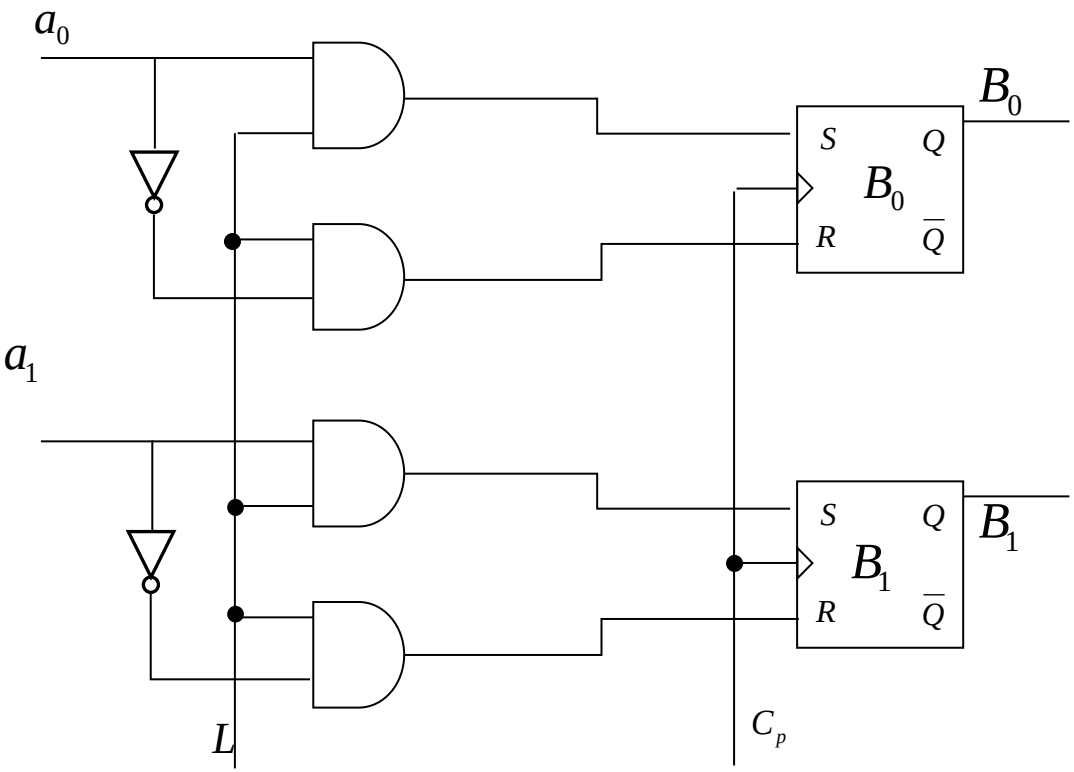
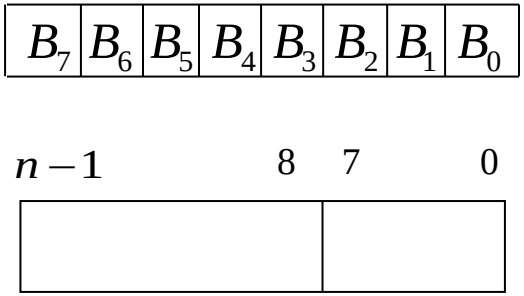
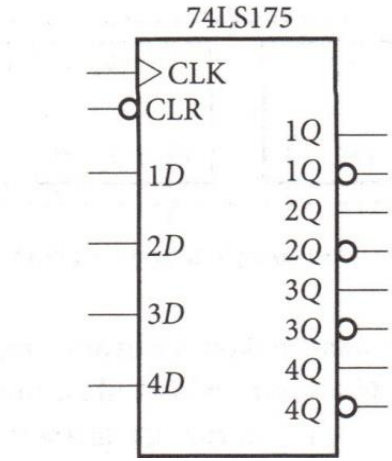
Sekvencijalni moduli - registri i brojači

