

LOGICA SEQUENZIALE

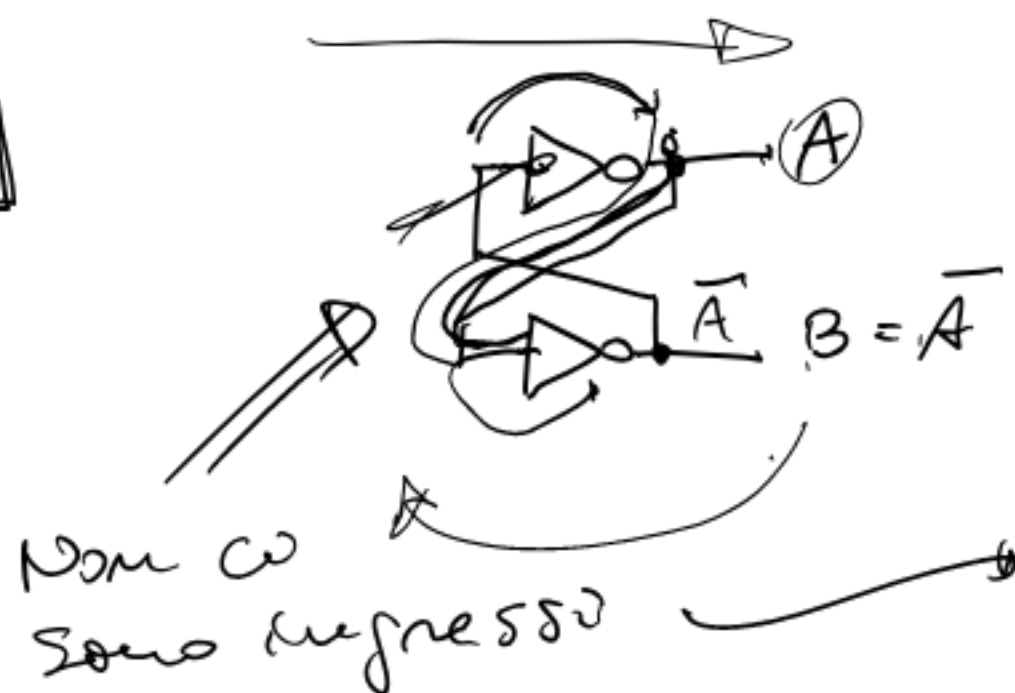
MEMORIA

≡ Rimemorando agli ingressi lo stato delle uscite.

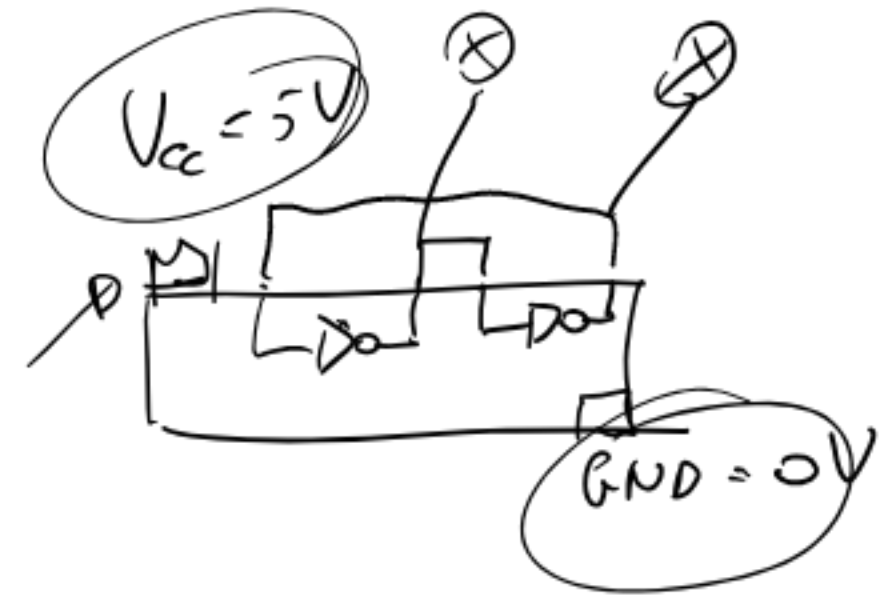
Lo stato delle uscite dipende dallo "STATO" delle var. ingresso.

RETROAZIONE

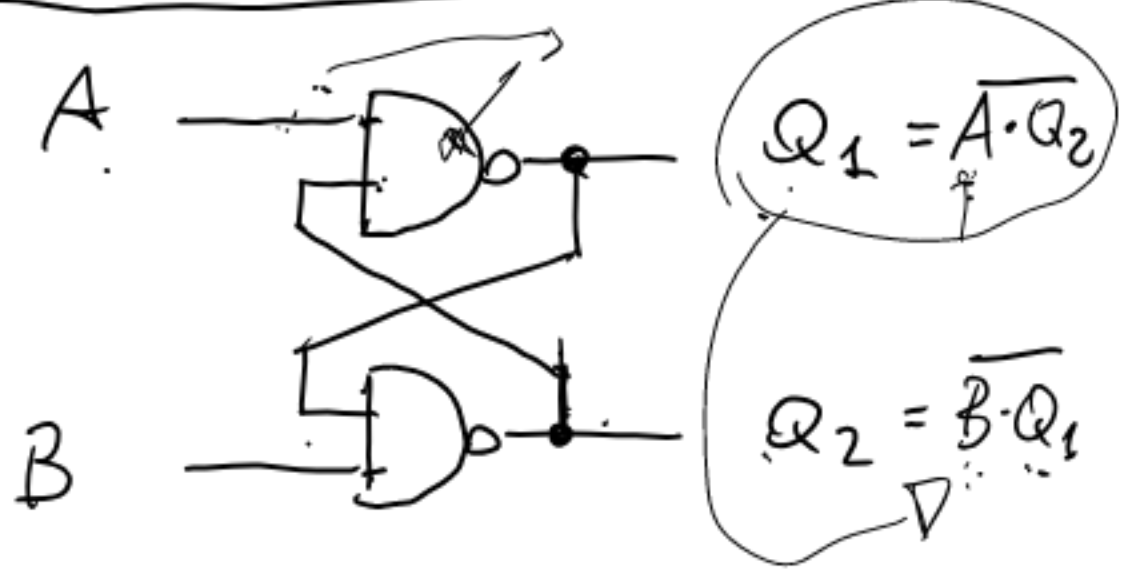
BISTABILE



0	1
1	0
↑	↑
↑	↑



CELLA MEMORIA / FLIP-FLOP

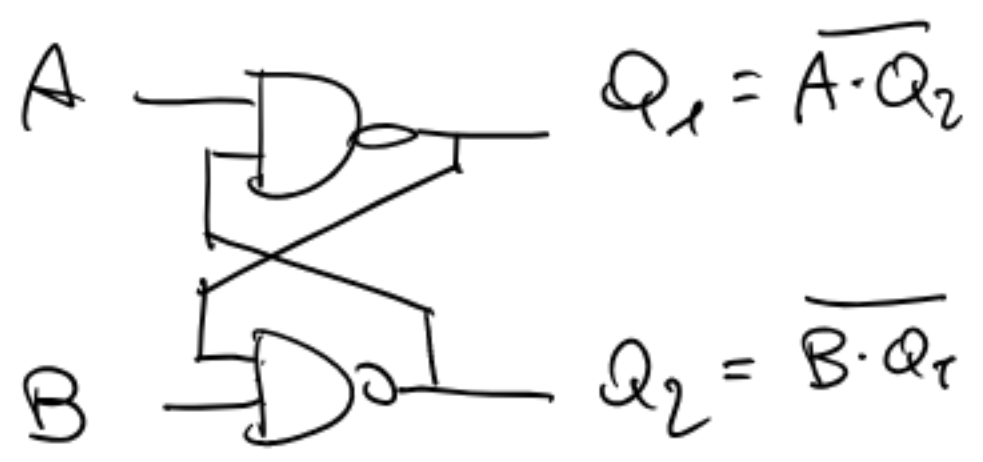


A	B	Q_1	Q_2
0	0	1	1
0	1	1	0
1	0	0	1
1	1	$\overline{Q_2}$	$\overline{Q_1}$

???

$\overline{Q_2}$ $\overline{Q_1}$

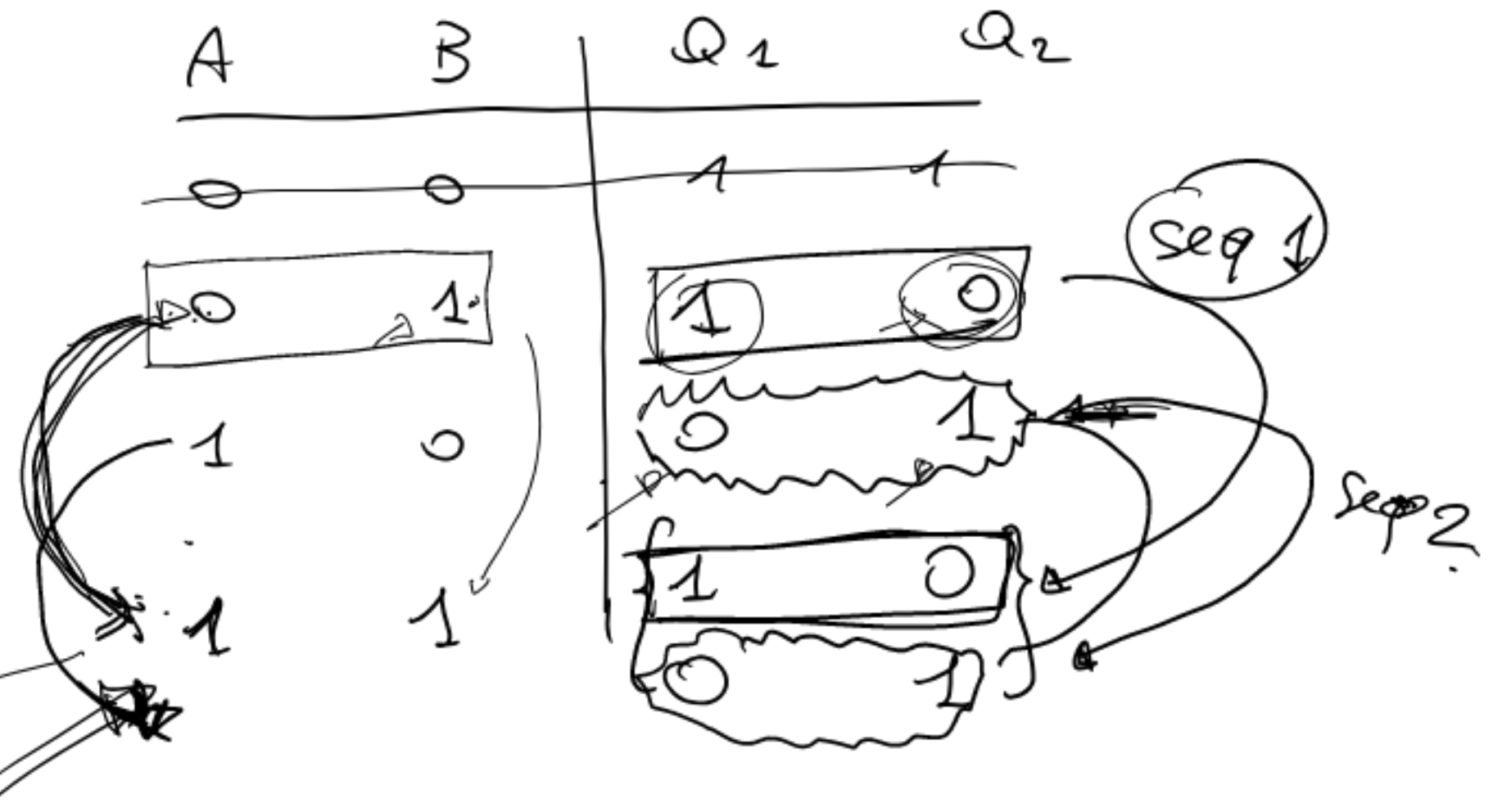
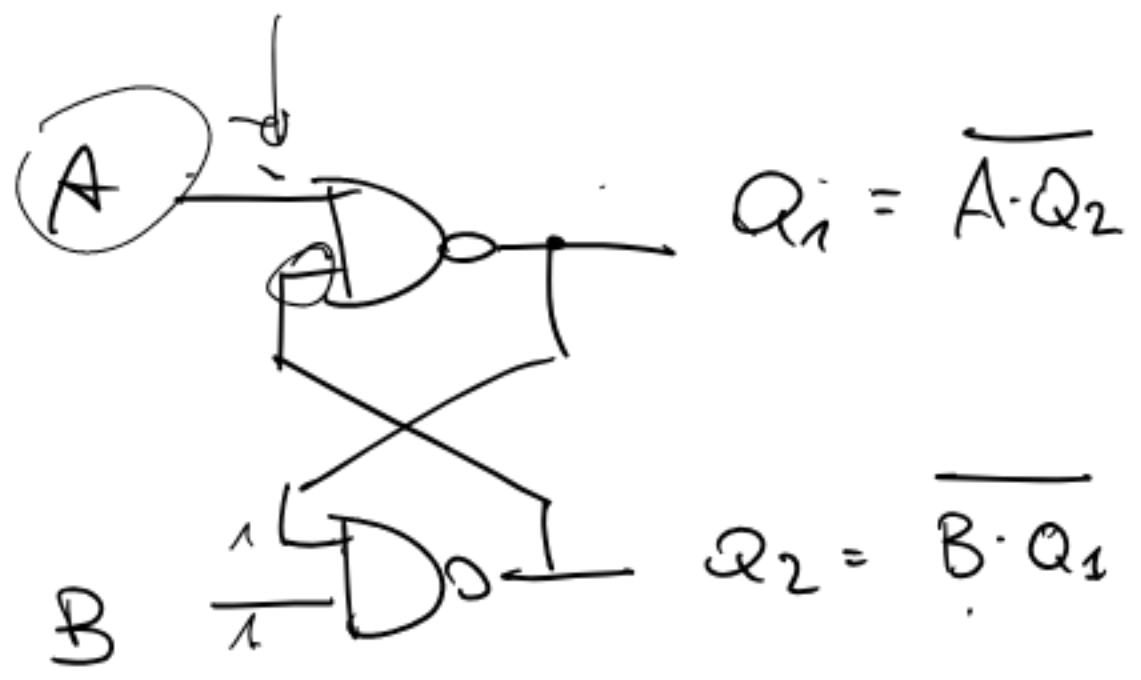
Q_1 Q_2



