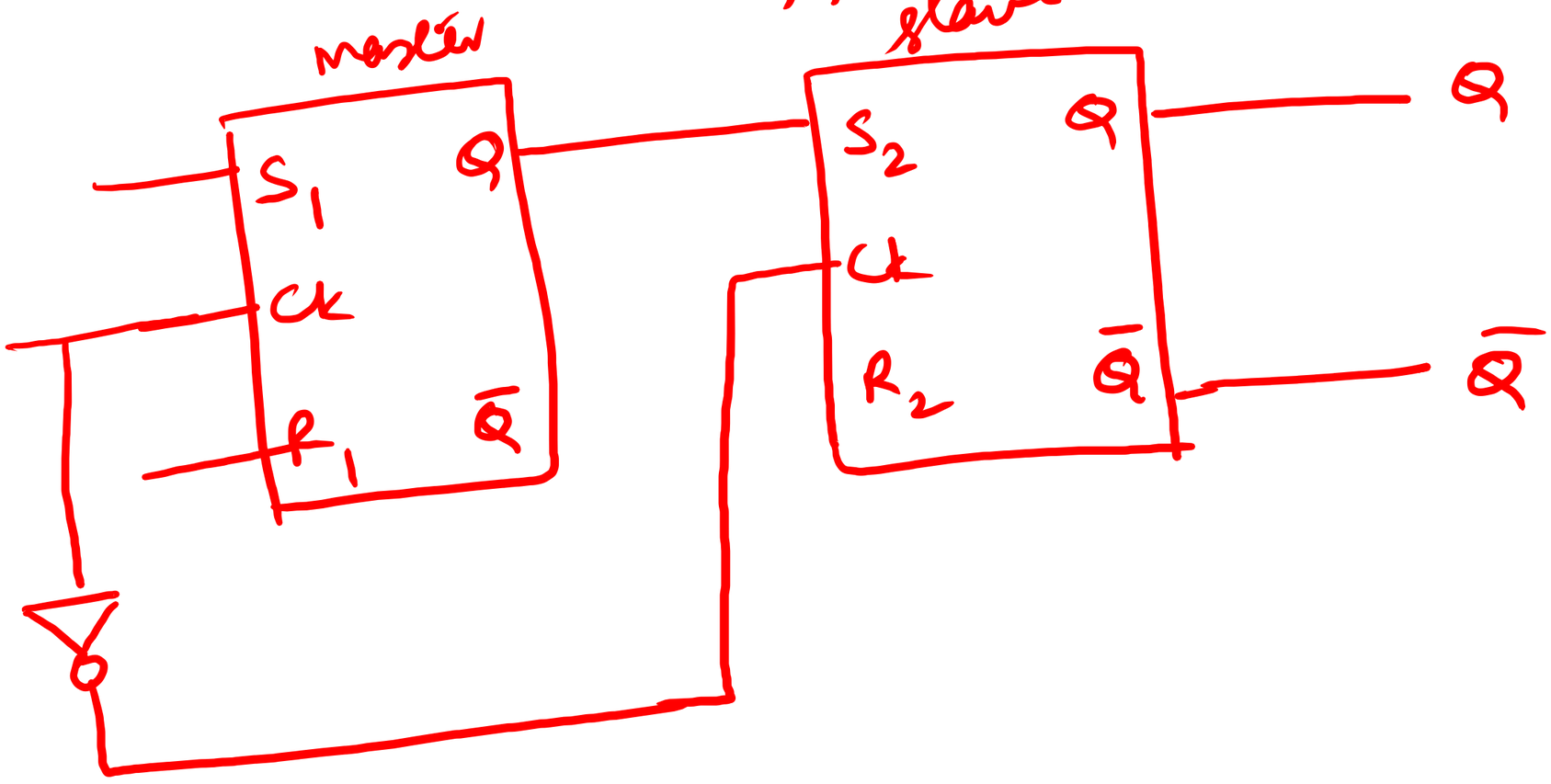
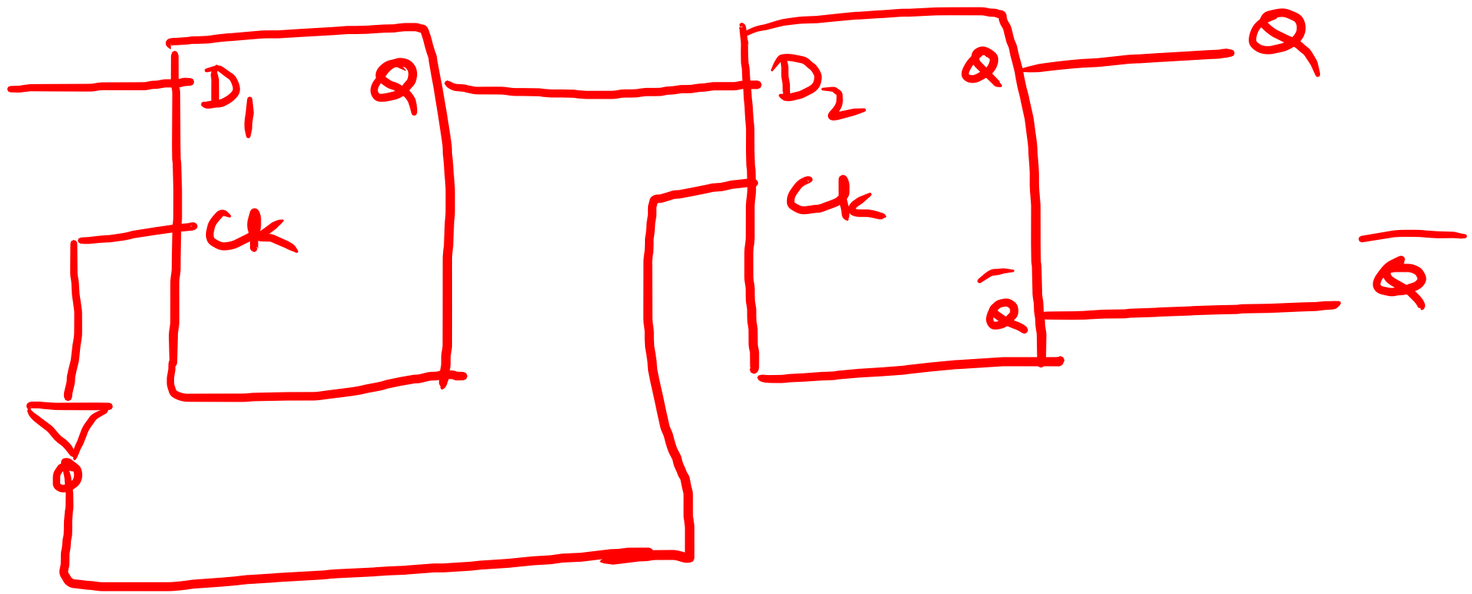
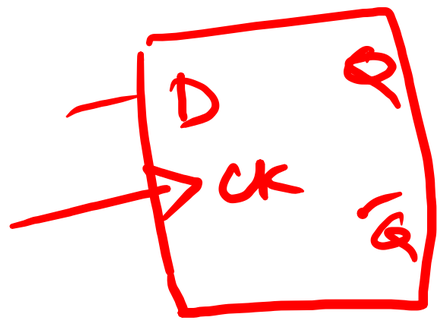
Master slave ffs