Parelelni registri

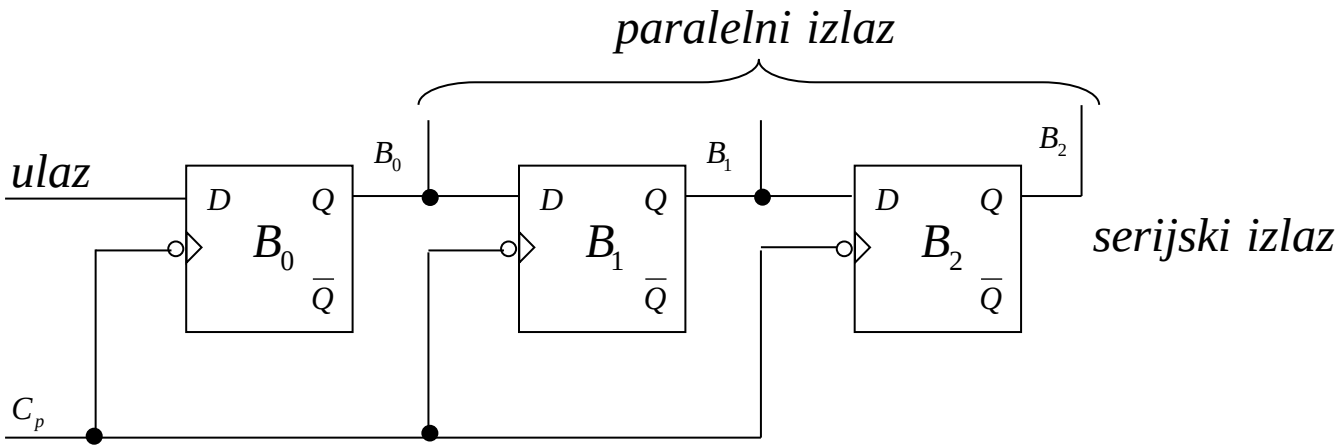


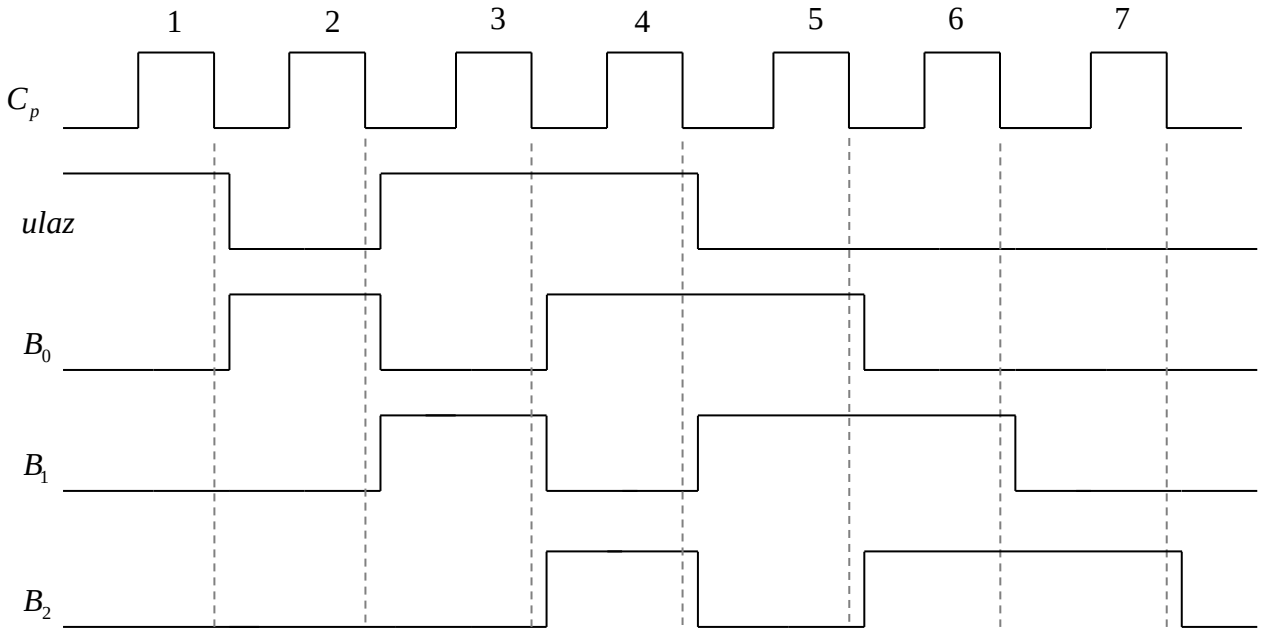




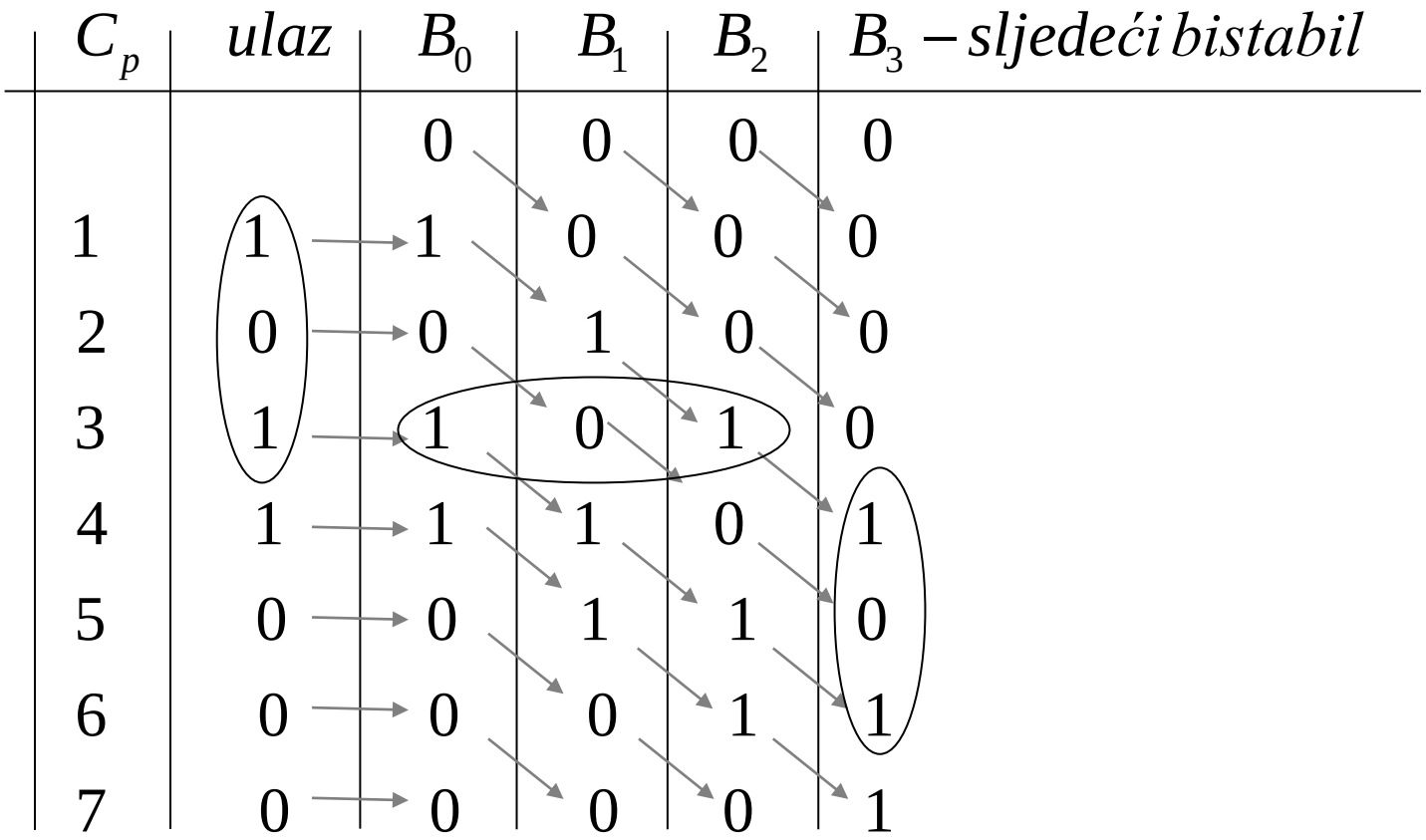
4-bitni paralelni registar

Posmačni registri

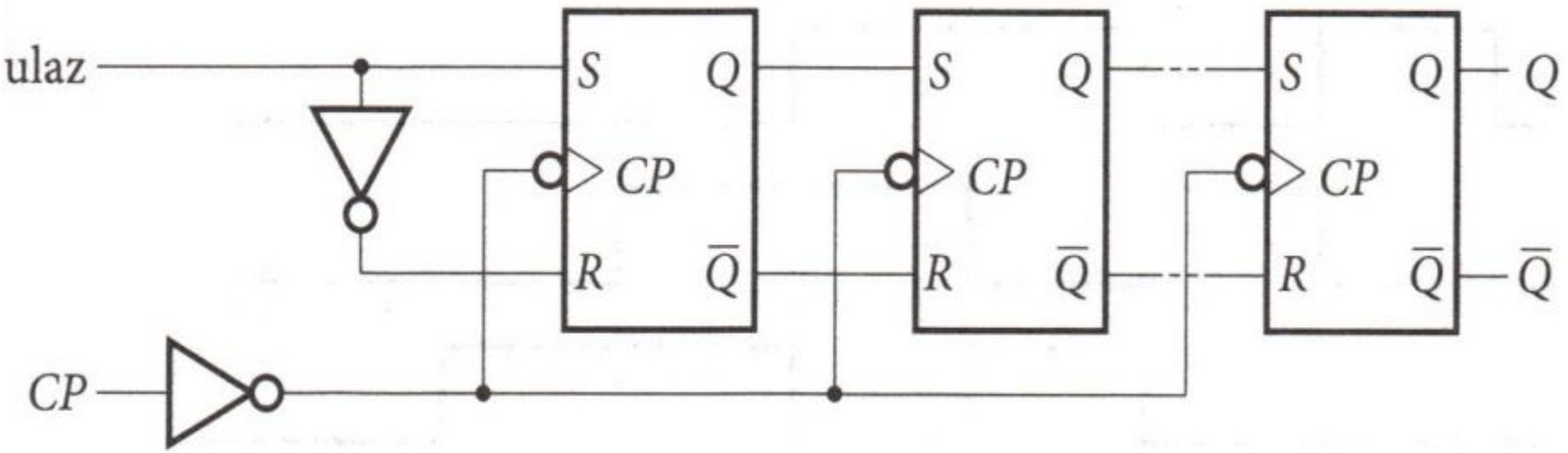




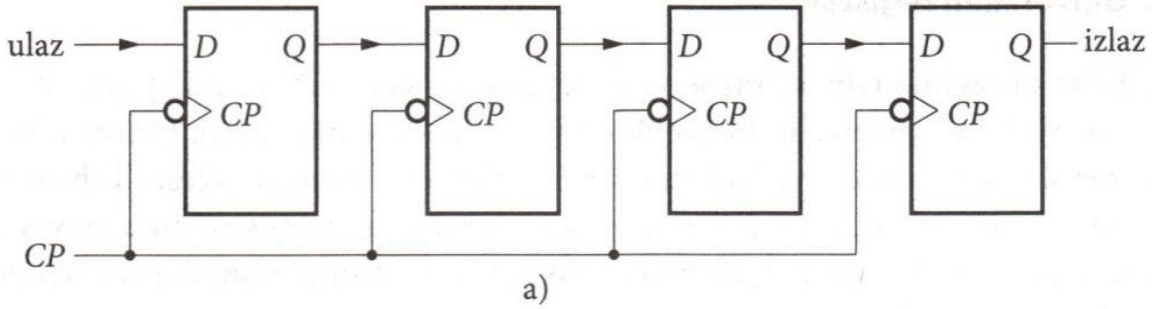
Odziv posmačnog registra na niz 10110



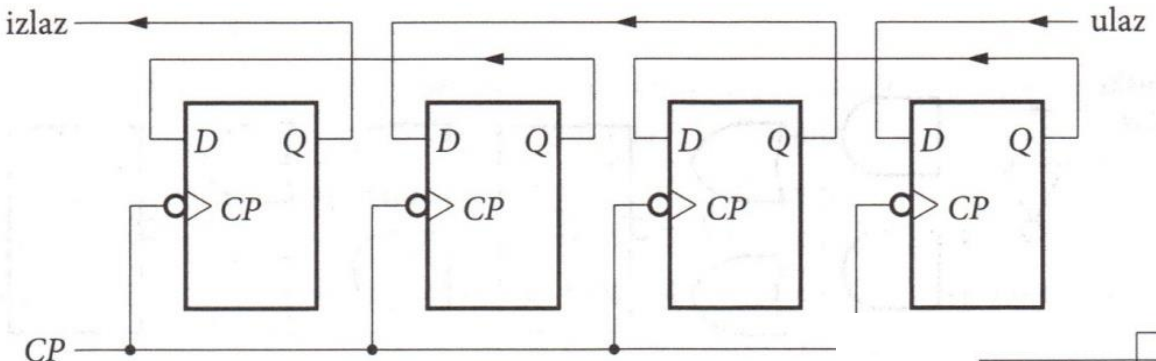
