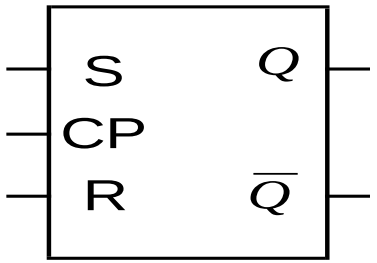
OSNOVE DIGITALNE ELEKTRONIKE

BISTABILI

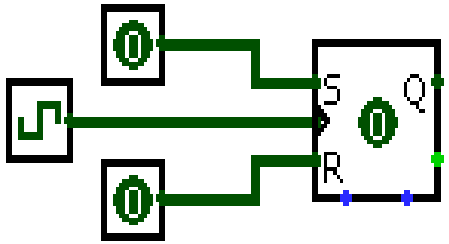
Rad SR bistabila i tablica stanja

Bistabili-memorijski elementi
Ima dva stabilna stanja
Pamti “0” ili “1”
Vrste-prema ulazima za okidanje(promjenu stanja):
-SR; JK; D; T
Upravljivi bistabili –sa CP ulazom—Sinkroni rad



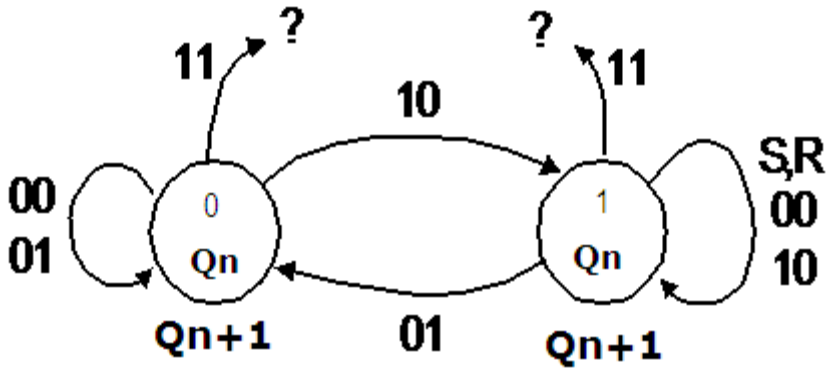
sažeta tablica

S	R	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	X



Q_n	S	R	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	?, X
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	?, X

Dijagram stanja SR bistabila



Q_n	S	R	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	?, X
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	?, X

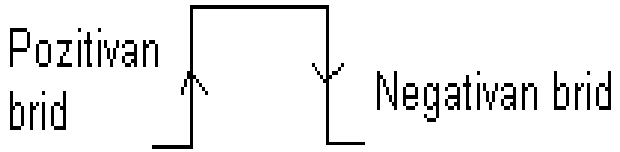
Q_{n+1} SR

Q_n	00	01	11	10
0			x	1
1	1		x	1

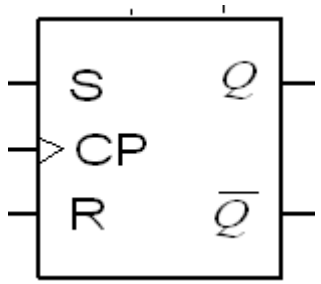
$$Q_{n+1} = S + \overline{R} \cdot Q_n$$

Bridom okidani SR bistabil

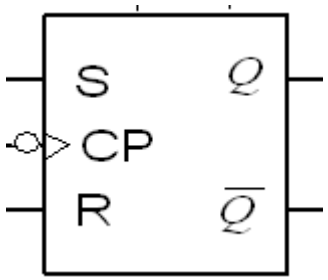
- Stanje na izlazu mijenja se na prednji ili zadnji brid Cp impulsa u skladu sa stanjem sinkronih ulaza (SR,JK;D,T)