SR master slave ff



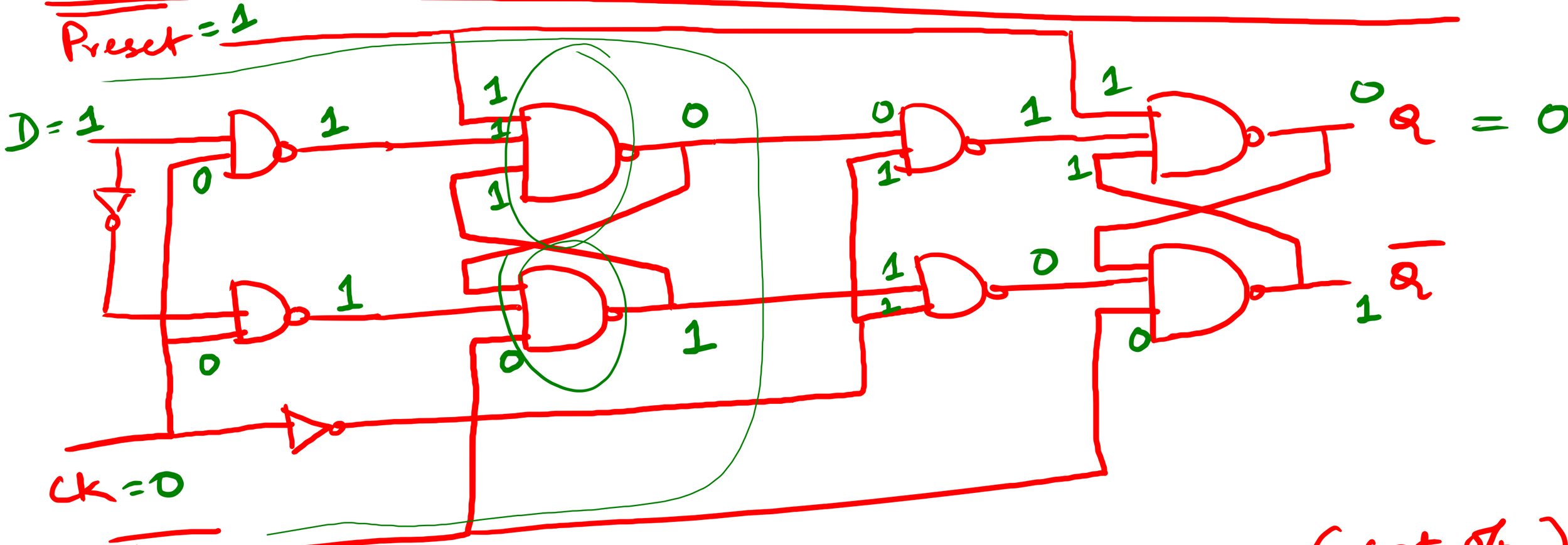
D master slave ff





D ff

MS Dff with asynchronous preset & clear



$\overline{preset} = 0 \rightarrow Q = 1$ (set o/p)

$\overline{clear} = 0 \rightarrow Q = 0$ (reset o/p)

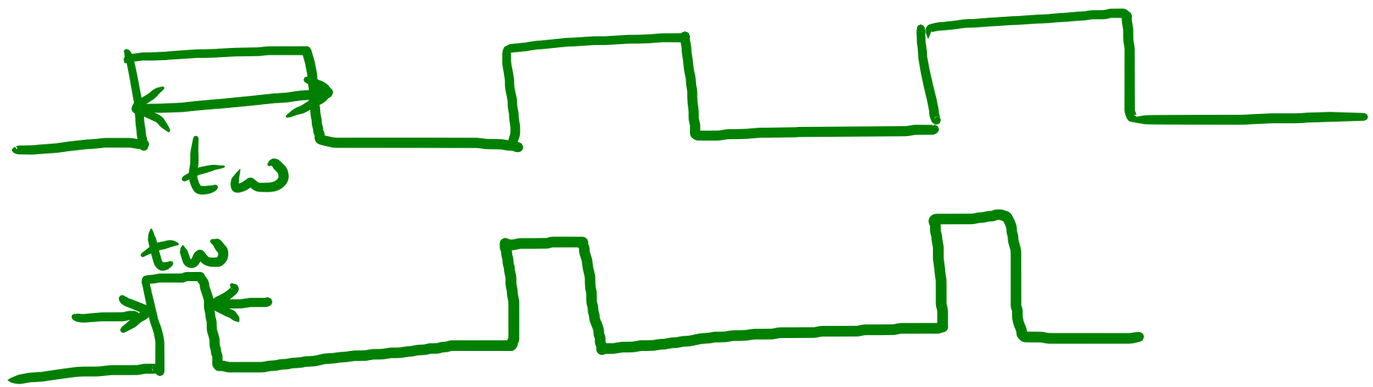
State table of Master Slave D ff with preset & clear

$\overline{\text{Preset}}$	$\overline{\text{Clear}}$	Ck	D	Q	$\overline{Q}$	
0	1	x	x	1	0	
1	0	x	x	0	1	
0	0	x	x	1	1	(not allowed)
1	1	↑	0	0	1	
1	1	↑	1	1	0	

Timing Issues.

