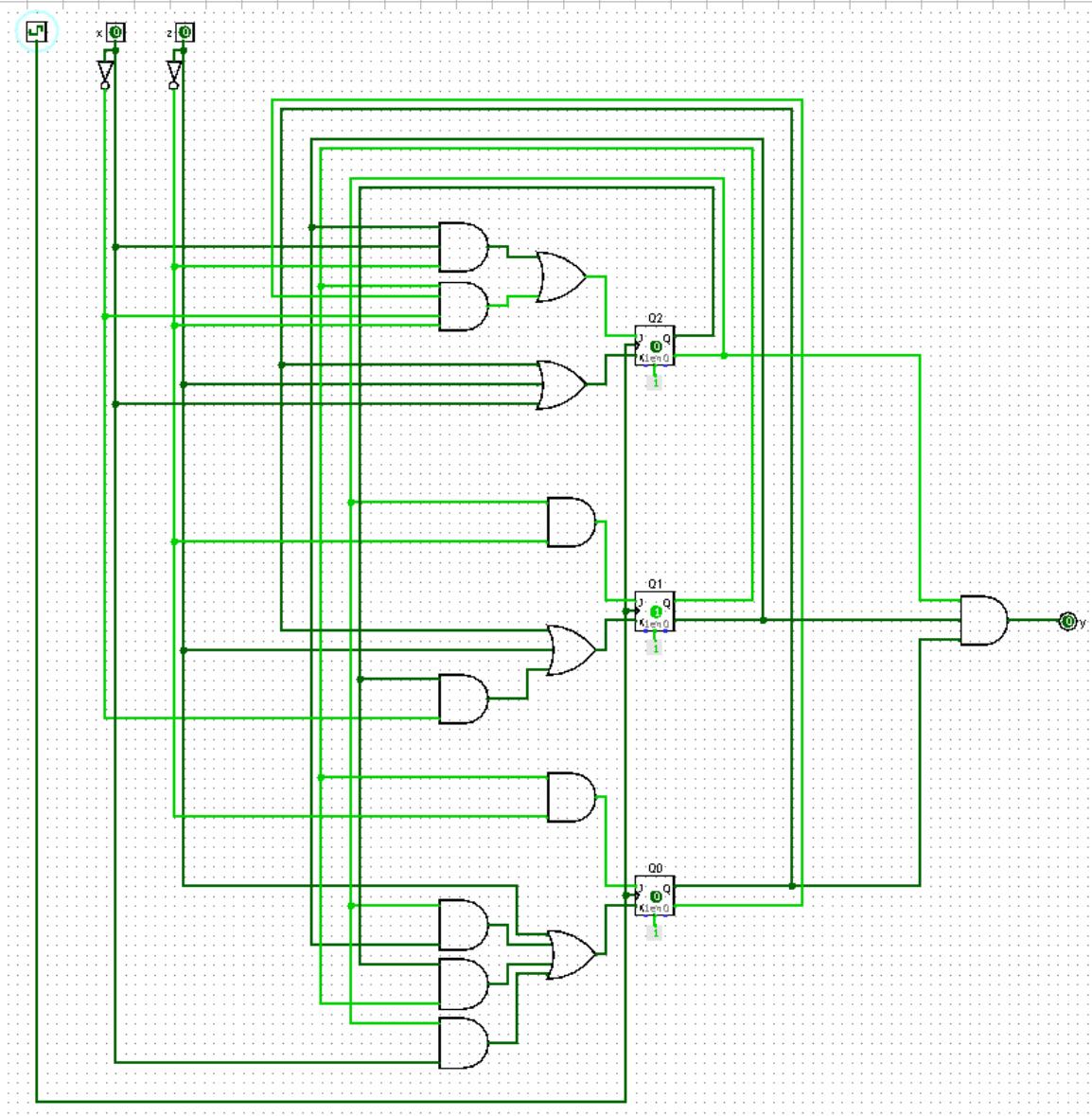
$$K_0 = z + \bar{Q}_2 \bar{Q}_1 + Q_2 Q_1 + \bar{Q}_2 x$$