CP	S	R	Q_{n+1}
↓↑	0	0	Q_n
↓↑	0	1	0
↓↑	1	0	1
↓↑	1	1	X



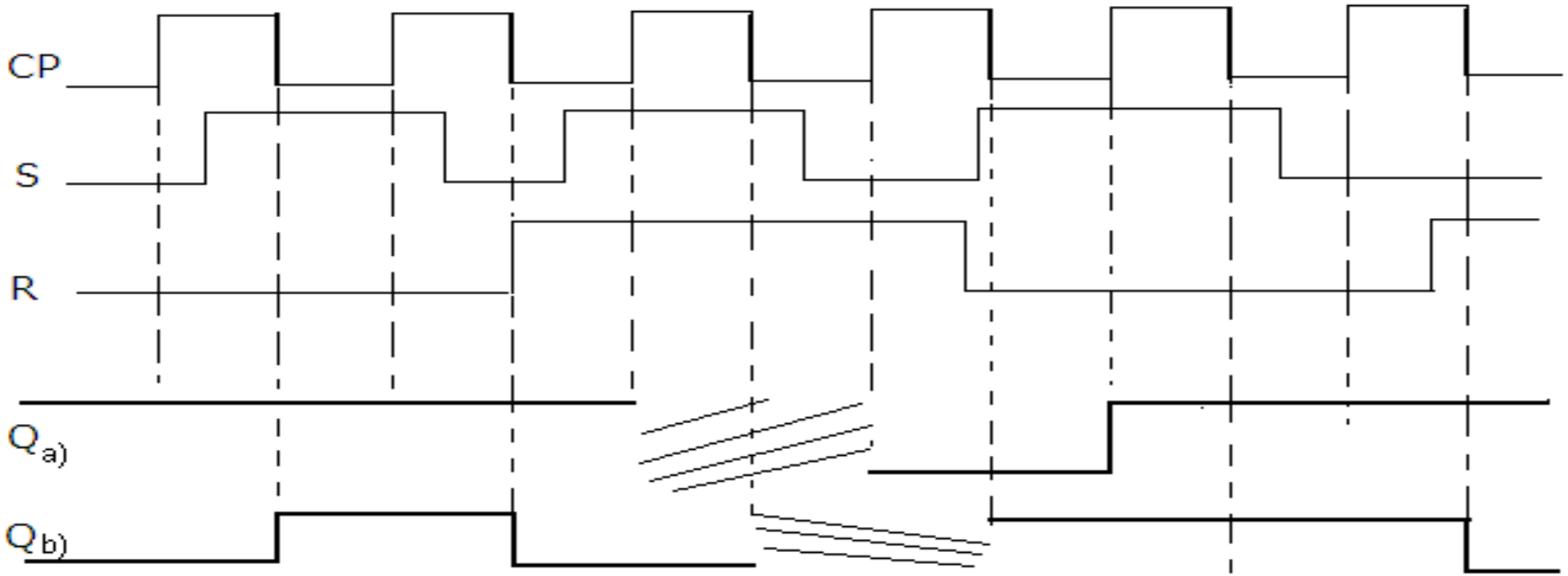
a)



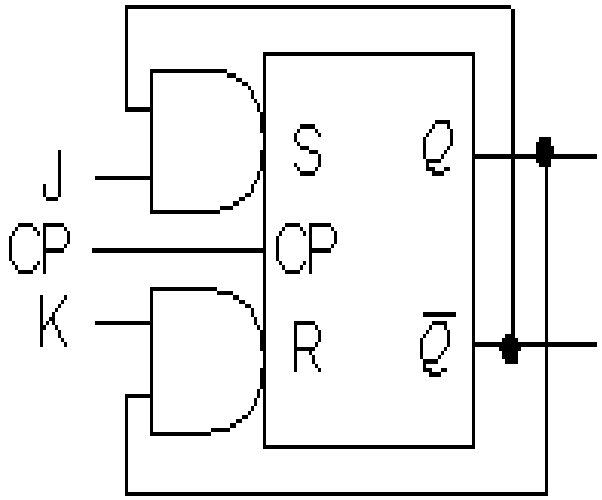
b)

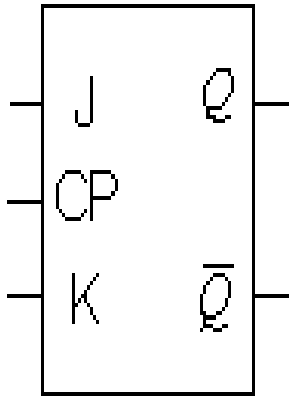
Za zadane vremenske signale odrediti promjene na izlazu bridom okidanog bistabila