- clock width (t_w)

Min time for which clock pulse should be high for the flip flops that it feeds to work properly

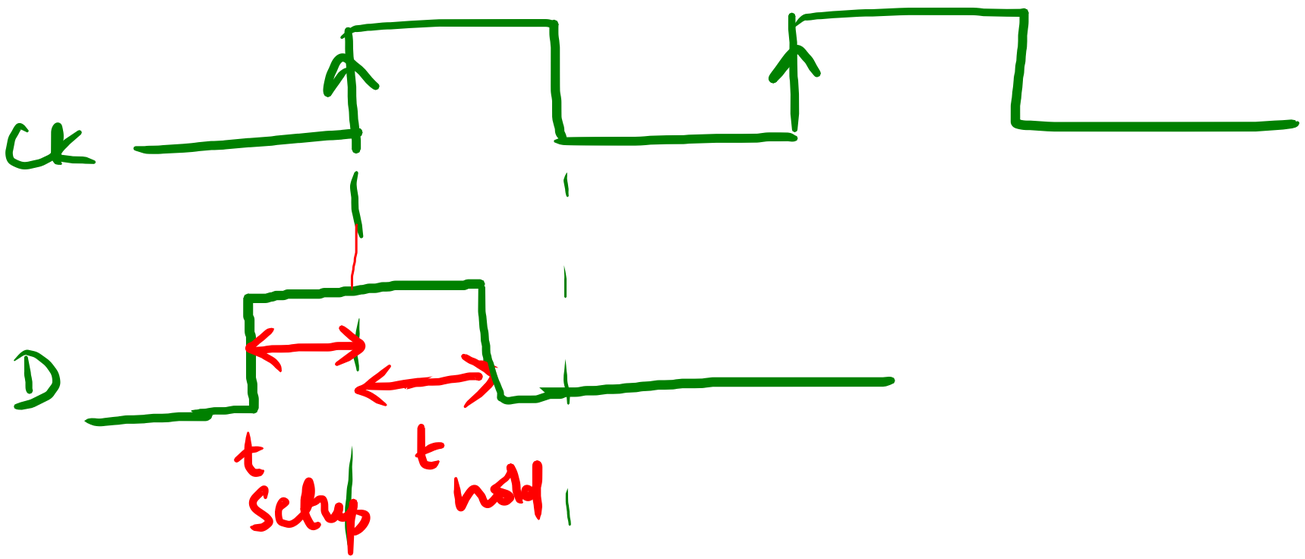


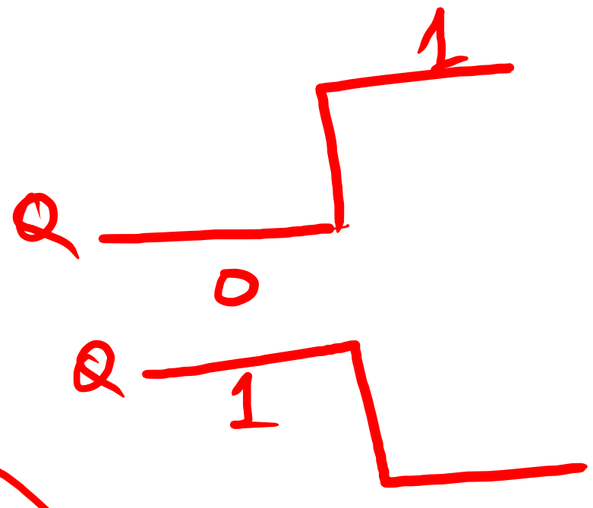
- Set up time (t_{setup})

  Amount of time the i/p to a ff should be stable before the arrival of active edge of clock pulse

- Hold time (t_{hold})

  Amount of time the i/p to a ff should be stable after the active clock edge arrives.