A	B	Q_1	Q_2
0	0	1	1
0	1	1	0
1	0	0	1
1	1	1	1

$Q_1 = \bar{Q}_2 = 1$
 $Q_2 = \bar{Q}_1 = 0$
 $Q_1 = \bar{Q}_2 = 0$
 $Q_2 = \bar{Q}_1 = 1$

A	B	Q_1	Q_2
0	0	1	1
0	1	1	0
1	0	0	1
1	1	1	0
		0	1



$Q_1 = \overline{A} \cdot Q_2 = \overline{Q_2} = \overline{0} = 1 \quad 0$

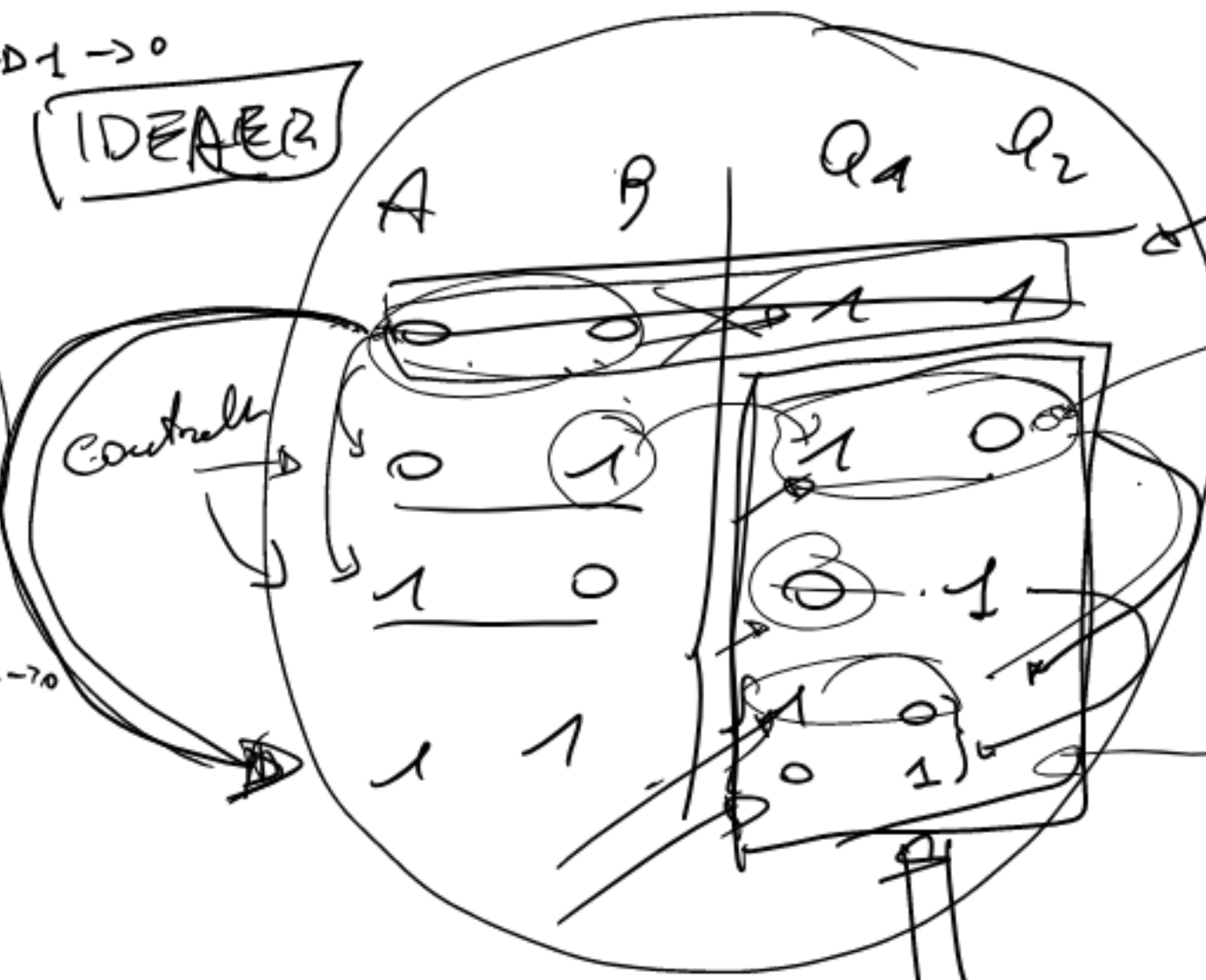
$Q_2 = \overline{B} \cdot Q_1 = \overline{Q_1} = \overline{1} = 0 \quad 1$

seq 1

A	B		A	B	\Rightarrow	Q ₁ = 1	Q ₂ = 0
0	1	\rightarrow	1	1	\Rightarrow	Q ₁ = 0	Q ₂ = 1
1	0	\rightarrow	1	1	\Rightarrow		



1-0-0-1-0
 (IDEAER)