Posmačni registar od SR bistabila



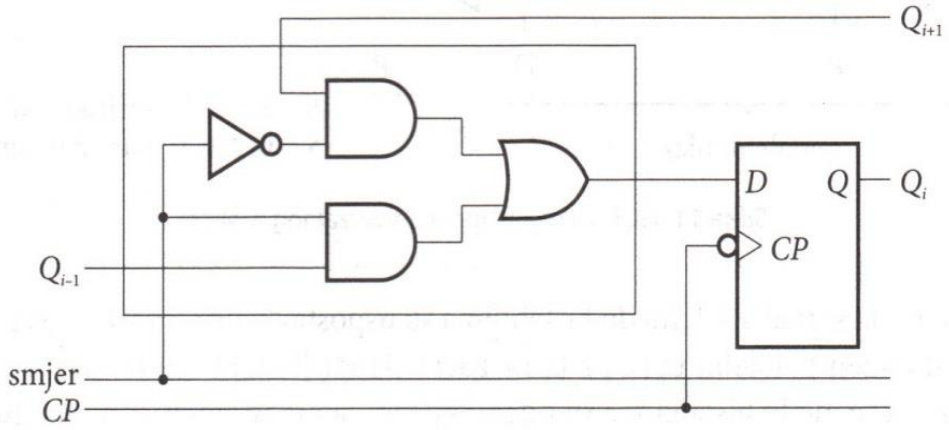
Dvosmjerni posmačni registar



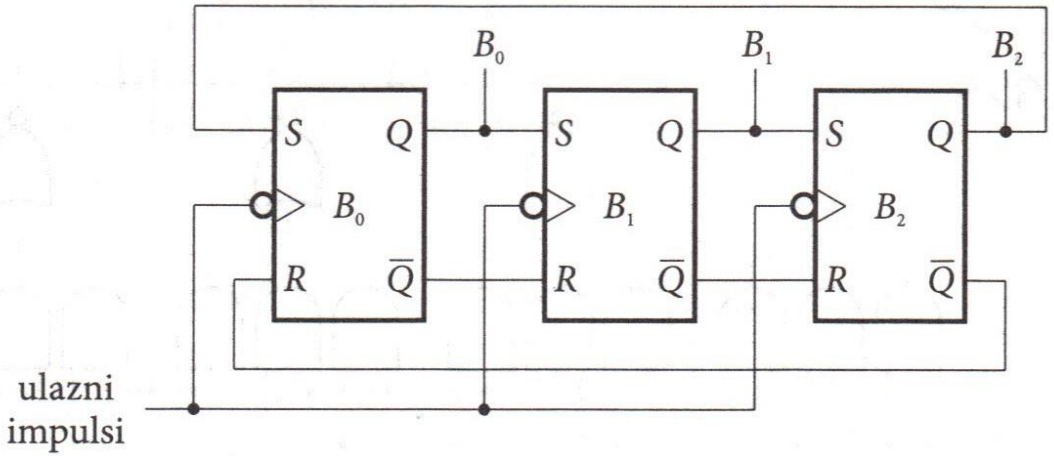
a)



b)

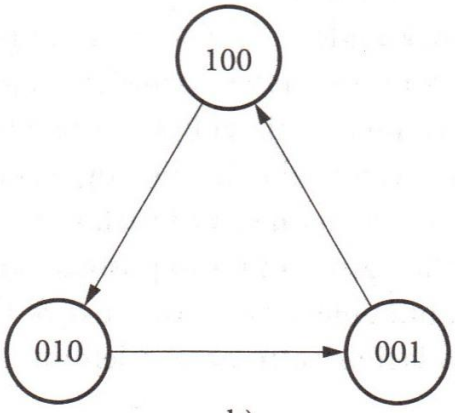


Brojači na osnovu posmačnog registra – prstenasti brojač



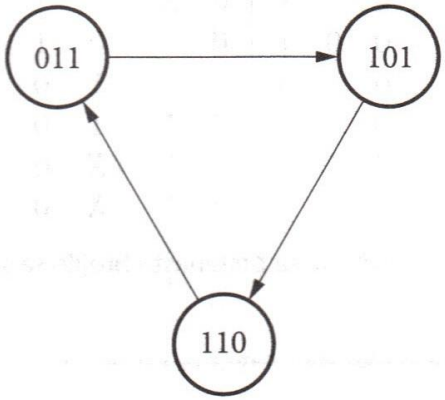
Ulaz	Stanja		
n	B_0	B_1	B_2
0	1	0	0
1	0	1	0
2	0	0	1
3	1	0	0

a)