Propagation delay $\longrightarrow$ t_{plh} , t_{phl}

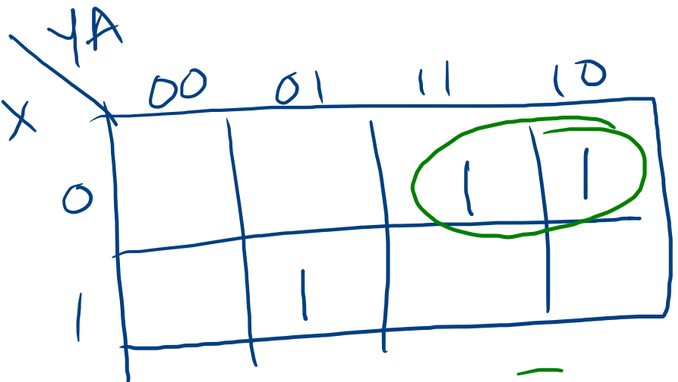
- Various types of ffs / latches.
- Clocking
- State table / State diagram
- Conversion of ff to another

Design of synchronous sequential ckts

1. Derive the state table & state diagram from the problem definition
2. Obtain the minimized form for ff i/ps & o/ps using K map
3. Draw the logic diagrams

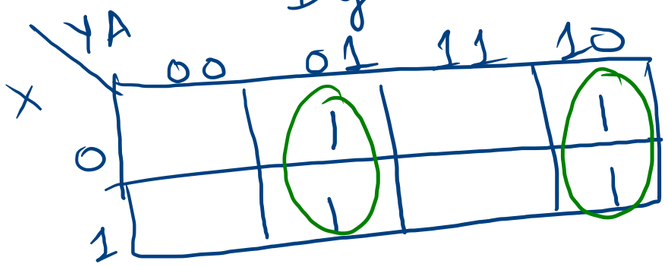
Design a synchronous sequential circuit using the D ffs for the state diagram given below