Kost 13 bramek 34 wyciąć

x^2	Q ₂ Q ₁ Q ₀	00	01	11	10
000	—	—	—	—	—
001	—	—	—	—	—
011	—	—	—	—	—
010	—	—	—	—	—
110	0 1 1	1	1	1	1
111	1 1 1	1	1	1	1
101	1 1 1	1	1	1	1
100	—	—	—	—	—

x^2	Q ₂ Q ₁ Q ₀	00	01	11	10
000	—	—	—	—	—
001	—	—	—	—	—
011	1 1 1	1	1	1	1
010	0 1 1	0	1	1	0
110	1 1 1	1	1	1	0
111	1 1 1	1	1	1	1
101	—	—	—	—	—
100	—	—	—	—	—

x^2	Q ₂ Q ₁ Q ₀	00	01	11	10
000	—	—	—	—	—
001	—	—	—	—	—
011	—	—	—	—	—
010	—	—	—	—	—
110	—	—	—	—	—
111	—	—	—	—	—
101	0 1 1	0	1	1	0
100	—	—	—	—	—

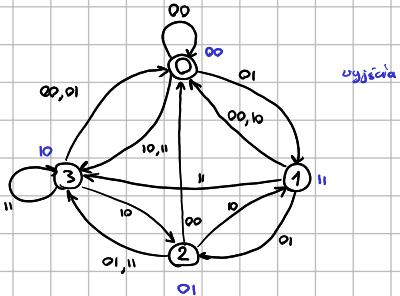


C1.

L koduje staną i wyjście automatu

 x_1, x_0 określają operację na LRealizacja na przesinkach D i multiplexerach $8 \rightarrow 1$

Stan	L_1, L_0	x_1, x_0	Operacja
0	0 0	0 0	$L = 0$
1	1 1	0 1	$L = L + 1$
2	0 1	1 0	$L = L - 1$
3	1 0	1 1	$L = 3$



S	00	01	11	10	y
0	0	1	3	3	00
1	0	2	3	0	11
2	0	3	3	1	01
3	0	0	3	2	10

L_1, L_0	00	01	11	10	y
00	00	11	10	10	00
01	11	00	01	10	00
11	01	00	10	11	01
10	10	00	00	10	10

L_1, L_0	00	01	11	10
00	0	1	1	1
01	0	1	1	1
11	0	0	1	0
10	0	0	1	0

L_1, L_0	00	01	11	10
00	0	1	0	2
01	0	0	0	1
11	0	1	0	0
10	0	0	0	1

$$D_1 = \bar{L}_1 x_0 + \bar{L}_1 x_1 + x_0 x_1$$

$$D_0 = \bar{L}_1 \bar{L}_0 \bar{x}_1 x_0 + \bar{L}_1 L_0 \bar{x}_1 x_0 + L_1 \bar{L}_0 \bar{x}_1 x_0 + L_1 L_0 \bar{x}_1 x_0$$

$$(L_1) \rightarrow 2$$

$$L_0 \rightarrow 0$$

$$(x_1) \rightarrow 2$$

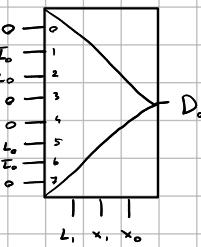
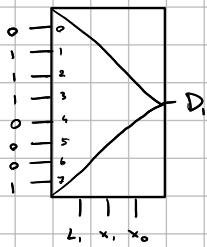
$$(x_0) \rightarrow 2$$