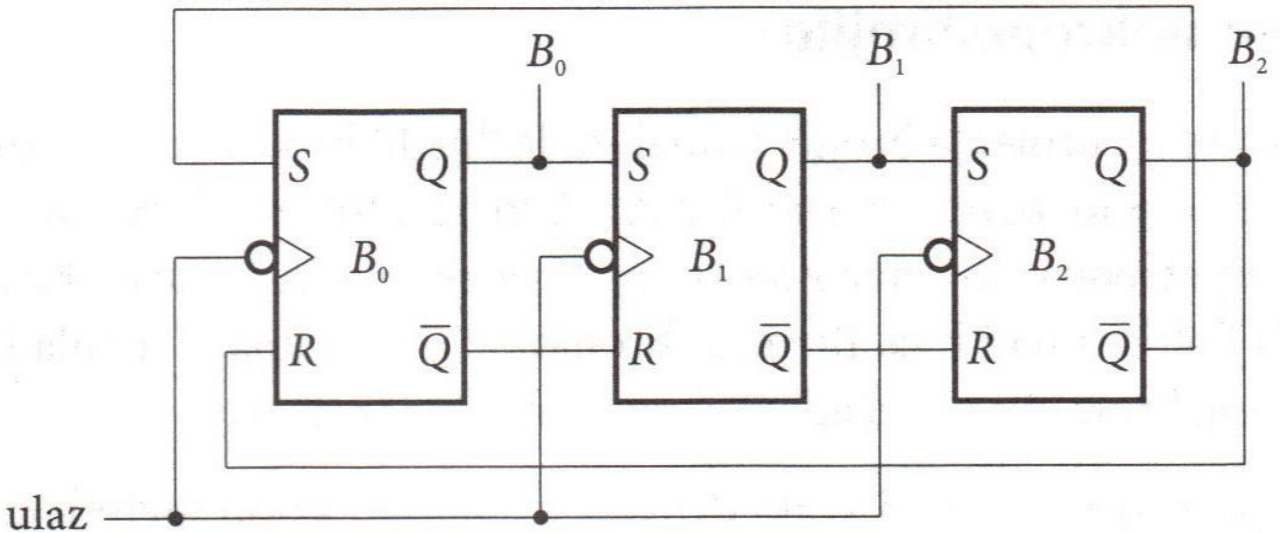
b)

cirkuliše 1



cirkuliše 0

Brojači na osnovu posmačnog registra - Johnsonov brojač



ulaz	B_0	B_1	B_2
0	0	0	0
1	1	0	0
2	1	1	0
3	1	1	1
4	0	1	1
5	0	0	1
6	0	0	0

Sinhroni binarni brojač (m=16)

n

$N = 2^n$

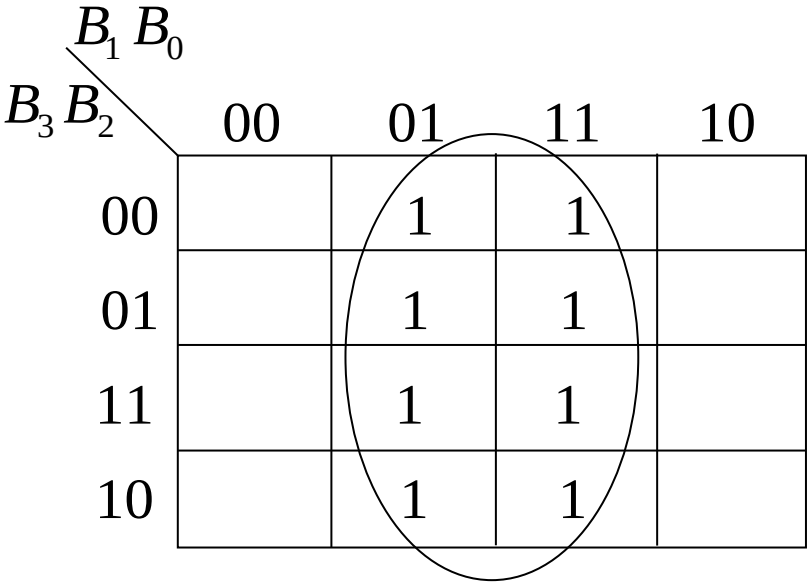
$W = 2^n - 1$

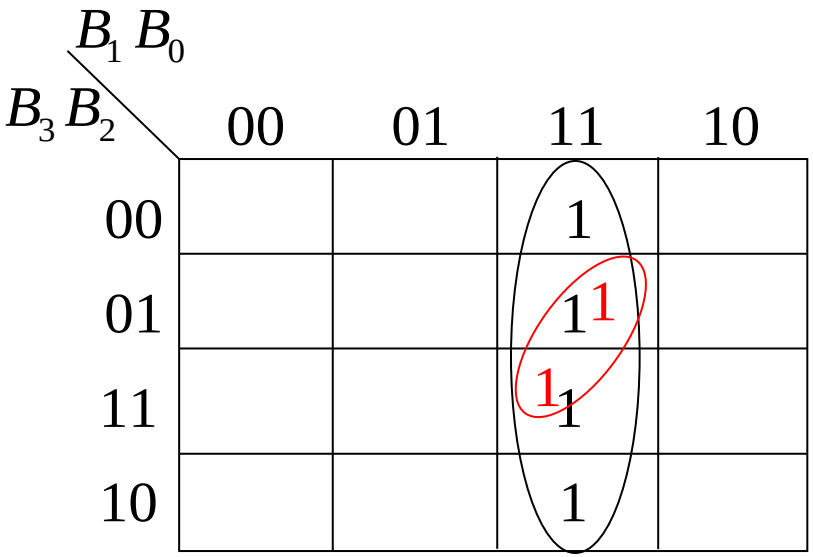
1111

T	Q_{n+1}
0	Q_n
1	$\overline{Q_n}$

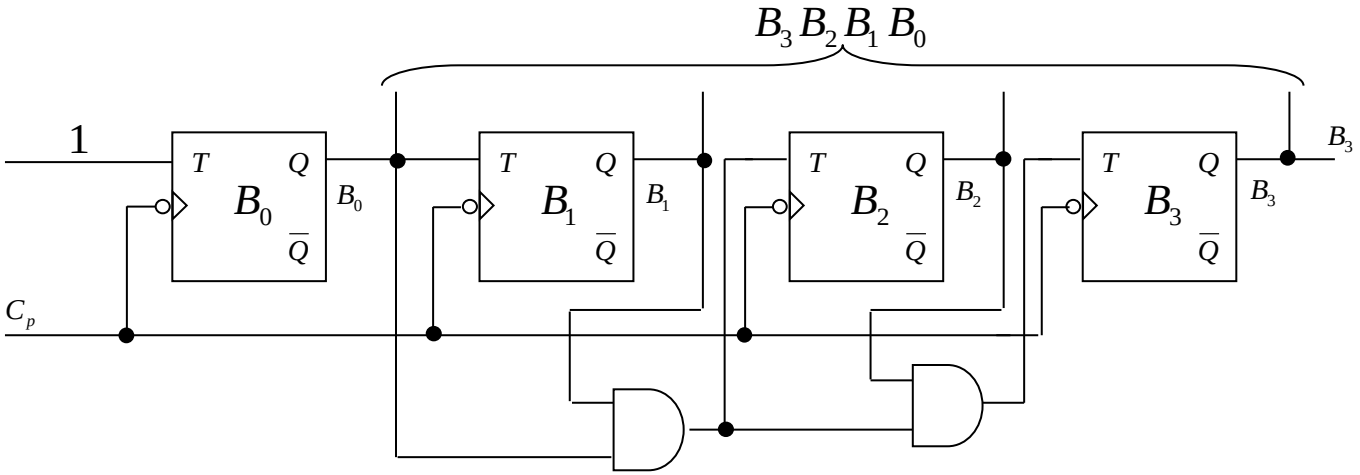
C_p	B_3	B_2	B_1	B_0	T_3	T_2	T_1	T_0
0	0	0	0	0	0	0	0	1
1	0	0	0	1	0	0	1	1
2	0	0	1	0	0	0	0	1
3	0	0	1	1	0	1	1	1
4	0	1	0	0	0	0	0	1
5	0	1	0	1	0	0	1	1
6	0	1	1	0	0	0	0	1
7	0	1	1	1	1	1	1	1
8	1	0	0	0	0	0	0	1
9	1	0	0	1	0	0	1	1
10	1	0	1	0	0	0	0	1
11	1	0	1	1	0	1	1	1
12	1	1	0	0	0	0	0	1
13	1	1	0	1	0	0	1	1
14	1	1	1	0	0	0	0	1
15	1	1	1	1	1	1	1	1
16	0	0	0	0				