- a) Qn=1 b) Qn=0



Realizirati JK bistabil pomoću SR bistabila i napisati tablicu stanja

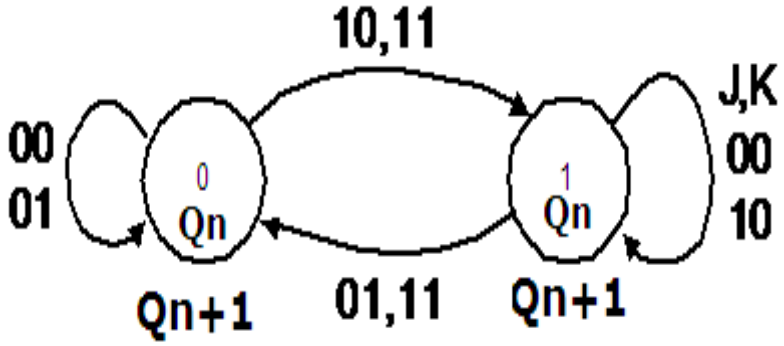


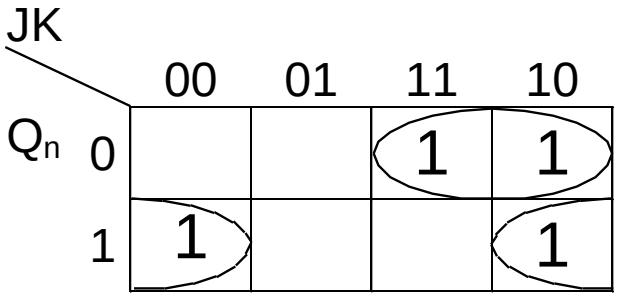


Q_n	J	K	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

J	K	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	$\overline{Q_n}$

Dijagram stanja JK bistabila

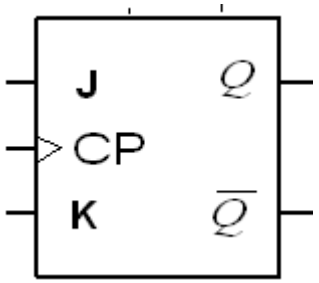


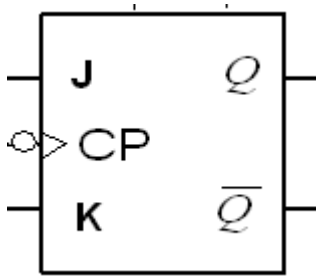


$$Q_{n+1} = J \cdot \overline{Q}_n + \overline{K} \cdot Q_n$$

Q_n	J	K	Q_{n+1}
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

Bridom okidani JK bistabil

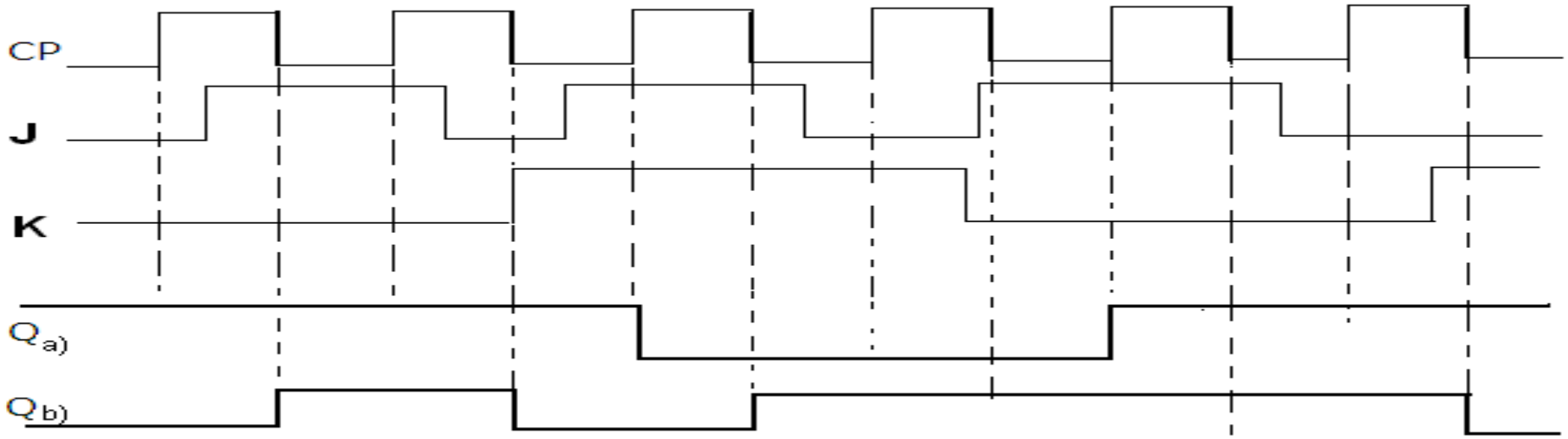




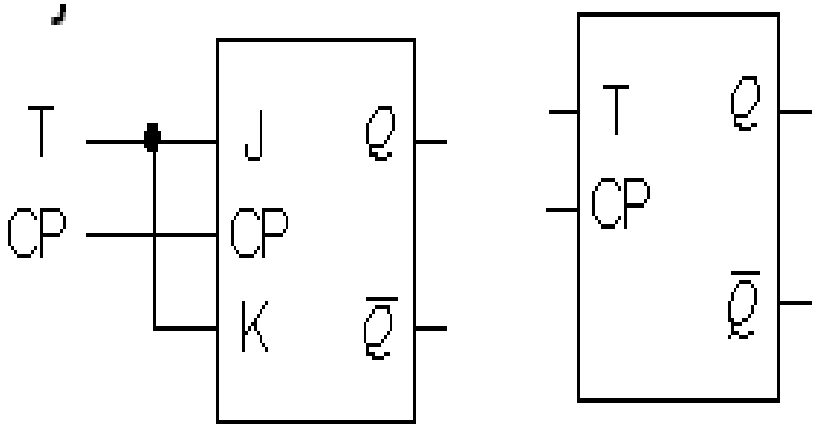
CP	J	K	Q_{n+1}
↓↑	0	0	Q_n
↓↑	0	1	0
↓↑	1	0	1
↓↑	1	1	$\overline{Q}_n$

Za zadane vremenske signale odrediti promjene na izlazu bridom okidanog bistabila

a) Qn=1 b) Qn=0



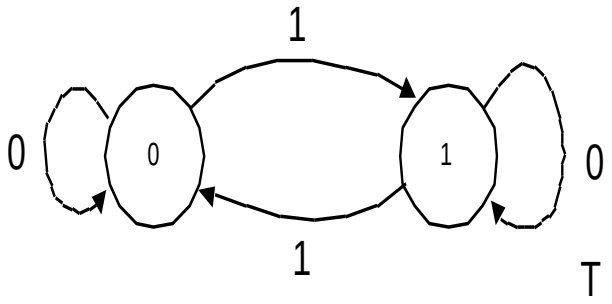
T bistabil –simbol i tablica stanja



tablica stanja:

Q_n	T	Q_{n+1}
0	0	0
0	1	1
1	0	1
1	1	0

Dijagram stanja T bistabila

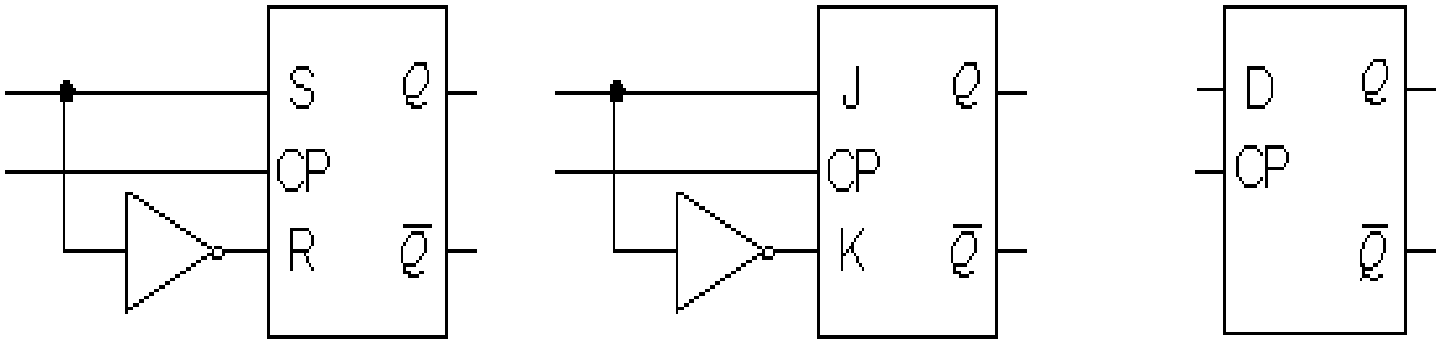


Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

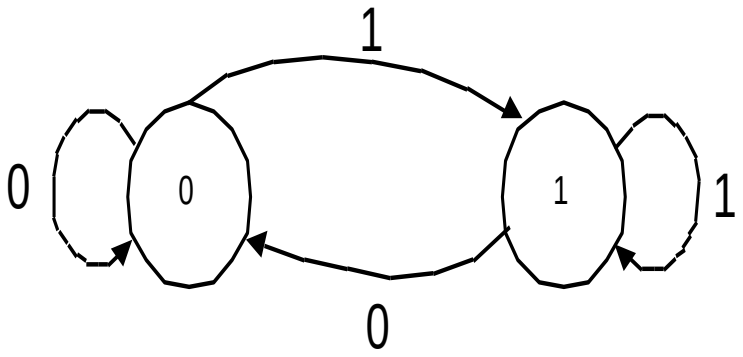
Qn \ T	0	1
0		1
1	1	

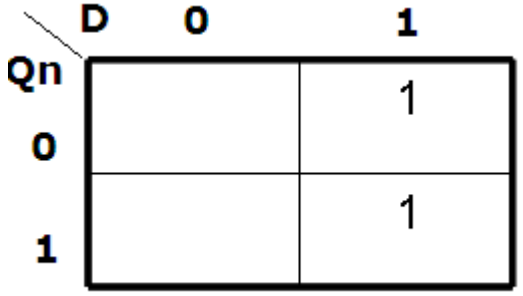
$$Q_{n+1} = T \cdot \overline{Q}_n + \overline{T} \cdot Q_n$$