NON PERMESSO

RESET

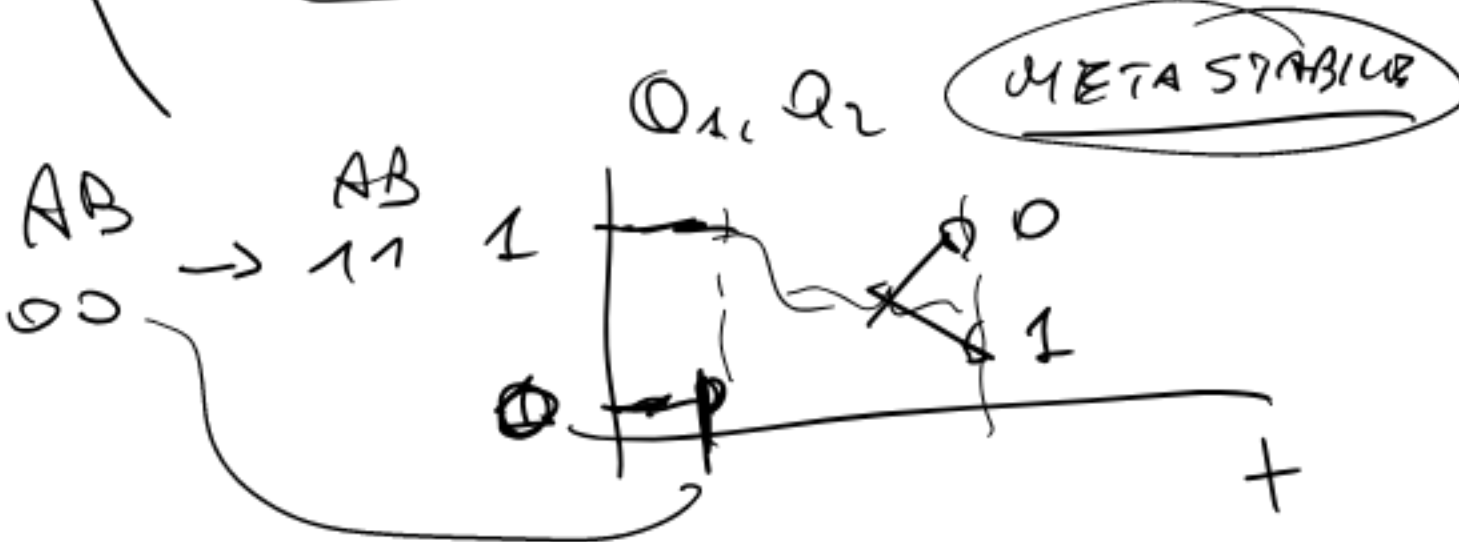
SET

RESET

MEMORIA

FENOMENO DI CORSA CRITICA

$$Q_1 = \bar{Q}_2$$

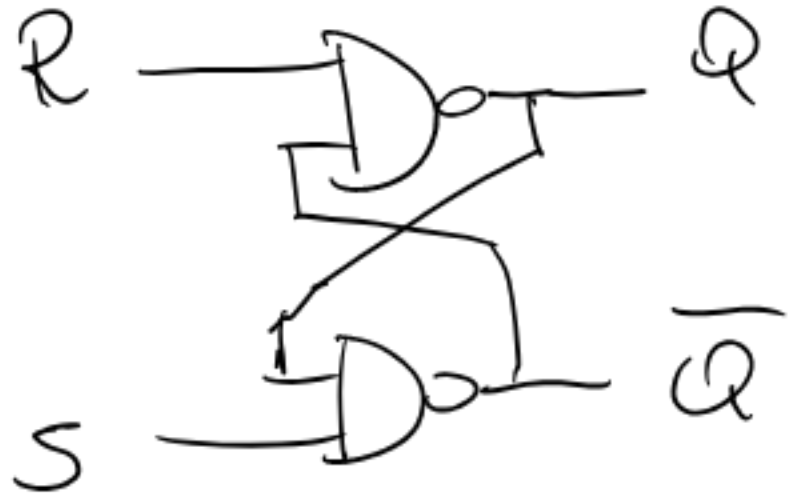


$$Q_1 = Q \quad A = R$$

$$Q_2 = \bar{Q} \quad B = S$$

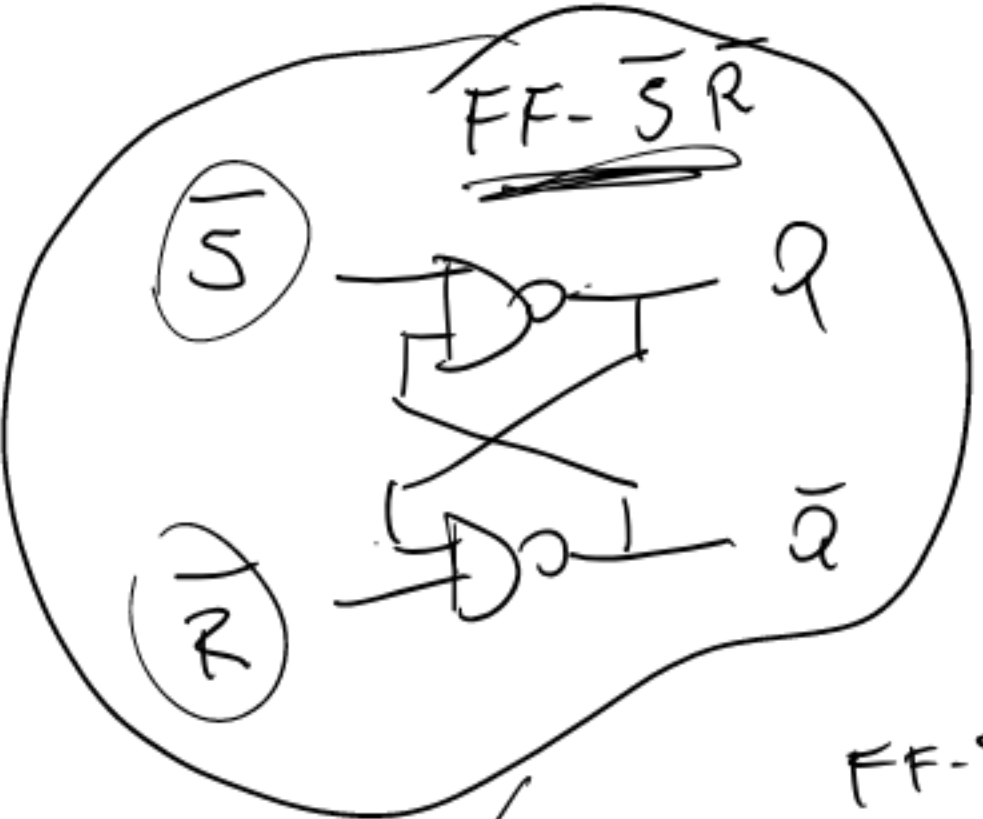
R	S	Q	Q	
0	0	1	1	M.P.
0	1	1	0	SET
1	0	0	1	RESET
1	1			KEY

FF-SR (NAND)



R	S	Q_n	\overline{Q}_n
0	0	X m.p.	
0	1	1	0
1	0	0	1
1	1	Q_{n-1}	\overline{Q}_{n-1}

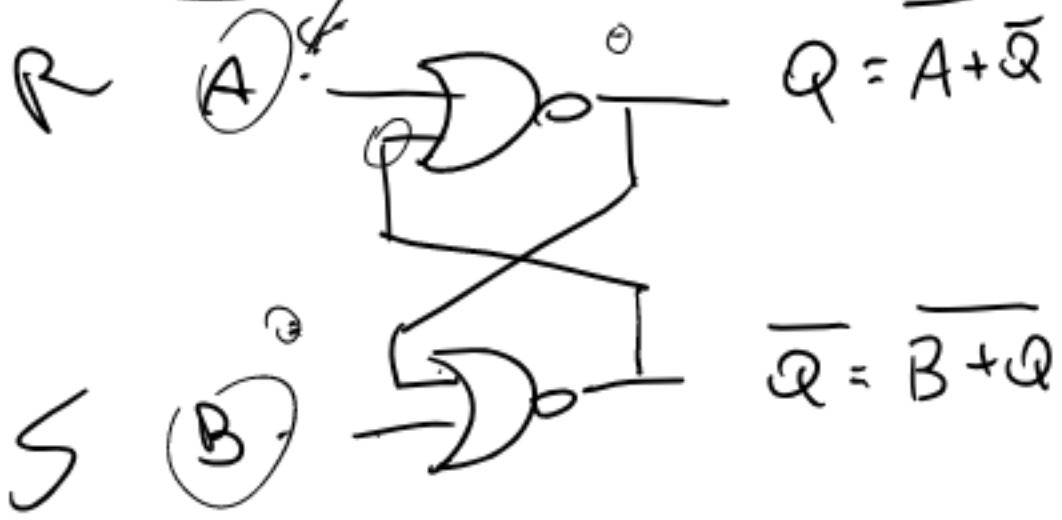
config. m-esima



R	S	Q_n	\overline{Q}_n
0	0	Q_{n-1}	\overline{Q}_{n-1}
0	1	1	0
1	0	0	1
1	1	0	0

NOR

FF-SR

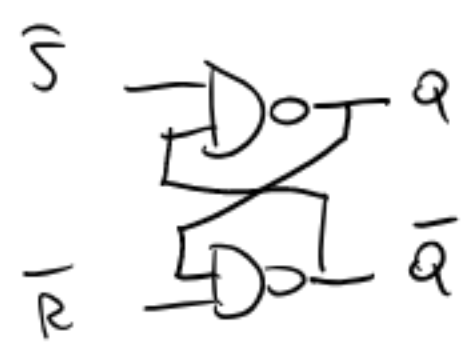
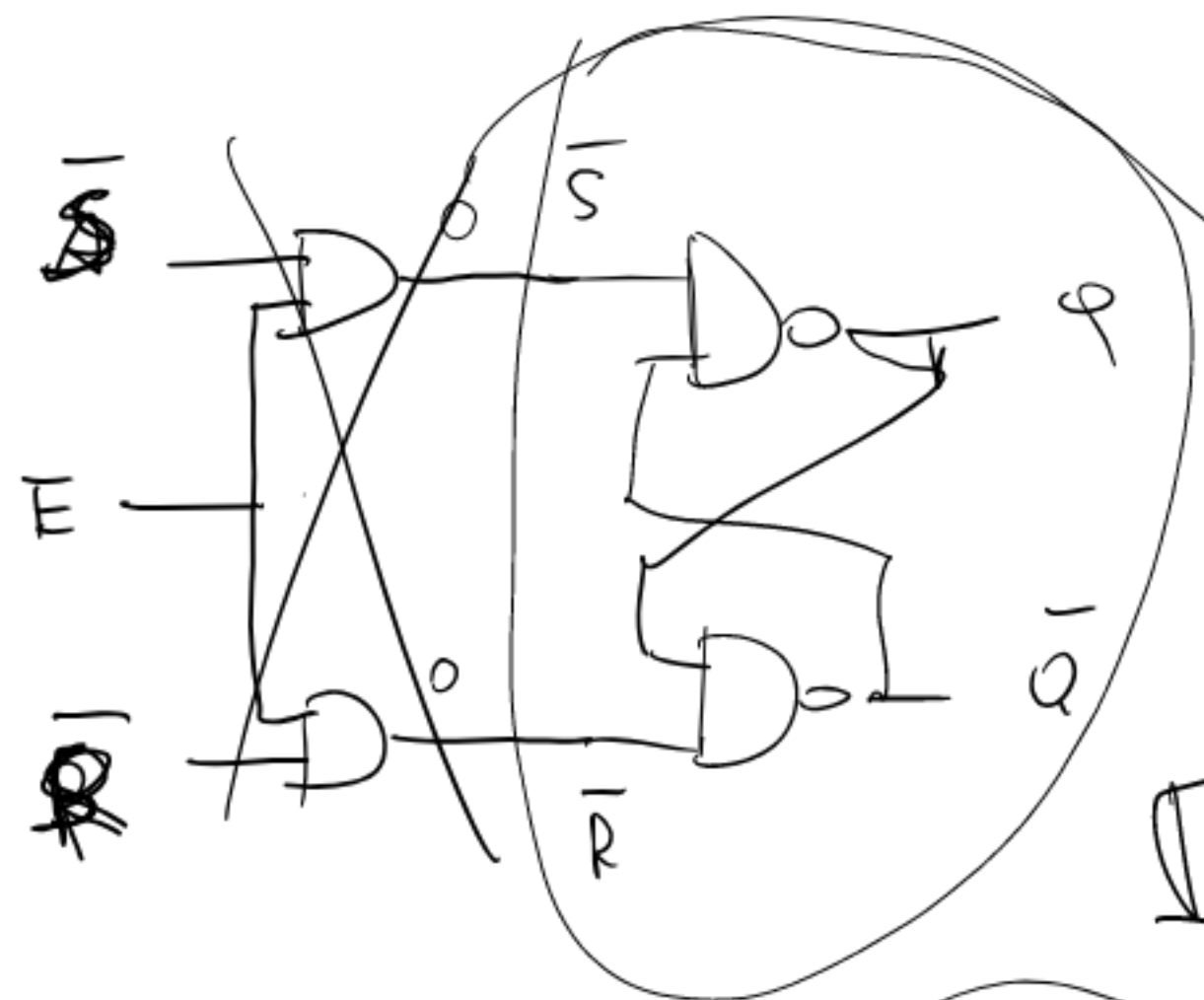


$Q = A + \overline{Q}$

$\overline{Q} = B + \overline{Q}$

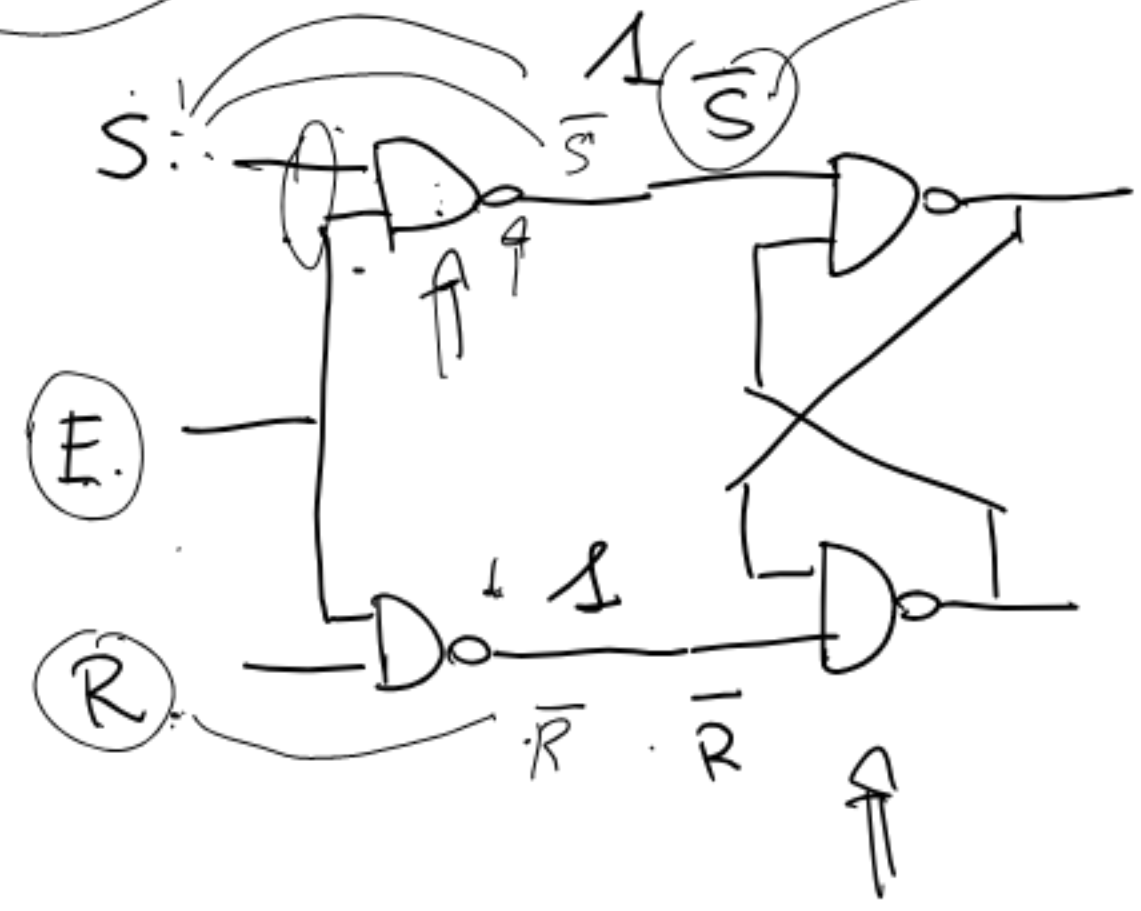
m.p.