Sinhroni binarni brojač - projektovanje

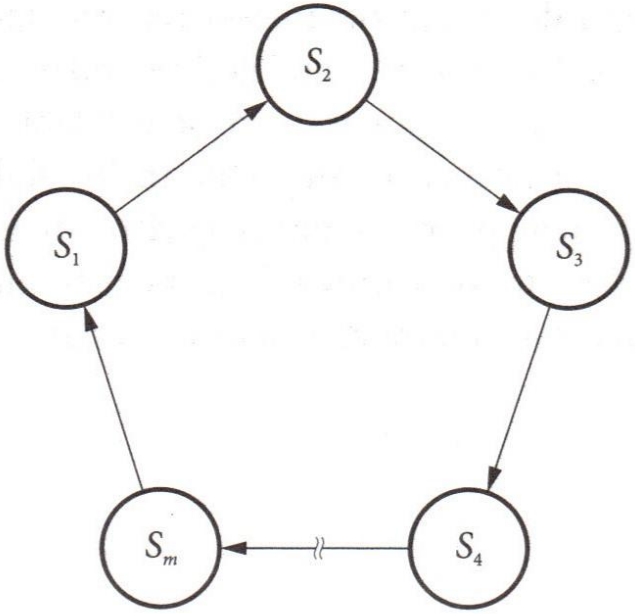




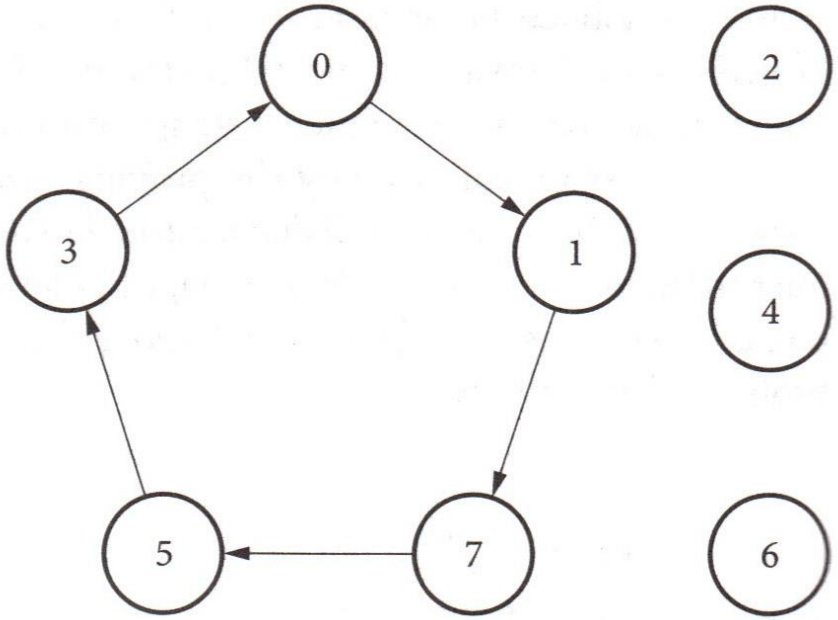
$T_0 = 1$ $T_1 = B_0$ $T_2 = B_1 B_0$ $T_3 = B_2 B_1 B_0$



Sinhroni brojač modula m



Dijagram stanja modulo m brojača



Dijagram stanja modulo 5 brojača

Sinhroni brojač modula 5 - projektovanje

	Sadašnje stanje			Sljedeće stanje					
d	B_2	B_1	B_0	B_2	B_1	B_0	T_2	T_1	T_0
0	0	0	0	0	0	1	0	0	1
1	0	0	1	1	1	1	1	1	0
7	1	1	1	1	0	1	0	1	0
5	1	0	1	0	1	1	1	1	0
3	0	1	1	0	0	0	0	1	1