D bistabil- simbol i tablica stanja



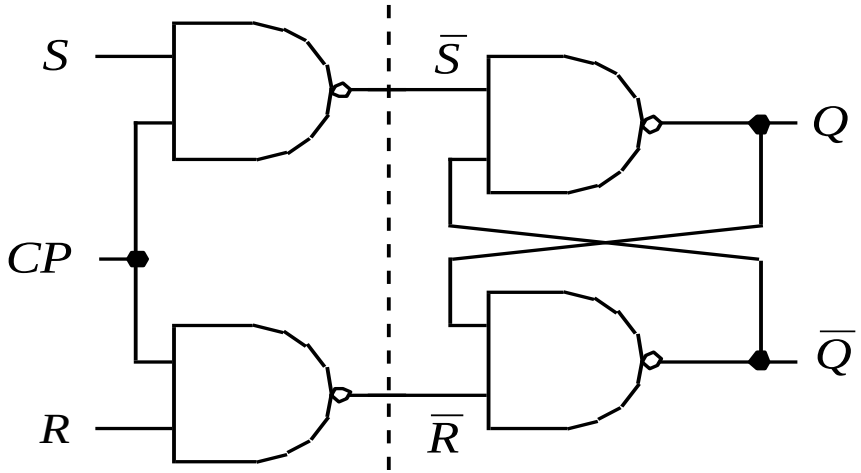
Q_n	D	Q_{n+1}
0	0	0
0	1	1
1	0	0
1	1	1



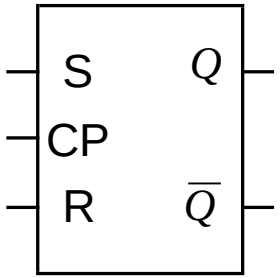


$$Q_{n+1} = D_n$$

Sinkroni bistabil- okidan Cp impulsima

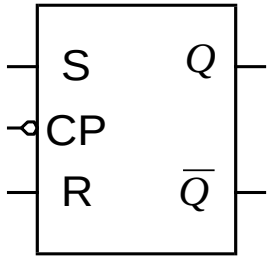


logička shema upravljivog bistabila- izvedba sa NI logičkim sklopovima



aktivna 1

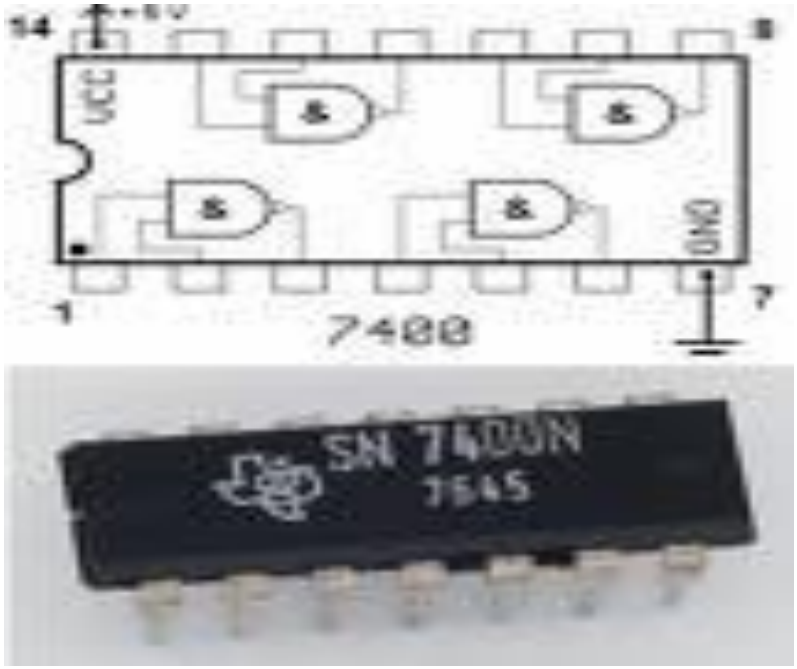
Cp impulsa

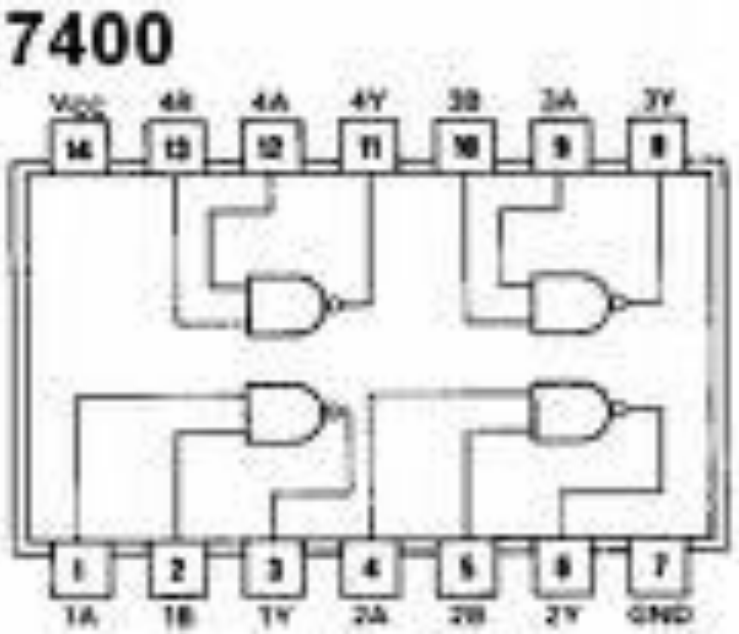


aktivna 0

Cp impulsa

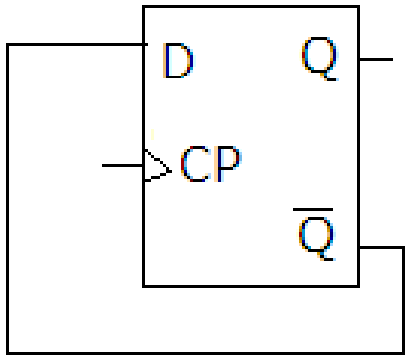
Sinkroni bistabil izveden pomoću 7400

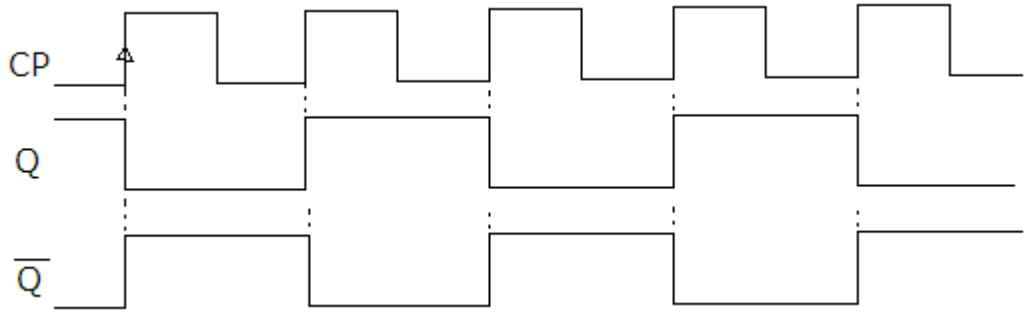




Odrediti frekvenciju izlaznog signala tako spojenog bistabila, ako je početno stanje bistabila $Q_n=1$, a frekvencija CP impulsa je 10kHz.