6

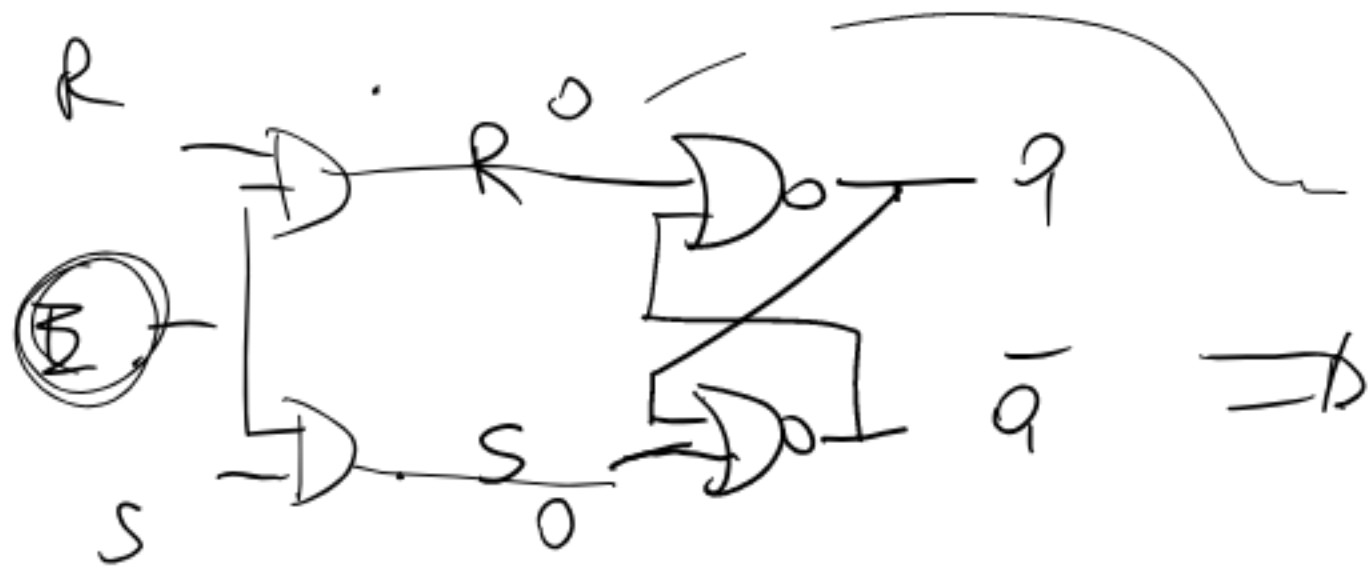


\bar{S}	\bar{R}	Q_n	\bar{Q}_n
0	0	N.P.	
0	1	1	0
1	0	0	1
1	1	Q_{n-1}	\bar{Q}_{n-1}

FF-SR

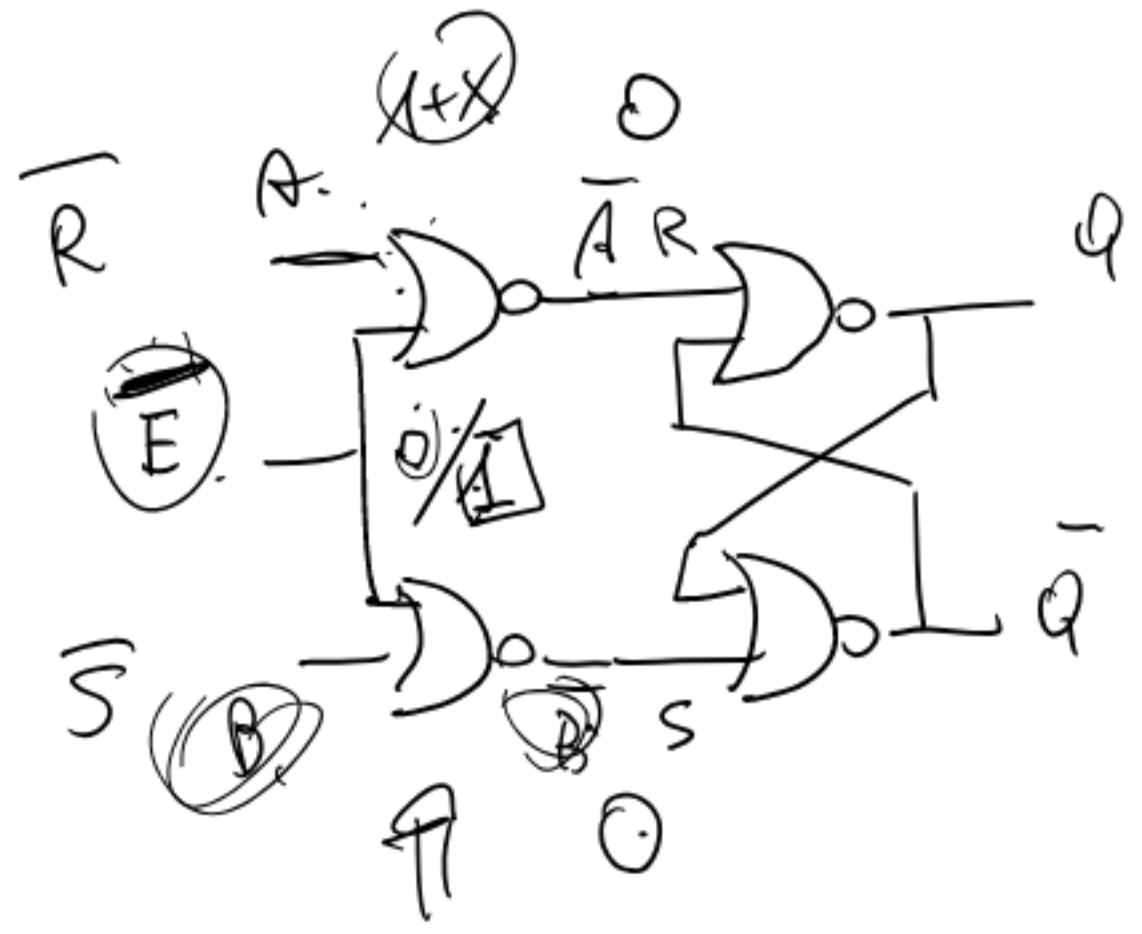


E	S	R	Q	\bar{Q}
1	0	0	MEM	
1	1	0	SET	
1	0	1	RESET	
1	1	1	N.P.	
0	X	X	MEM	



R	S	Q	Q̄
0	0	MEM	
0	1	SET	
1	0	RESET	
1	1	M.P.	

7



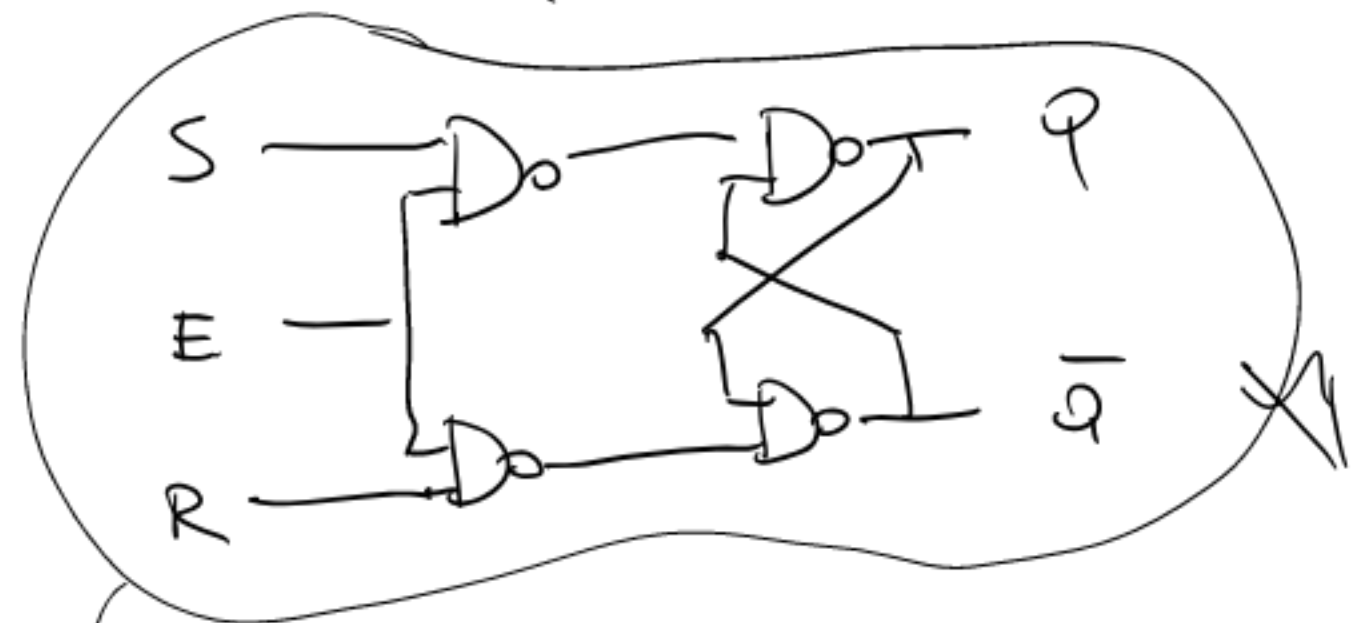
E = 0 ABILITATO

E ≠ 1 MEM.

E = 0 MEM

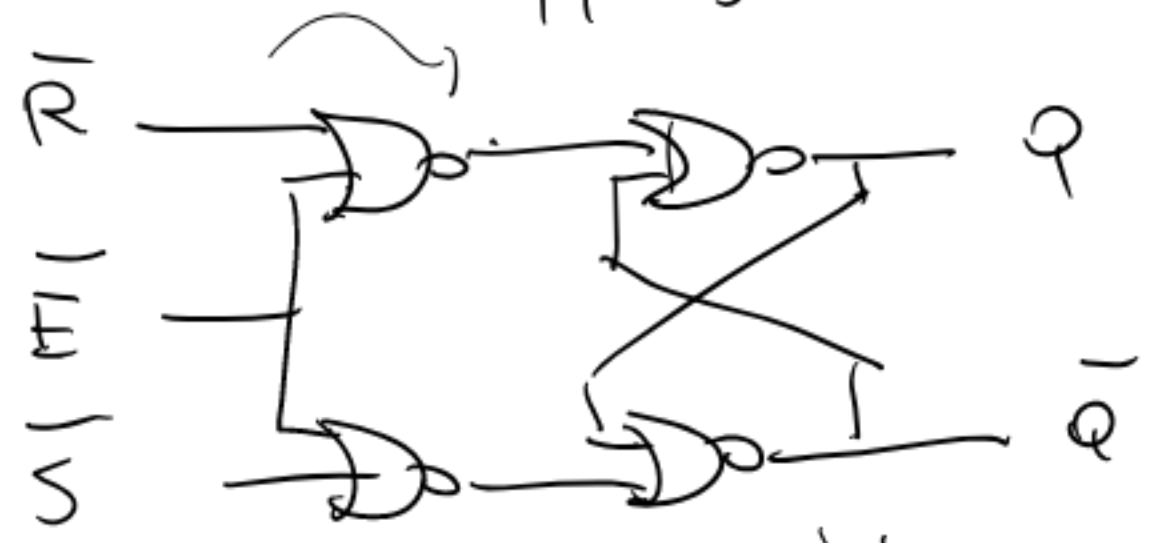
E = 1 ABILITATO

FF-SR



E	S	R	Q	\bar{Q}
1	0	0	MEM	
1	0	1	SET	
1	1	0	RESET	
1	1	1	N.P.	
0	x	x	MEM.	

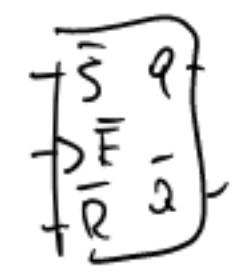
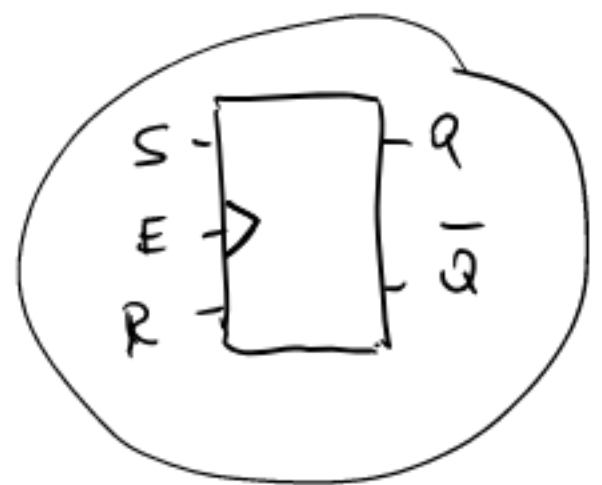
FF-SR



Q??