D_x



$D_x = \bar{x}y + x\bar{y}A$

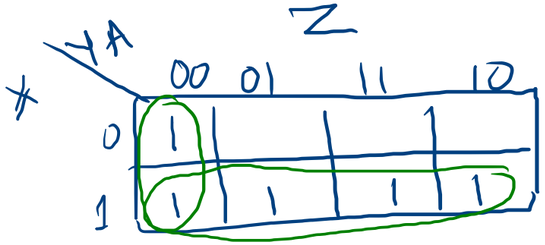
D_y



$D_y = \bar{y}A + y\bar{A}$

$= y \oplus A$

Z



$Z = x + \bar{y}\bar{A}$

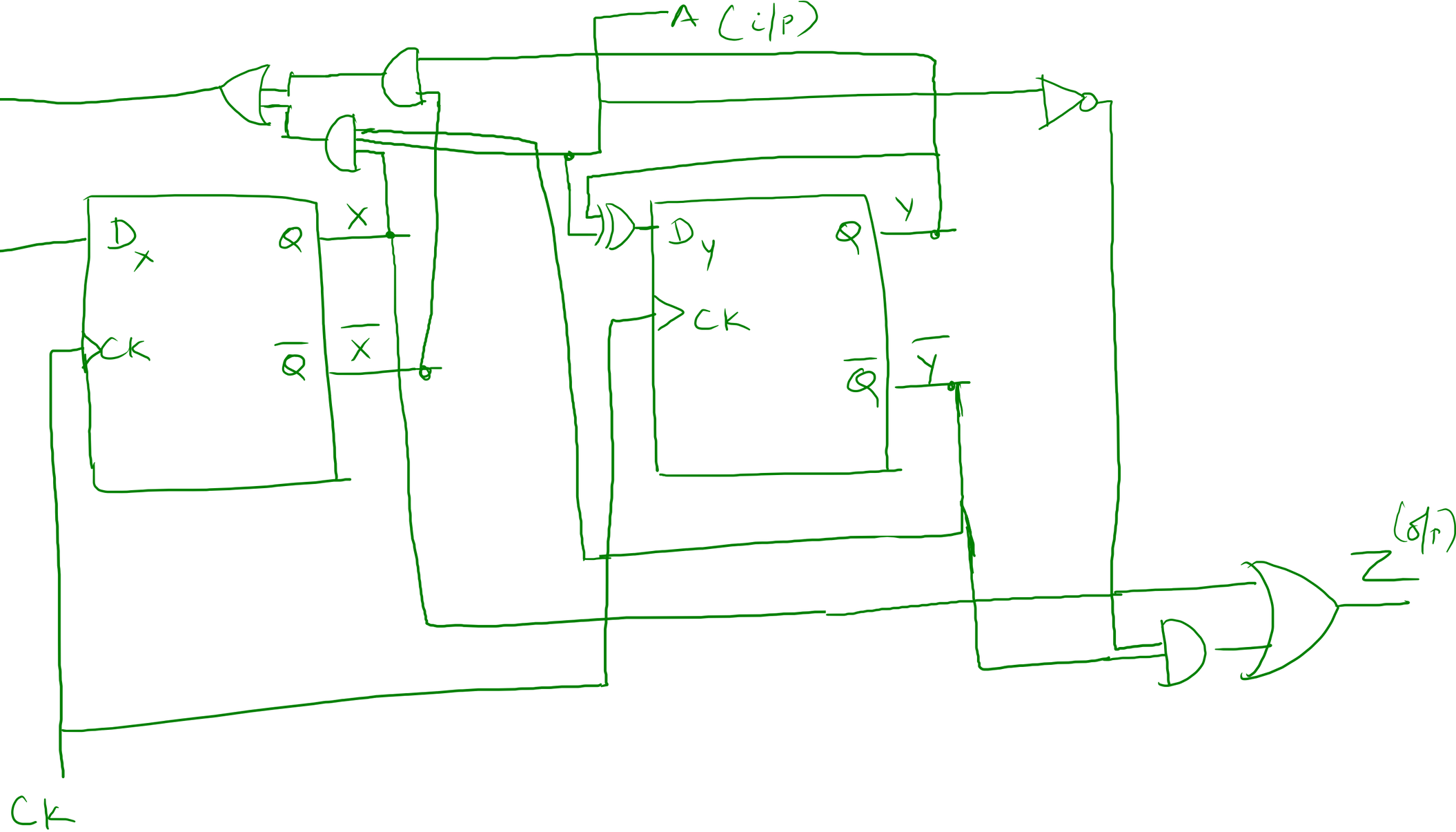
State table

PS x y Q_k	I/P A	NS x^+ y^+ Q_{k+1}	FF i/ps D_x D_y	o/p Z
00	0	00	0 0	1
00	1	01	0 1	0
01	0	11	✓1 1	0
01	1	10	✓1 0	0
10	0	00	0 0	1
10	1	11	✓1 1	1
11	0	01	0 1	1
11	1	00	0 0	1

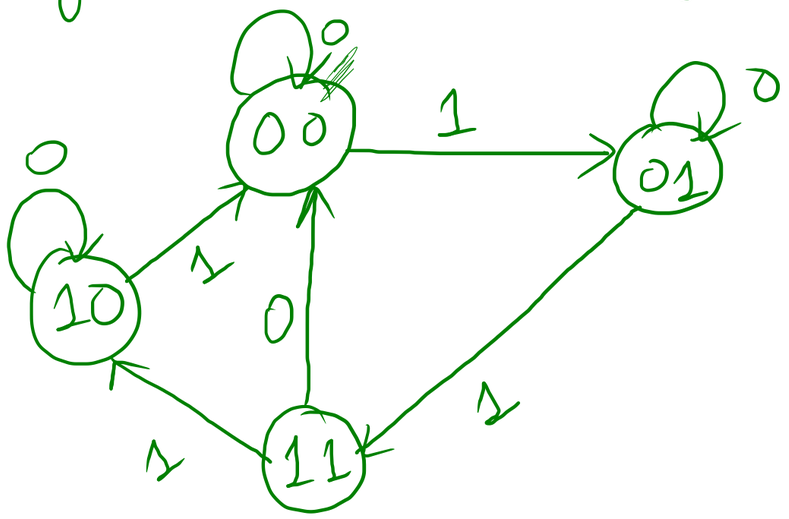
$D_a = \bar{X}Y + X\bar{Y}A$

$D_y = Y \oplus A$

$Z = X + \bar{Y}\bar{A}$



Design a synchronous sequential ckt for the state diagram given below using Jk ff.