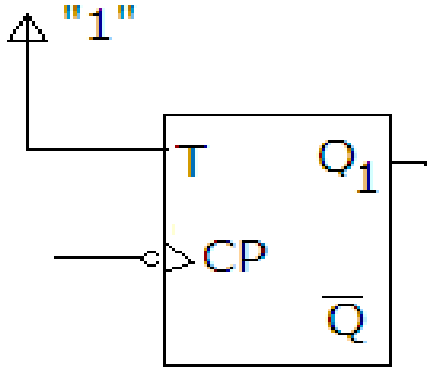
- $f_{CP}=10kHz$ $f_Q=f_{CP}/2=5kHz$

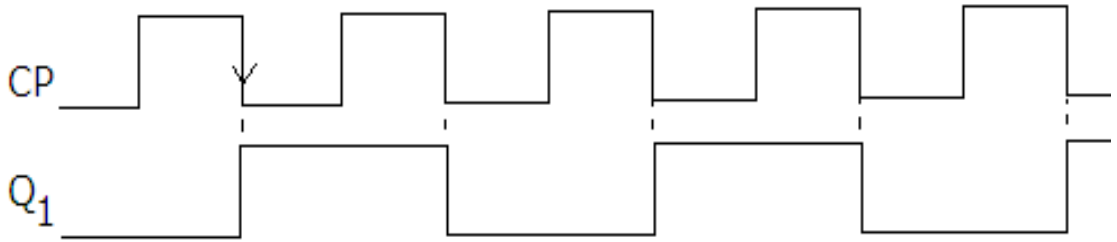




Odrediti frekvenciju izlaznog signala tako spojenog bistabila,ako je početno stanje bistabila Qn=0, a frekvencija CP impulsa je 10kHz.

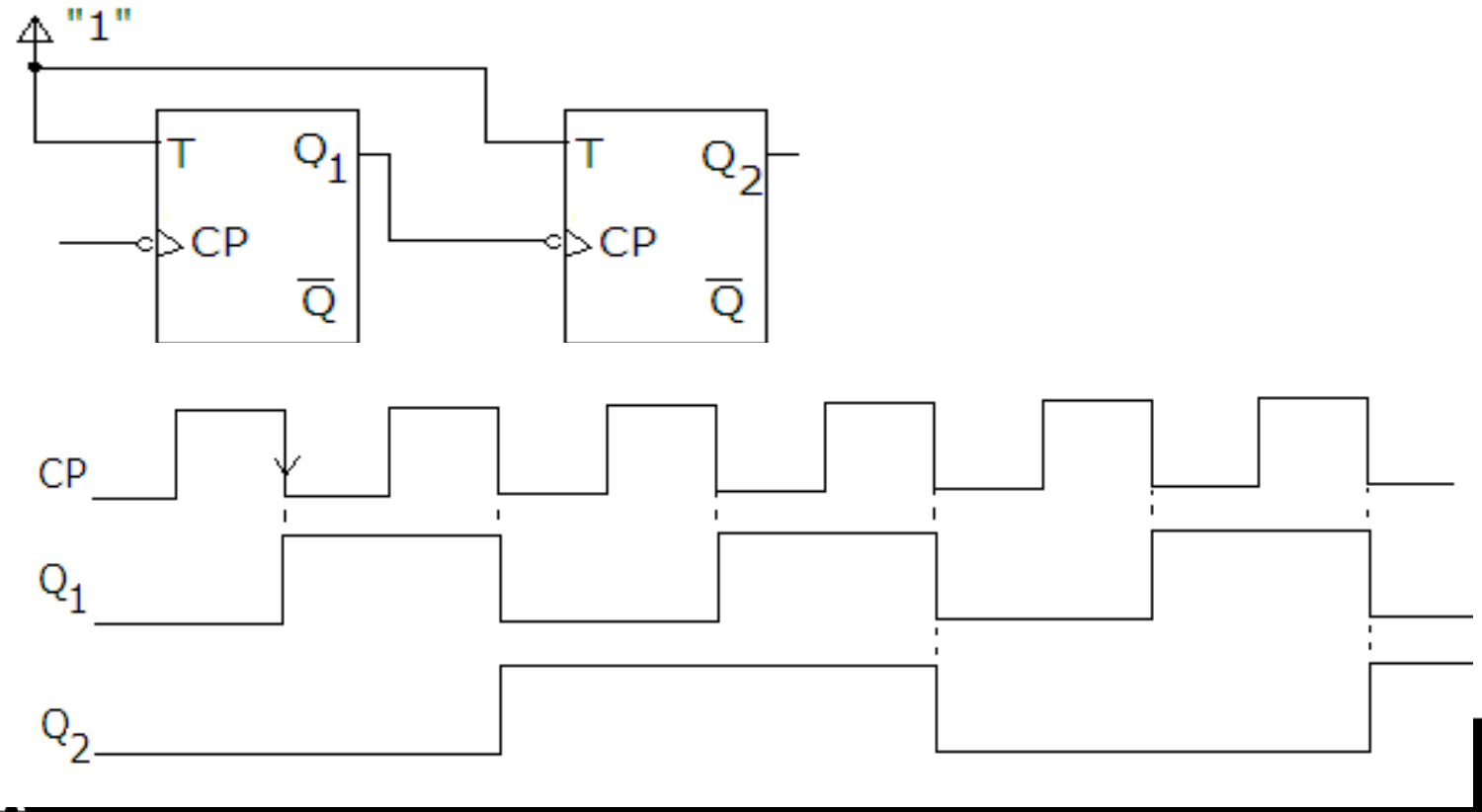
- $f_{CP}=10kHz$ $f_{Q1}=f_{CP}/2=5kHz$





Odrediti frekvenciju izlaznog signala tako spojenih bistabila,ako su početna stanja bistabila Qn=0, a frekvencija CP impulsa je 10kHz