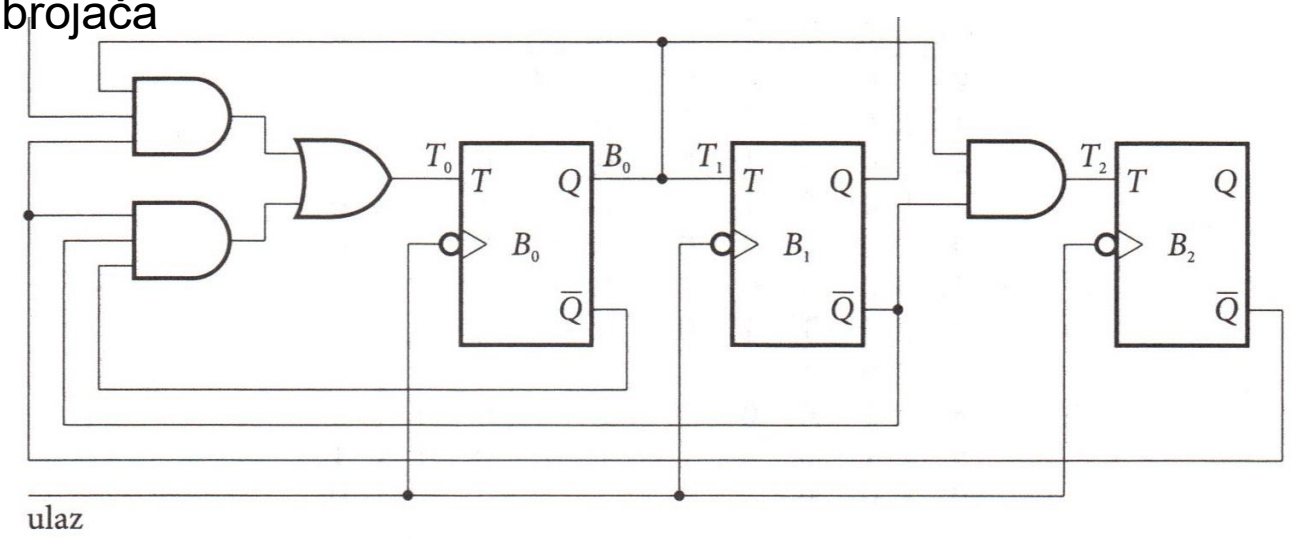
Tablica stanja modulo 5 brojača

$$T_0 = \overline{B_2} B_1 + \overline{B_0}$$

$$T_1 = B_0$$

$$T_2 = \overline{B_1}\, B_0$$

Shema modulo 5 brojača



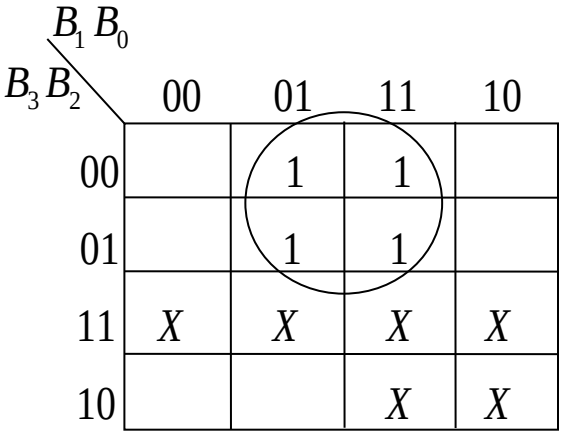
Sinhroni dekadni brojač

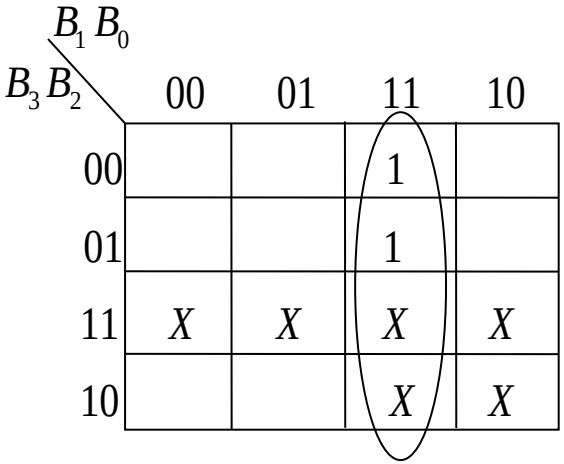
$2^n \geq M$

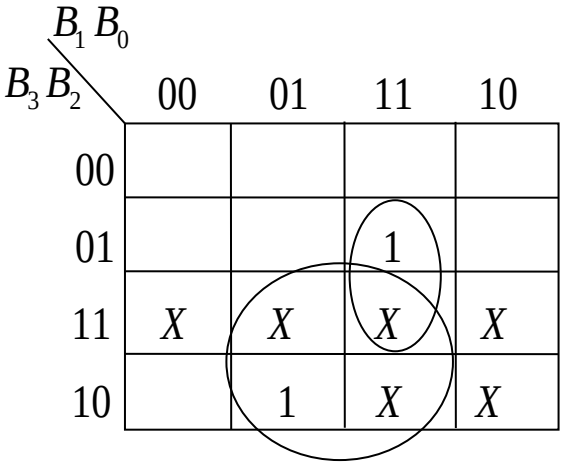
$M = 10$

C_p	B_3	B_2	B_1	B_0	T_3	T_2	T_1	T_0	Z
0	0	0	0	0	0	0	0	1	0
1	0	0	0	1	0	0	1	1	0
2	0	0	1	0	0	0	0	1	0
3	0	0	1	1	0	1	1	1	0
4	0	1	0	0	0	0	0	1	0
5	0	1	0	1	0	0	1	1	0
6	0	1	1	0	0	0	0	1	0
7	0	1	1	1	1	1	1	1	0
8	1	0	0	0	0	0	0	1	0
9	1	0	0	1	1	0	0	1	0
10	0	0	0	0					1

Sinhroni dekadni brojač - projektovanje

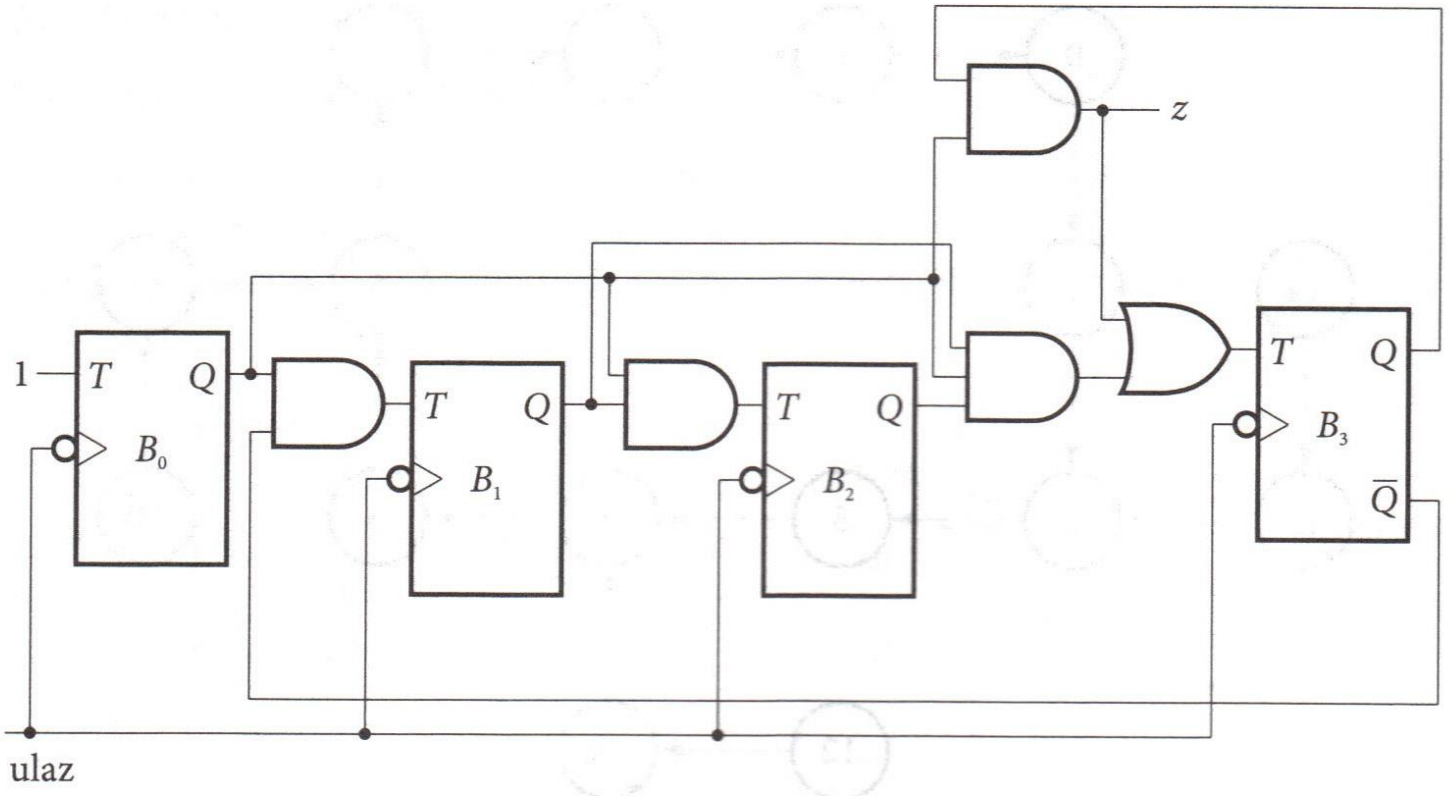




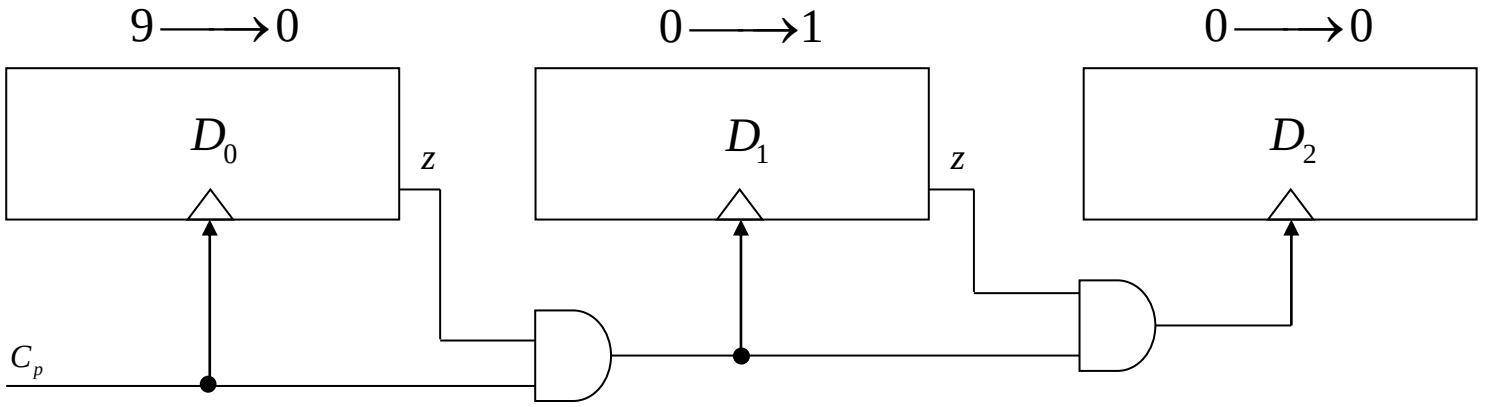


$$T_0 = 1 \qquad T_1 = \overline{B}_3 B_0 \qquad T_2 = B_1 B_0 \qquad T_3 = B_3 B_0 + B_2 B_1 B_0$$