E	\bar{S}	\bar{R}	Q	\bar{Q}
1				
1				
1				
1				
0	x	x	MEM.	

ABW

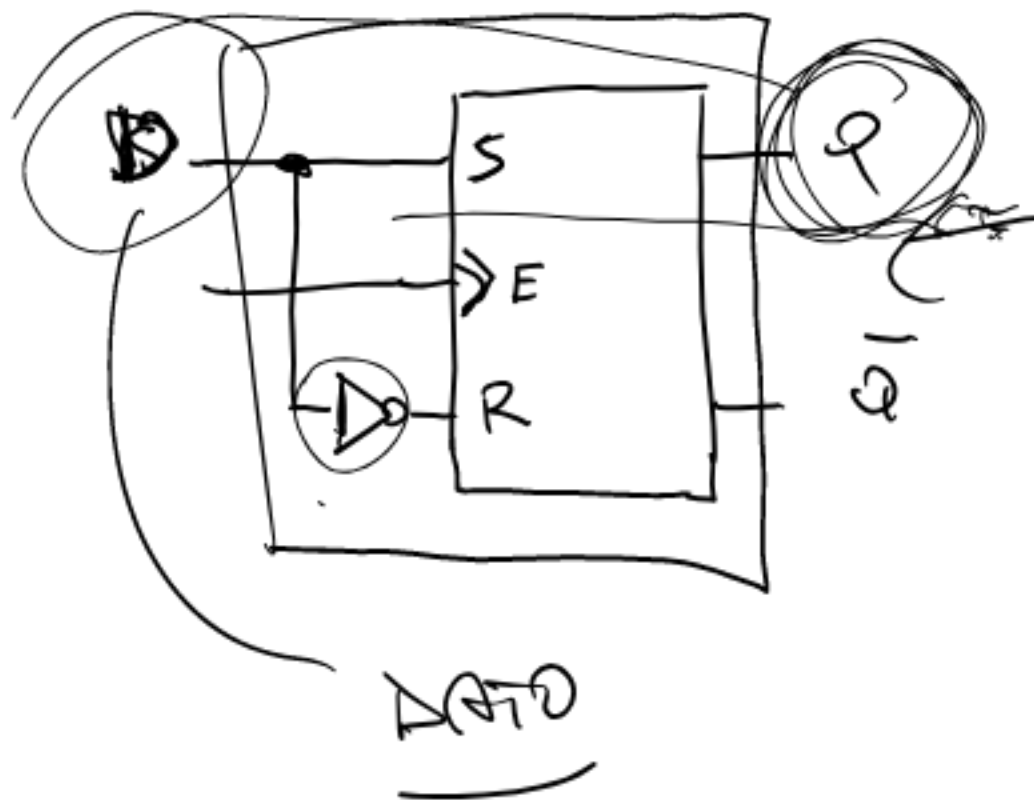


FF-D

LATCH TRASPARENTE

FF-SR

E	D	Q	Q̄
1	0	RESET	
1	1	SET (Q=1)	
0	X	MEM.	

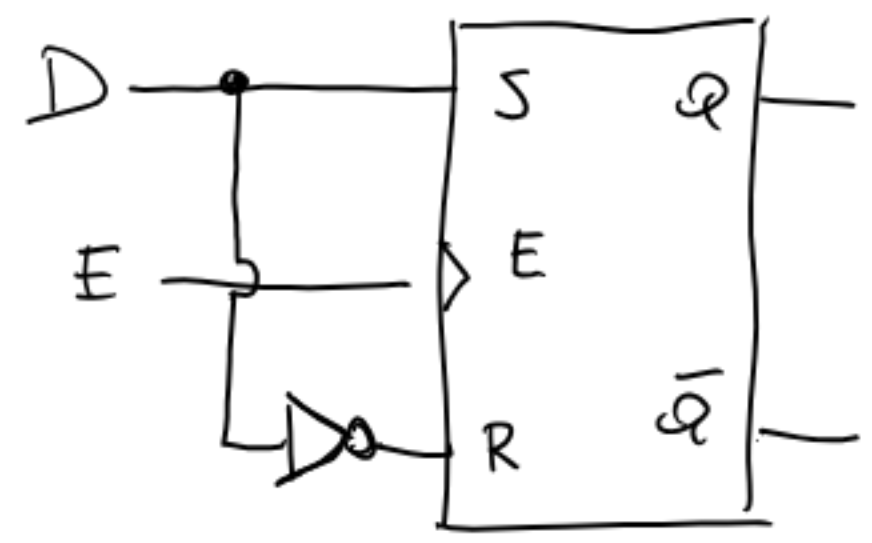
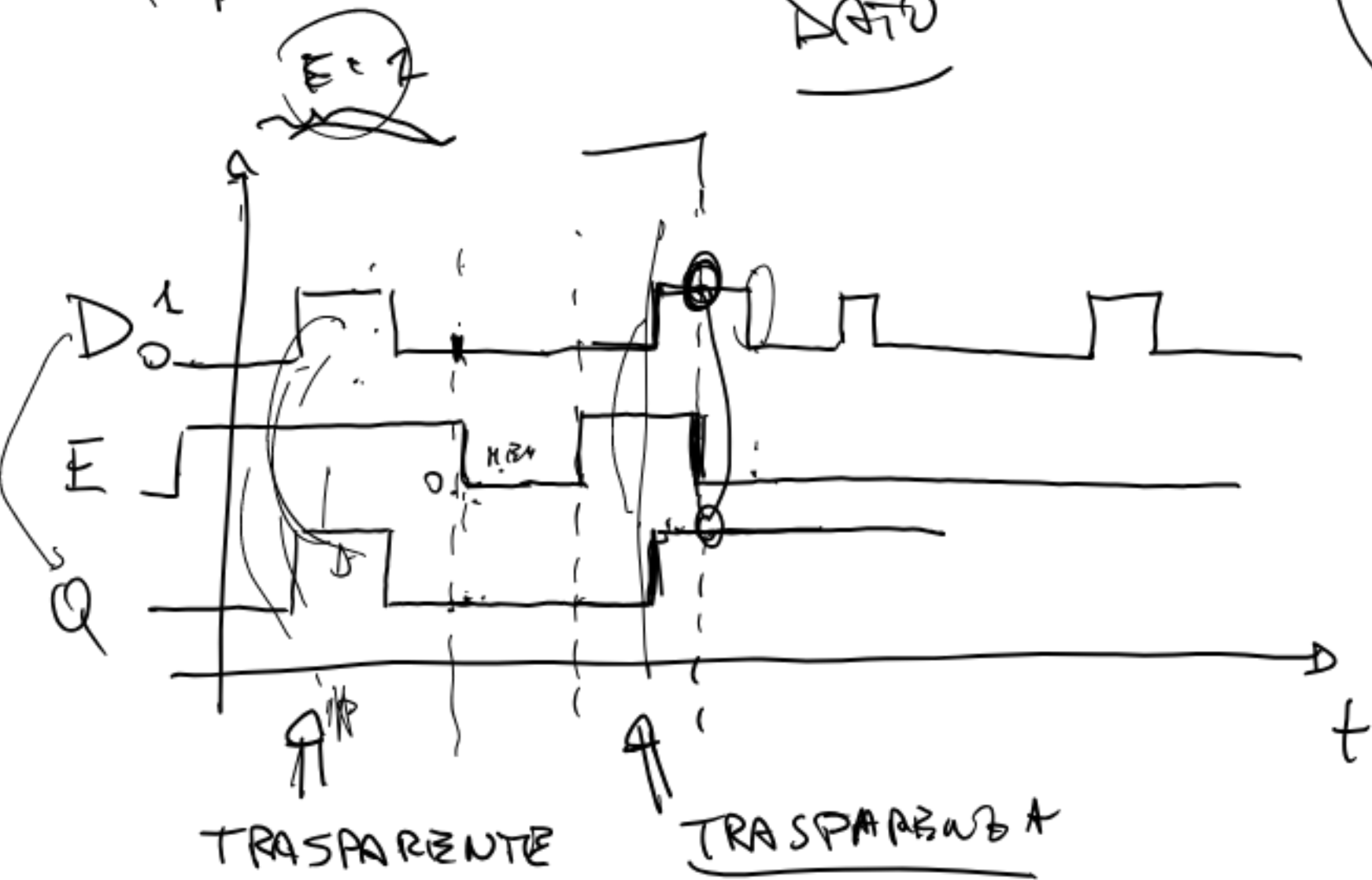


E=1

D → SET ⇒ D=1
RESET ⇒ D=0

S	R	Q	Q̄
0	1	RESET	
1	0	SET	

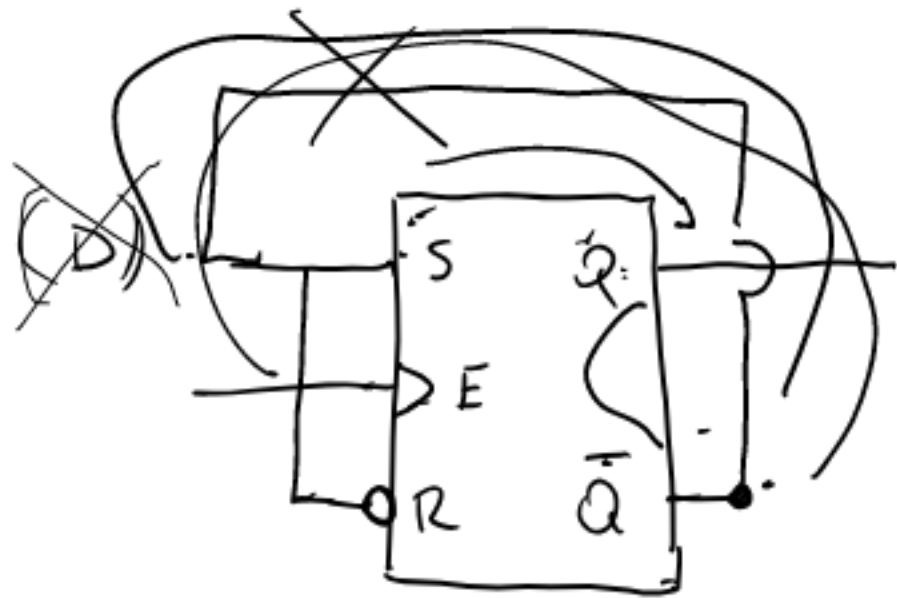
E=0 MEM.