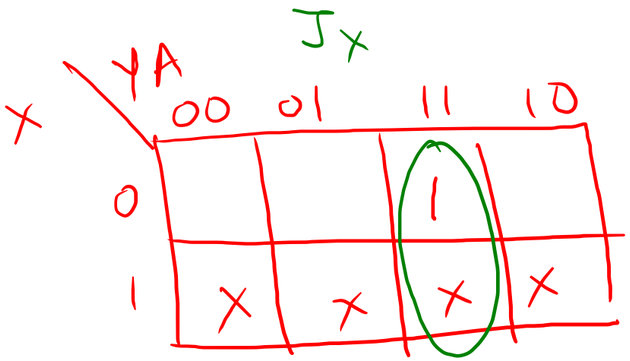
Jk excitation table

Q_t	Q_{t+1}	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

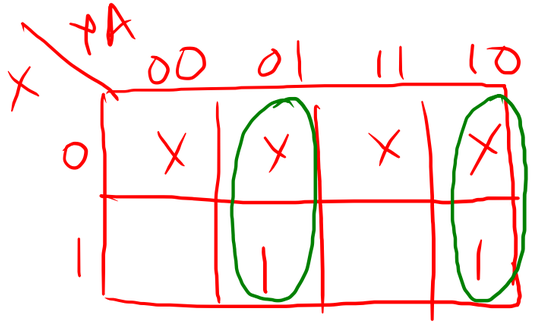
0 X
↓
00
01

PS		I/P	NS		FF i/ps			
X	Y	A	X^t	Y^t	J_x	K_x	J_y	K_y
0	0	0	0	0	0	X	0	X
0	0	1	0	1	0	X	1	X
0	1	0	0	1	0	X	X	0
0	1	1	1	1	1	X	X	0
1	0	0	1	0	X	0	0	X
1	0	1	0	0	X	1	0	X

X	Y	A	X^t	Y^t	J_x	K_x	J_y	K_y
1	1	0	0	0	X	1	X	1
1	1	1	1	0	X	0	X	1

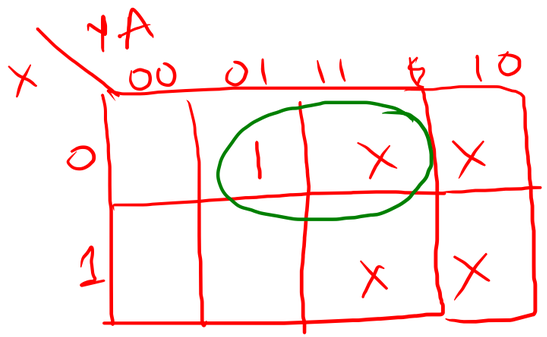


$J_X = yA$

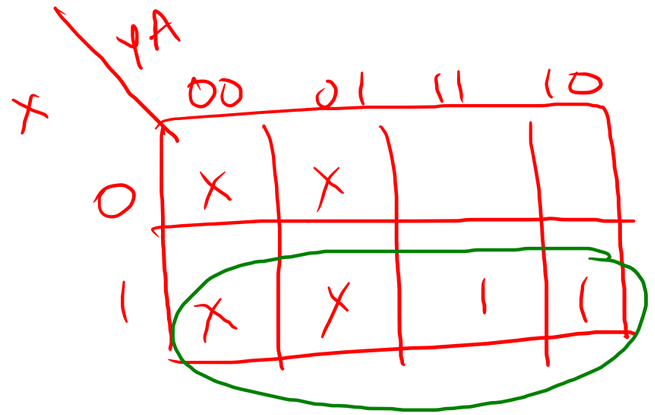


$K_x = \bar{y}A + y\bar{A}$

$= y \oplus A$



$J_y = \bar{x}A$



$K_y = x$