Shema sinhronog dekadskog brojača

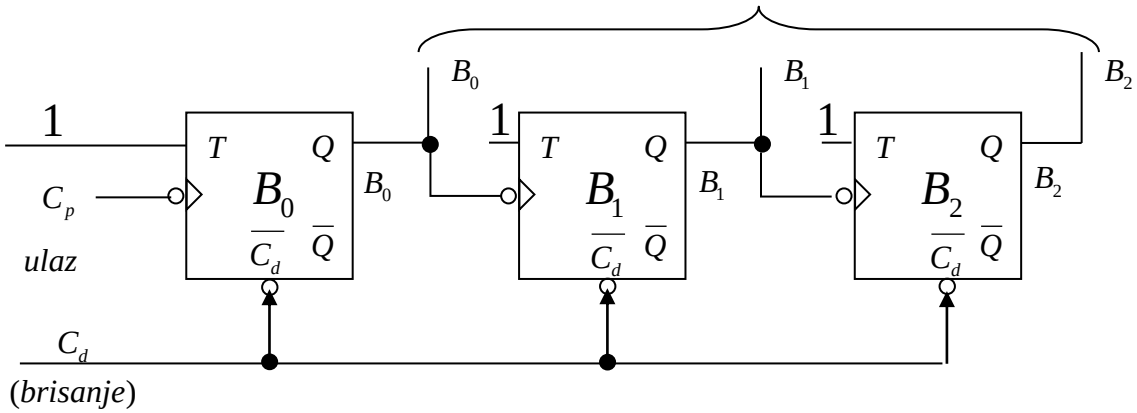


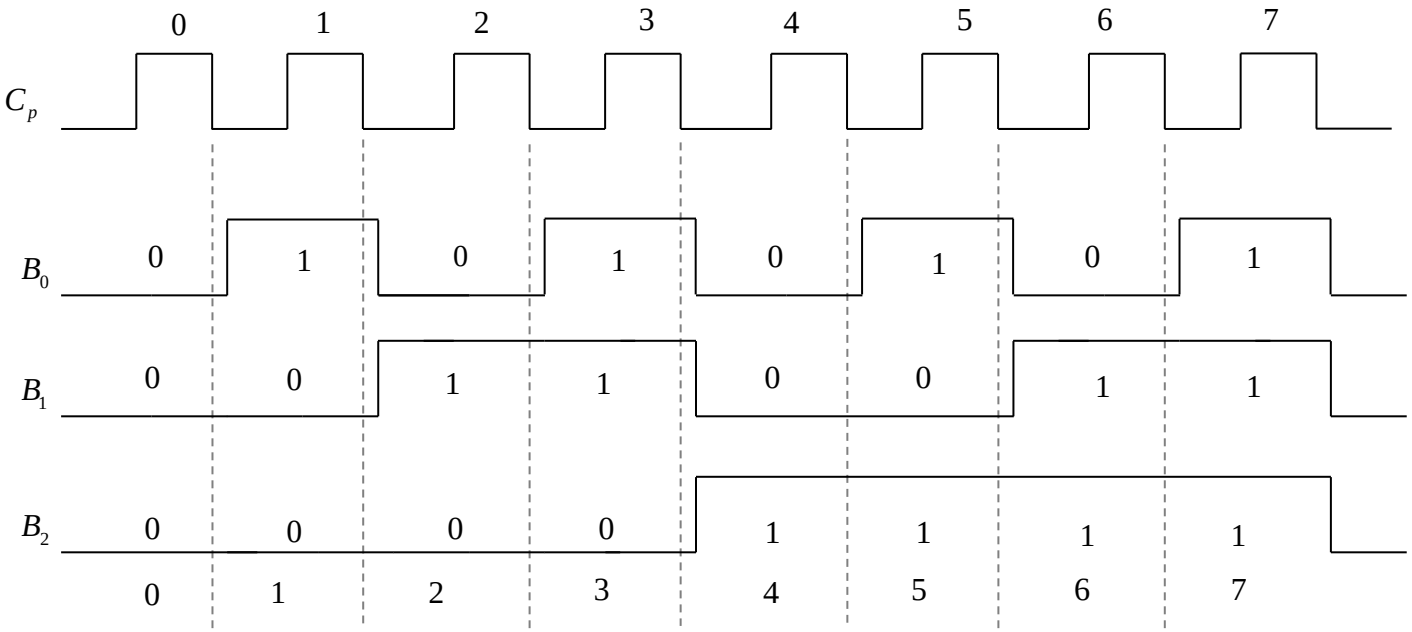
Kaskadiranje brojača



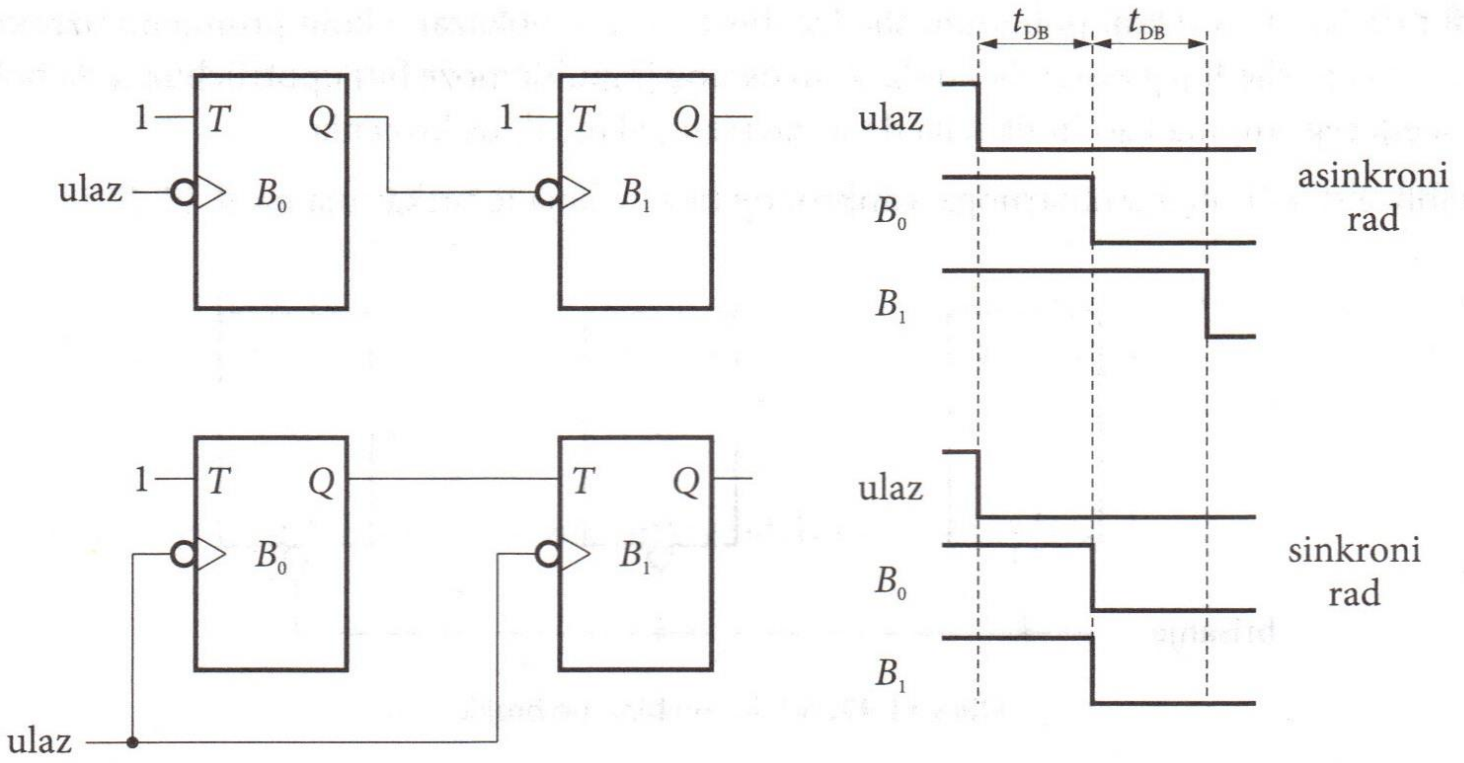
D_2	D_1	D_0
0	0	0
0	0	1
0	0	2
	. . .	
0	0	9
0	1	0
	. . .	
0	9	9
1	0	0
	. . .	
9	9	9