TRASPARENTE TRASPARENZA

FF - TOGGLE

(FF - T)



Q segue il valore di ~~SC~~ → \bar{Q}

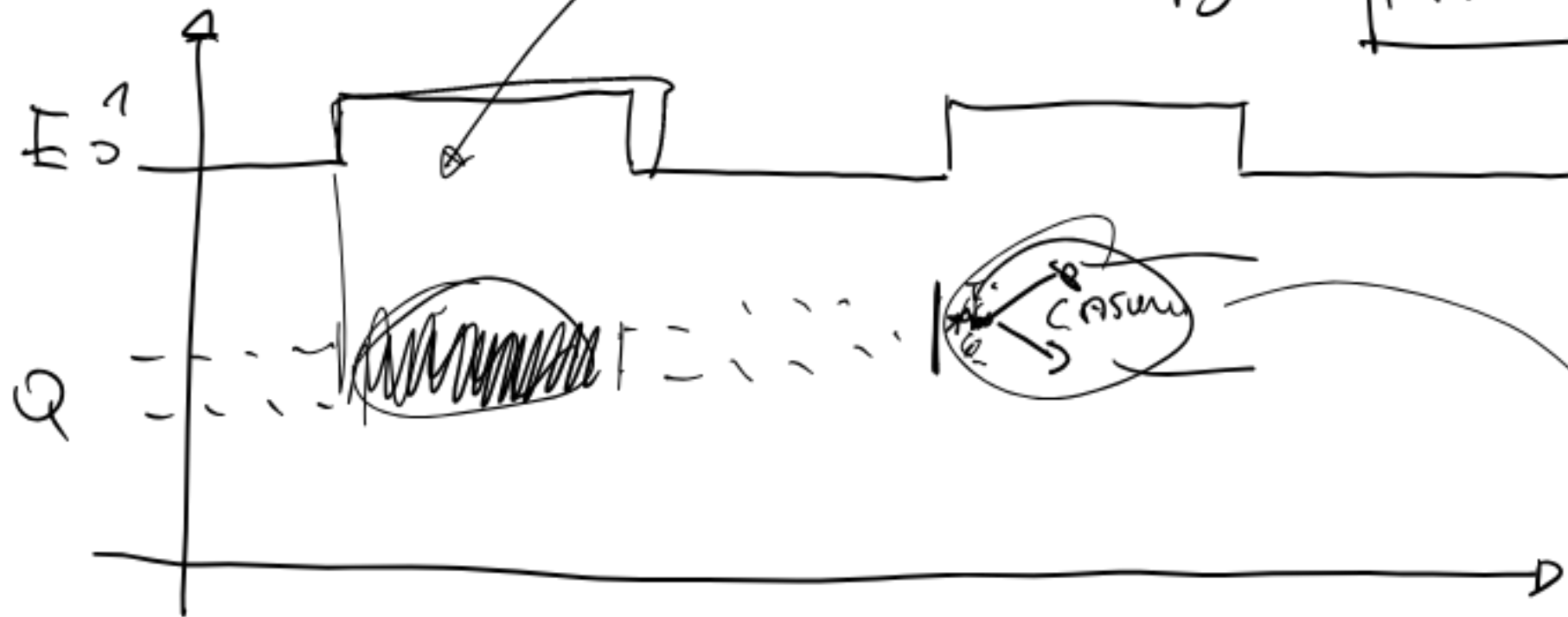
~~Q~~ → Q

Q → \bar{Q} → Q → \bar{Q} → \bar{Q} ...

Q = 0 → 1 → 0 → 1 → 0 → ?

FENOMENO DI CORSA CRITICA.

TRASPARENZA → RISOLVERE



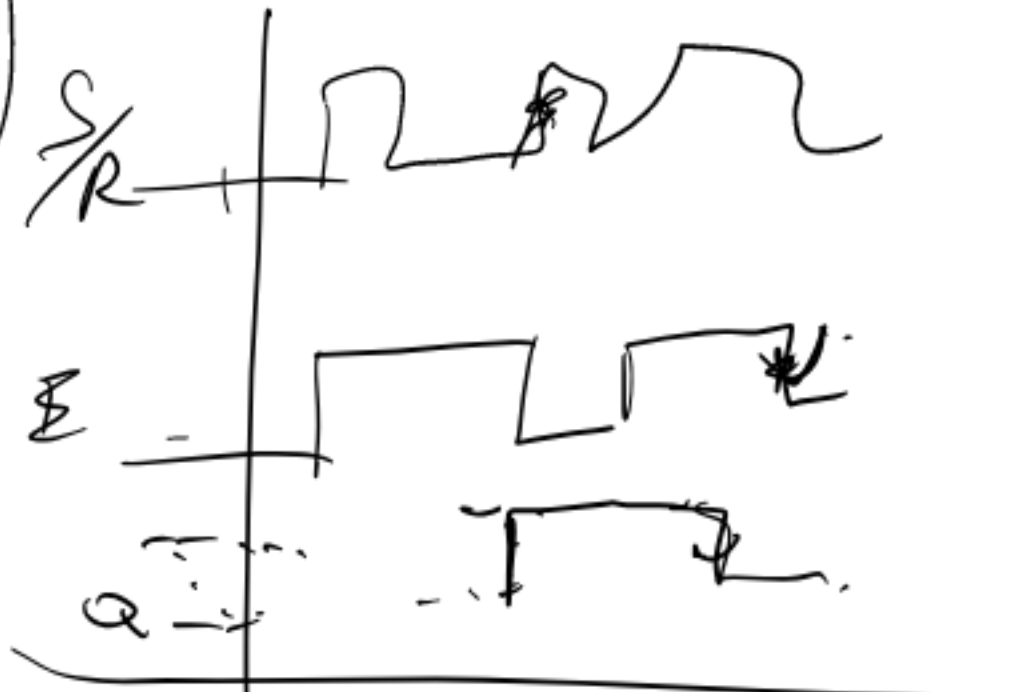
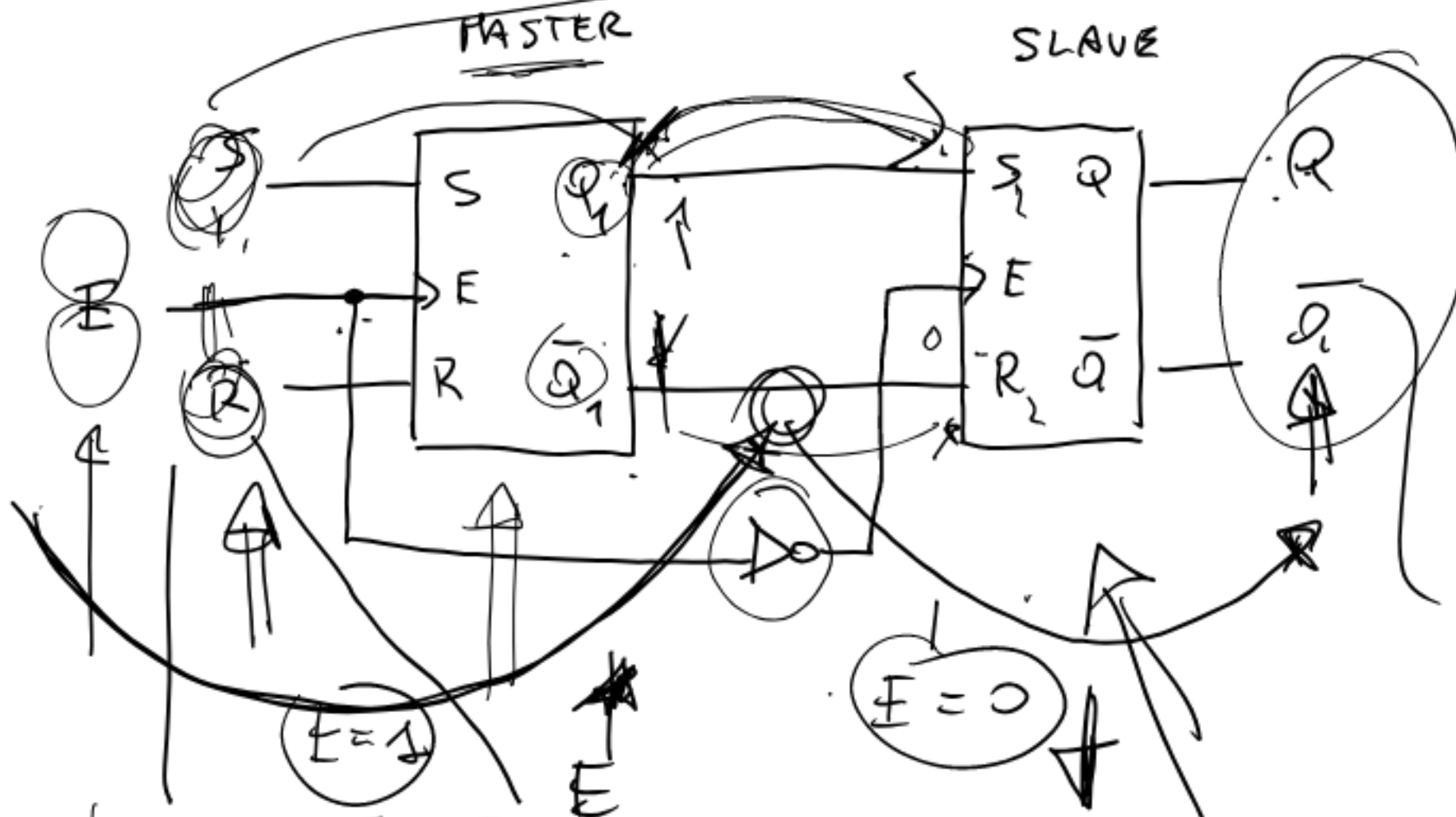
1) NON MI PERMETTE DI CONTROLLARE LE OSCILLAZIONI

2) METASTABILE

FF - MASTER - SLAVE

~~TRASPARENZA~~

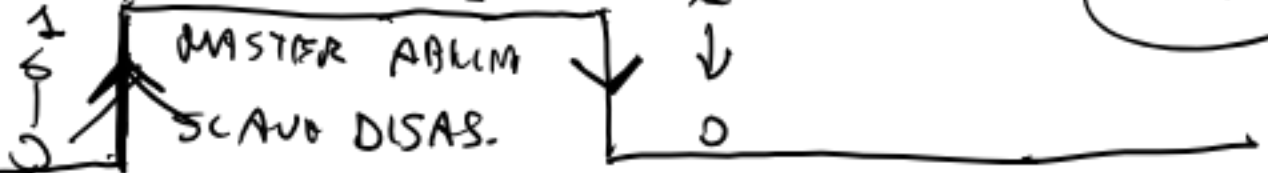
(11)



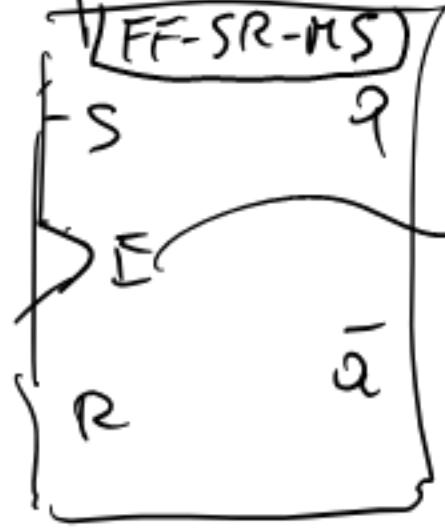
CAMBIARE
(SR)

cambia
 $Q_1, \bar{Q}_1 \rightarrow SR_2$

$E=0$



(JL)



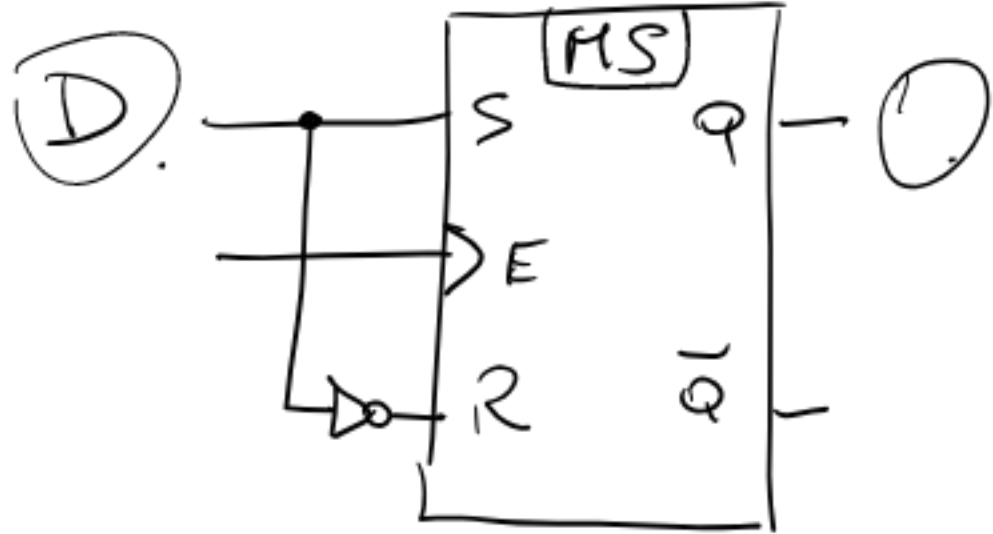
Q, \bar{Q}
NON
CAMBIANO

Q, \bar{Q} cambiano
presente i volter.