$$(L_1) \rightarrow 4$$

$$L_0 \rightarrow 4$$

$$(x_1) \rightarrow 4$$

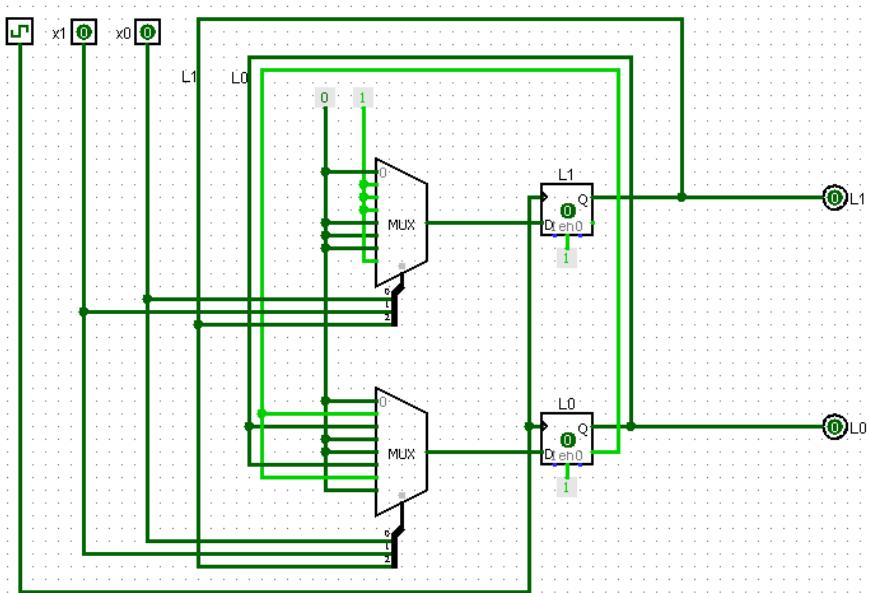
$$(x_0) \rightarrow 4$$



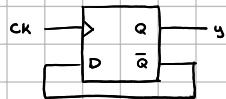
L_1, x_1, x_0	D_1
0 0 0	$1 \cdot 0 + 1 \cdot 0 + 0 \cdot 0 = 0$
0 0 1	$1 \cdot 1 + 1 \cdot 0 + 0 \cdot 1 = 1$
0 1 0	$1 \cdot 0 + 1 \cdot 1 + 1 \cdot 0 = 1$
0 1 1	$1 \cdot 1 + 1 \cdot 1 + 1 \cdot 1 = 1$
1 0 0	$0 \cdot 0 + 0 \cdot 0 + 0 \cdot 0 = 0$
1 0 1	$0 \cdot 0 + 0 \cdot 1 + 0 \cdot 1 = 0$
1 1 0	$0 \cdot 0 + 0 \cdot 1 + 1 \cdot 0 = 0$
1 1 1	$0 \cdot 1 + 0 \cdot 1 + 1 \cdot 1 = 1$

L_1, x_1, x_0	D_0
0 0 0	$0 + 0 + 0 + 0 = 0$
0 0 1	$\bar{L}_0 + 0 + 0 + 0 = \bar{L}_0$
0 1 0	$0 + \bar{L}_0 + 0 + 0 = L_0$
0 1 1	$0 + 0 + 0 + 0 = 0$
1 0 0	$0 + 0 + 0 + 0 = 0$
1 0 1	$0 + 0 + L_0 + 0 = L_0$
1 1 0	$0 + 0 + 0 + \bar{L}_0 = \bar{L}_0$
1 1 1	$0 + 0 + 0 + 0 = 0$

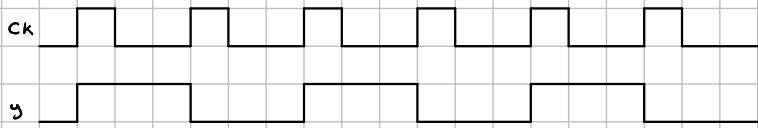
$$y, y_0 = L_1 L_0$$



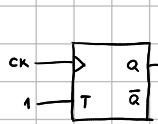
Wejściówka



Przykaz w czasie

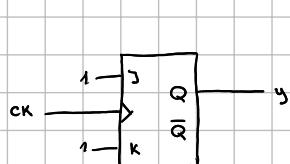


a) tak samo działaższy ułotka = T



Q	T	0	1
0	0	0	1
1	1	1	0

b) tak samo działaższy ułotka = JK



JK	00	01	11	10
0	0	0	1	1
1	1	0	0	1