Asinhroni brojač

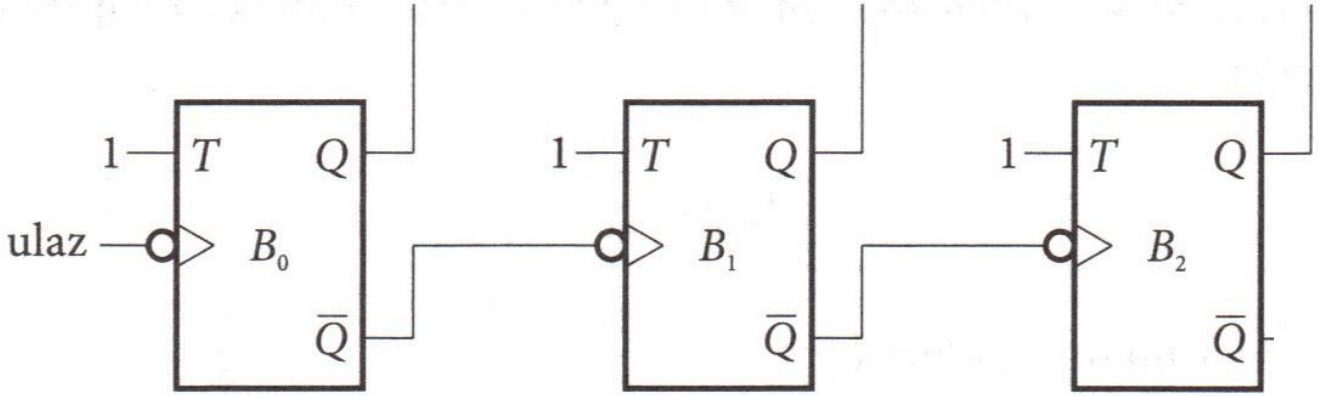




Asinhroni i sinhroni način upravljanja bistabilima

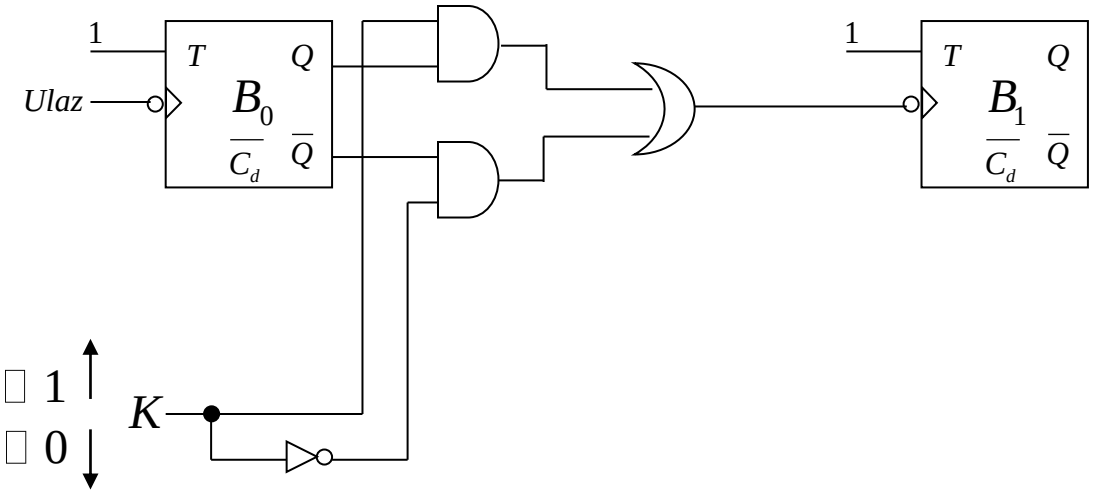


Reverzibilni binarni asinhroni brojač

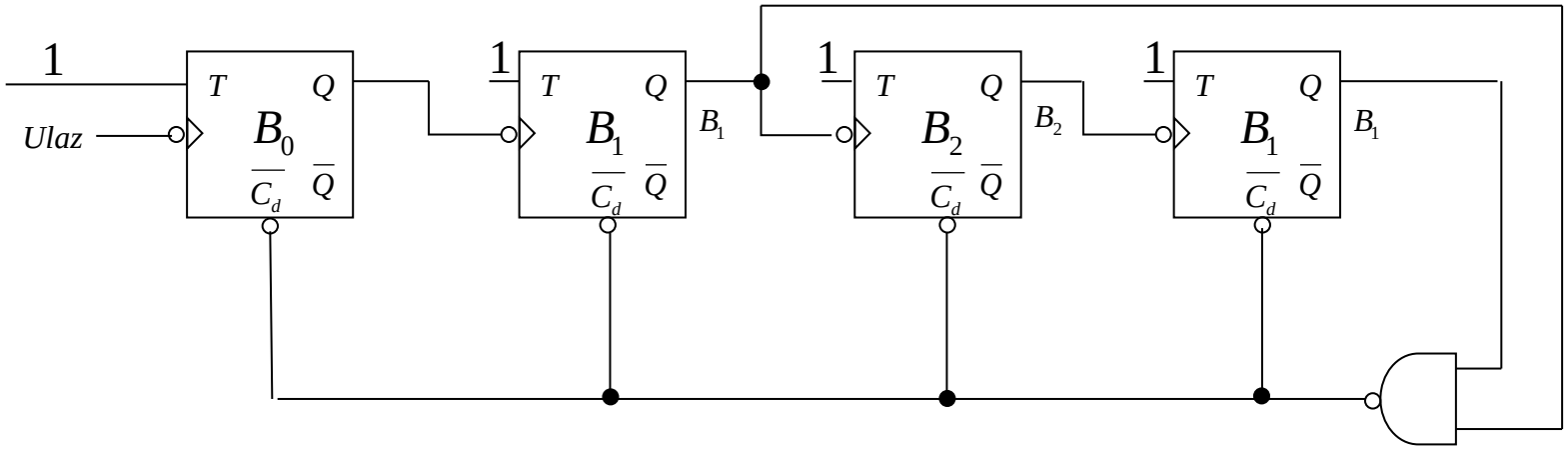


ulaz	B_2	B_1	B_0
0	0	0	0
1	1	1	1
2	1	1	0
3	1	0	1
4	1	0	0
5	0	1	1
6	0	1	0
7	0	0	1
8	0	0	0

Dvosmjerni binarni asinhroni brojač



Modulo m asinhroni brojač - asinhroni dekadni brojač



$2^n \geq 10$

$n = 4$

Ulaz	B_3	B_2	B_1	B_0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
	1	0	1	0
10	0	0	0	0