$Q_1, \bar{Q}_1 (S, R)$

E	S	R	Q	\bar{Q}
1	0	0	1	0
1	1	0	0	1
1	0	1	1	0
1	1	1	0	1

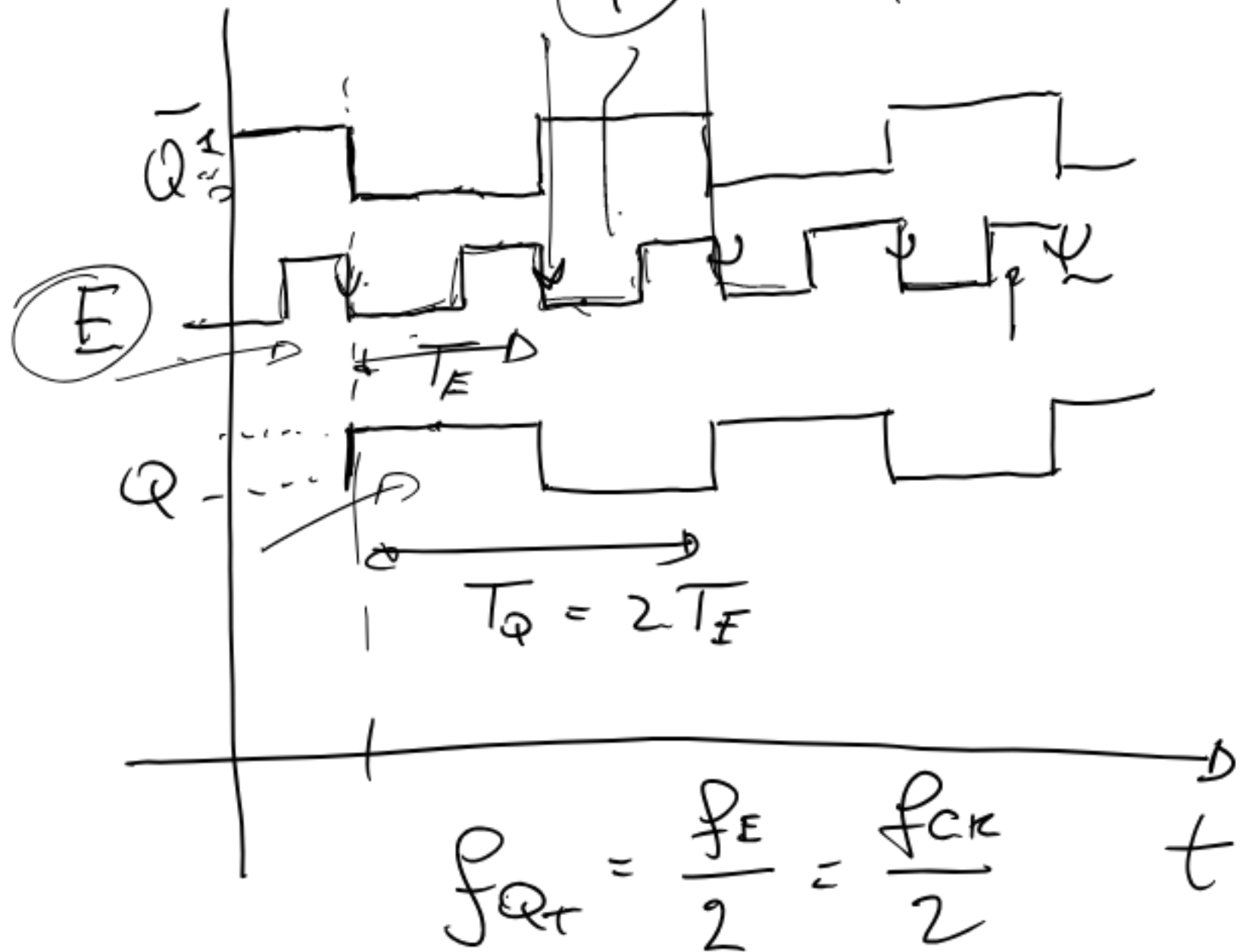
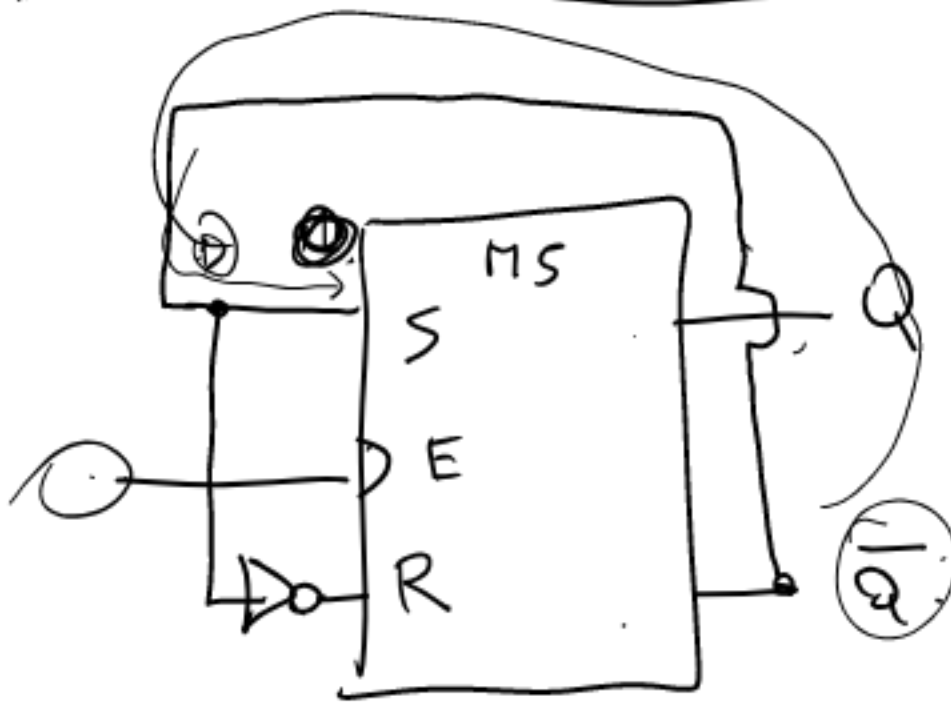
FF-D-MS



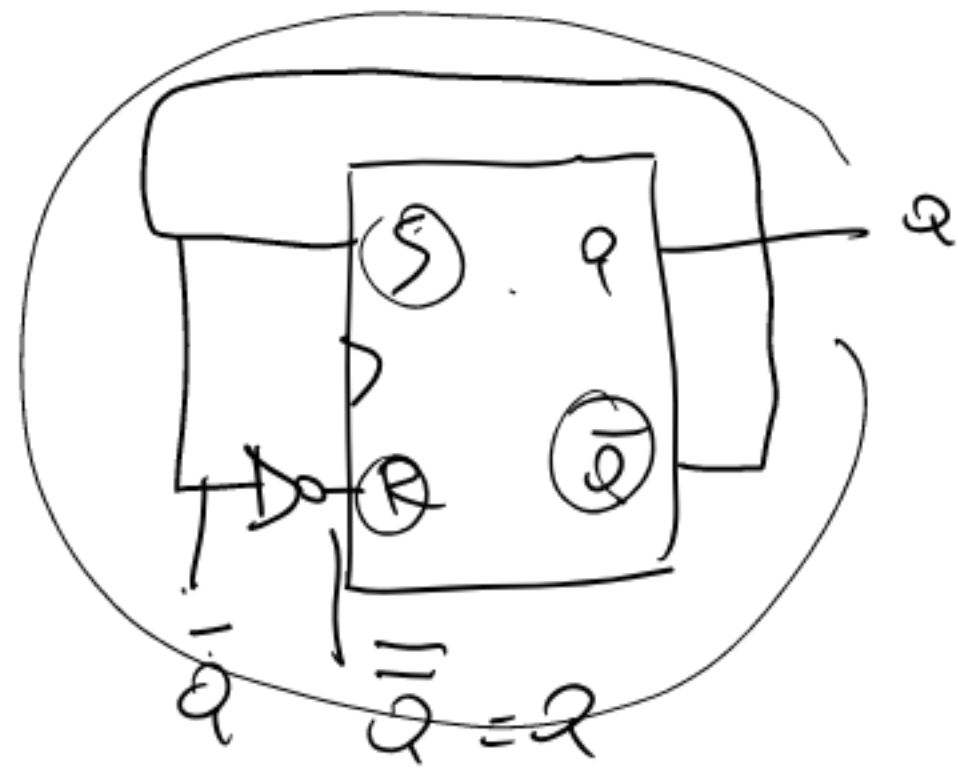
$Q = D$

$f = \frac{1}{T}$

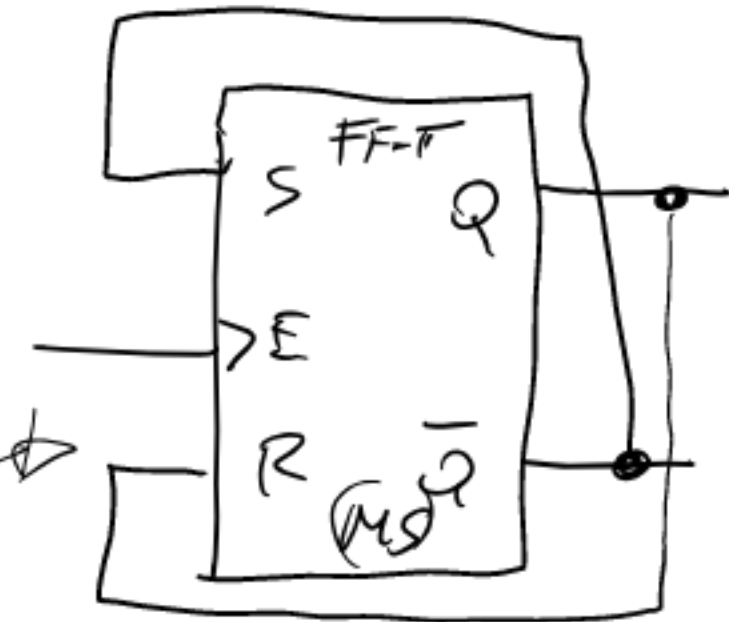
FF-TOGGLE



$f_{Q,t} = \frac{f_E}{2} = \frac{f_{clk}}{2}$



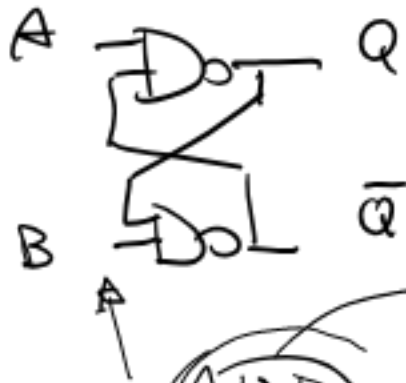
≡



~~FF-TOGGLE TRANSPARENTE~~

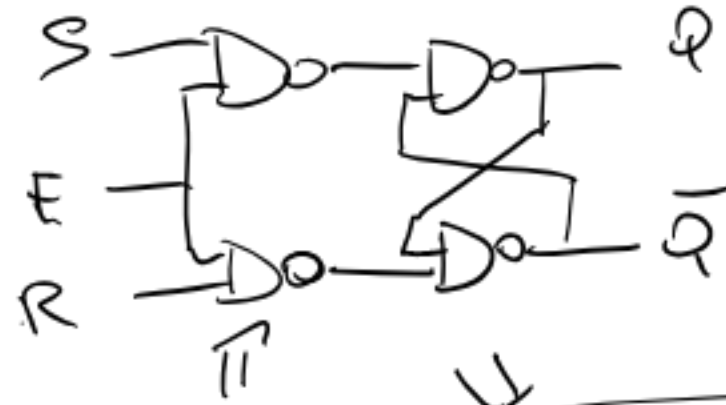
FF-TOGGLE SOLID res

CELLA-MEM.