- $f_{CP}=10kHz$ $f_{Q1}=f_{CP}/2=5kHz$
- $f_{Q2}=f_{CP}/4=2,5kHz$



Pomoću D bistabila i logičkih sklopova realizirati T bistabil

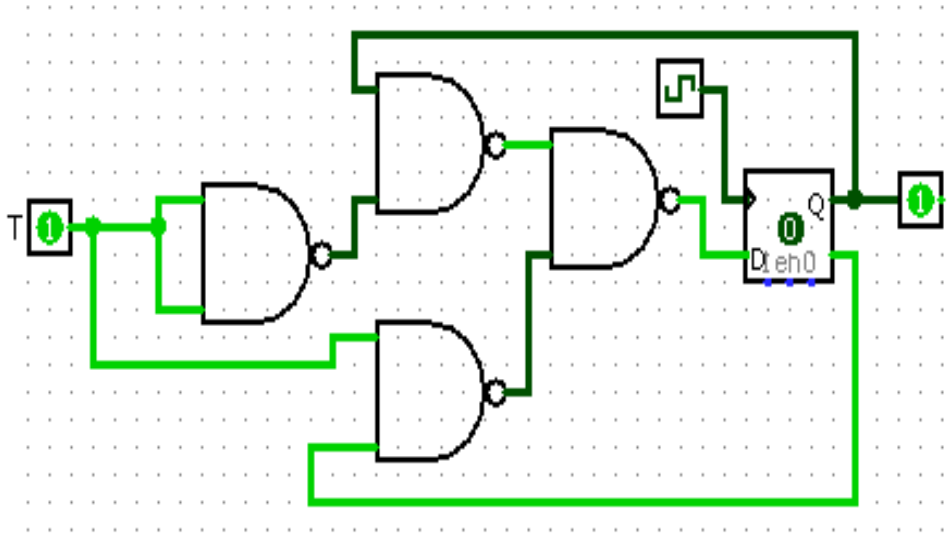
tablica stanja:

Q_n	T	Q_{n+1}	**D**
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

$$Qn+1 = D$$

$$D=\overline{T}Qn+T\overline{Qn}$$

$$D=\overline{\overline{\overline{T}Qn} * \overline{T\overline{Qn}}}$$



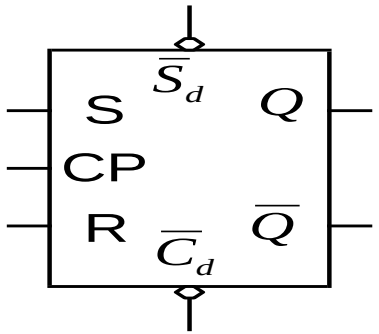
Rad bistabila: sinkroni-asinkroni

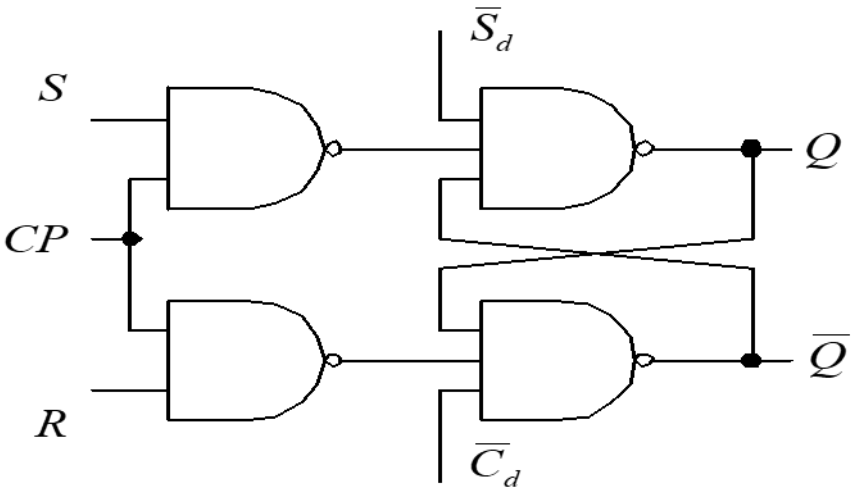
- Sinkroni rad bistabila- promjena stanja događa se preko ulaza SR, JK, D, T u skladu sa Cp impulsima

- Asinkroni rad bistabila-preko ulaza Sd (PR) ili Cd (CLR)
- Prioritet tih ulaza nad sinkronim

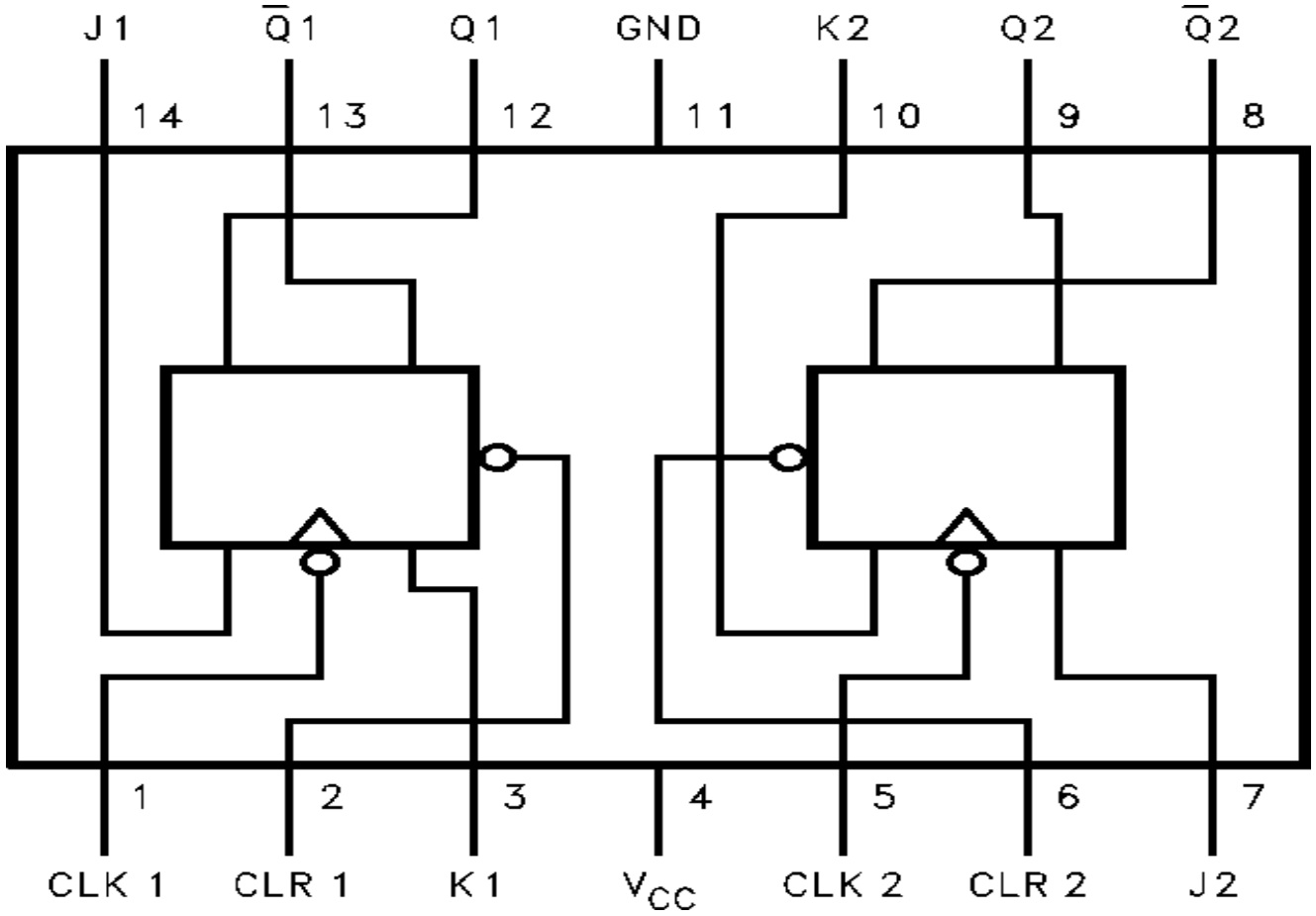
Bistabili sa asinkronim ulazima

- Preko asinkronih ulaza postavljamo bistabile u određeno stanje bez obzira na stanja sinkronih ulaza (SR; JK; D; T) i Cp impulsa
- Sa Sd (PR) Q=1
- Sa Cd (CLR) Q=0
- Sd i Cd aktivni u nuli
- (oznaka kružića)

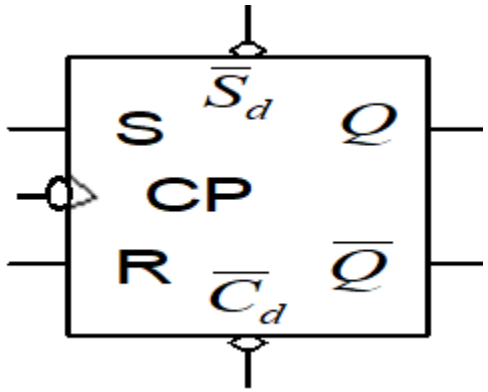




7473 - Dual Master-Slave J-K Flip-Flops with Clear and Complementary Outputs

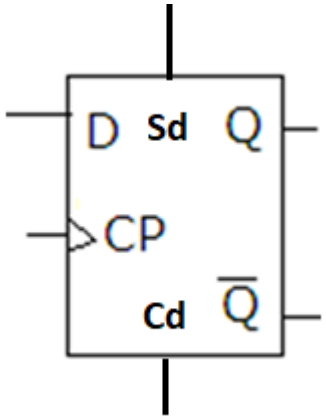


Primjer 1: Za zadani bistabil napisati tablicu stanja i analizirati rad (vremenski dijagram proučiti iz udžbenika.str.137; pr.8



CP	Sd	Cd	S	R	Q_{n+1}	
↓	1	1	0	0	Q_n	
↓	1	1	0	1	0	sinkroni rad
↓	1	1	1	0	1	
↓	1	1	1	1	X	
X	0	1	X	X	1	asinkroni rad
X	1	0	X	X	0	

Primjer 2: Za zadani bistabil napisati tablicu stanja i analizirati rad



CP	Sd	Cd	D	Q_{n+1}	
0	0	0	X	Q_n	
↑	0	0	0	0	sinkroni rad
↑	0	0	1	1	
X	0	1	X	0	asinkroni rad
X	1	0	X	1	