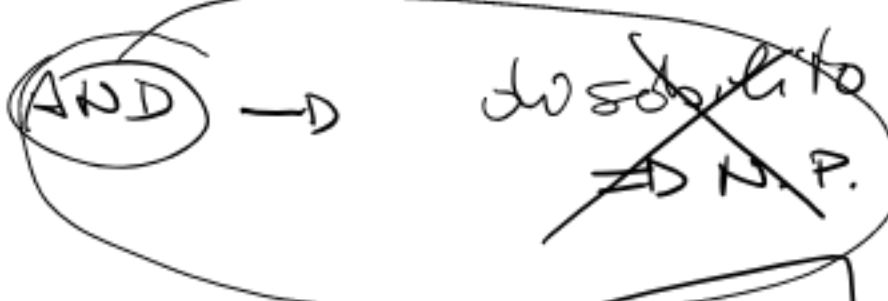


SET
 RESET
 MEM
~~N.P. (Q=Q)~~

FF-ER-E



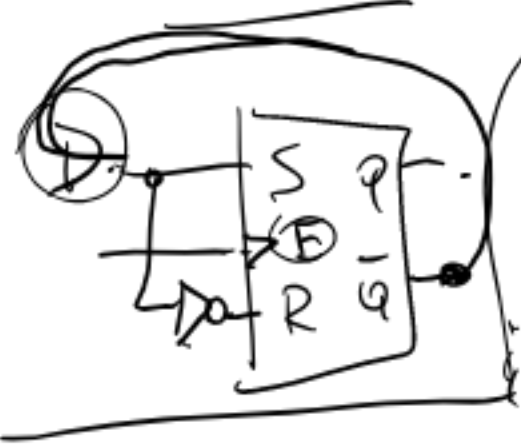
(NOR)
 POSSO mettere
 l'output AND



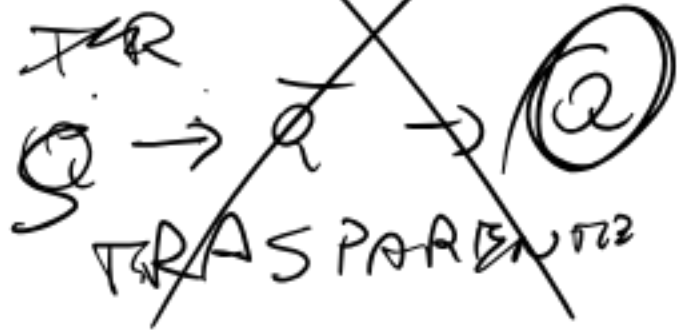
TRASPARENTI



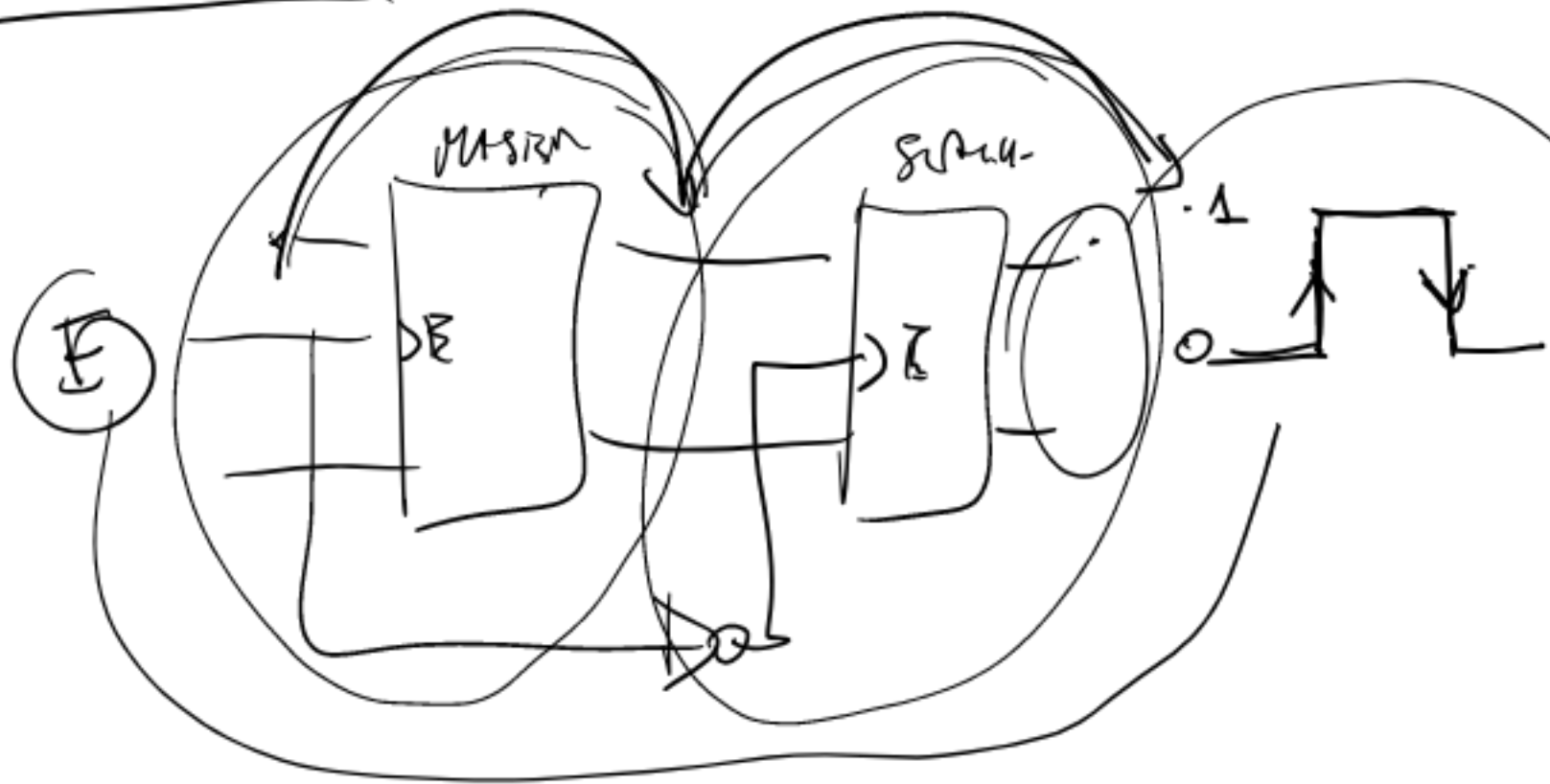
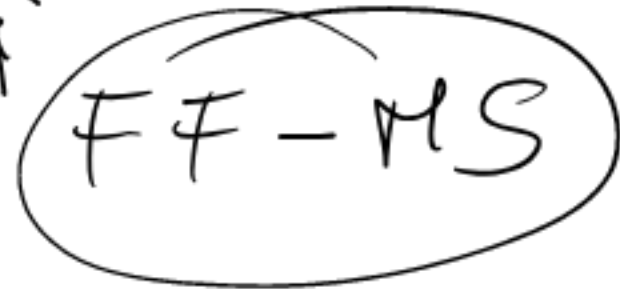
FF-D



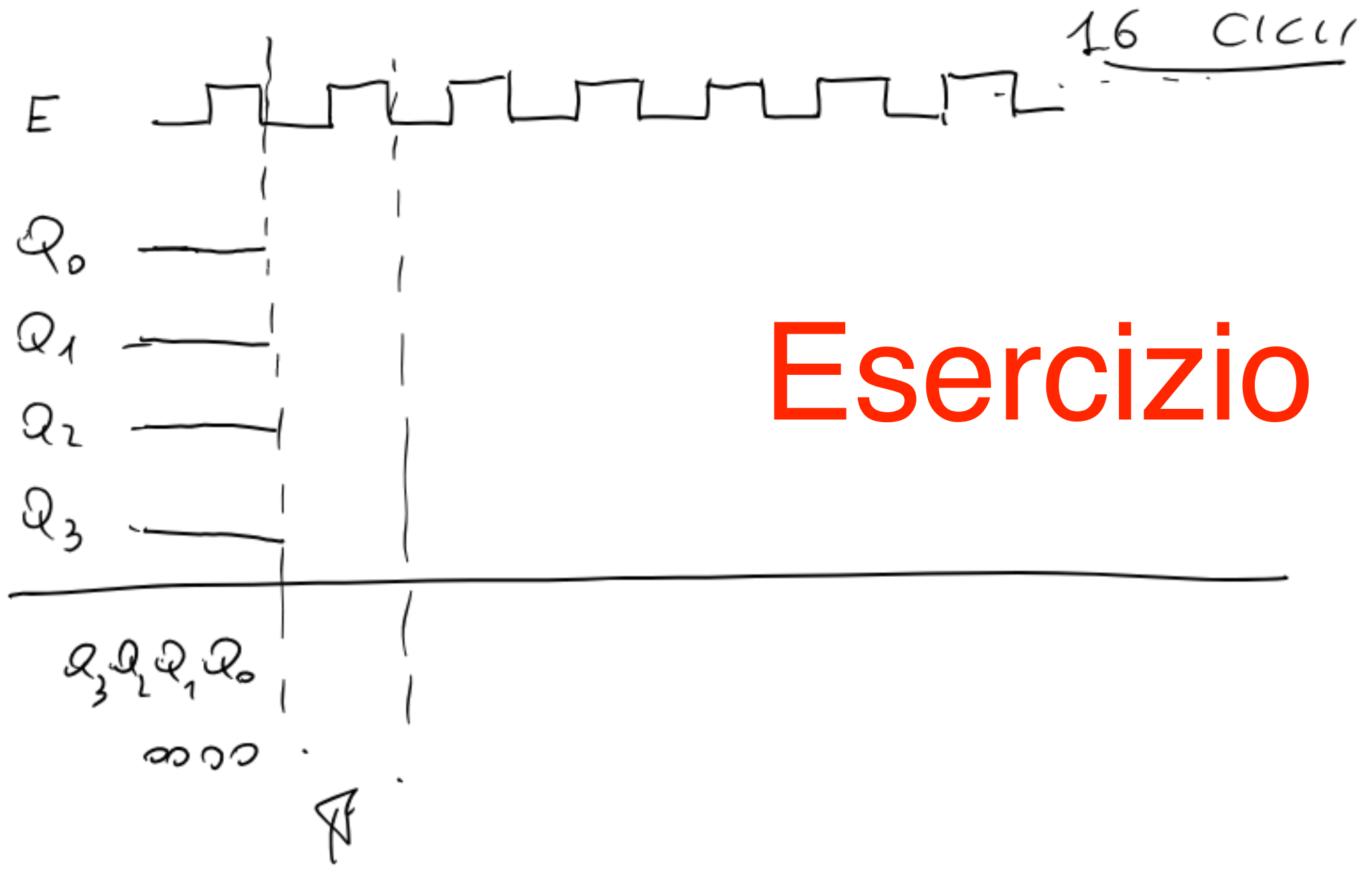
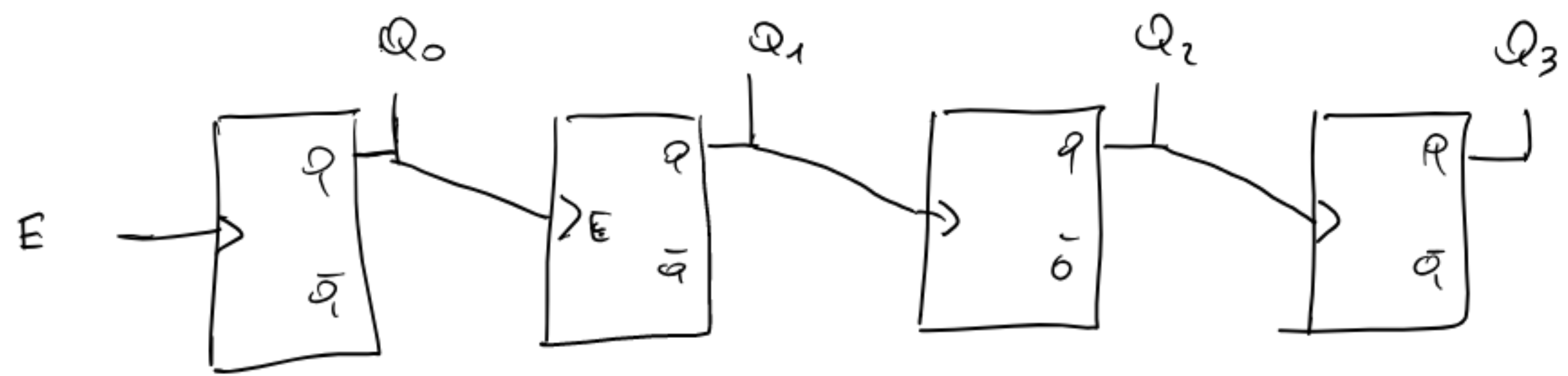
FA-T ???



~~TRASP~~
 TR



SOLO MS



Esercizio