Demultiplexer
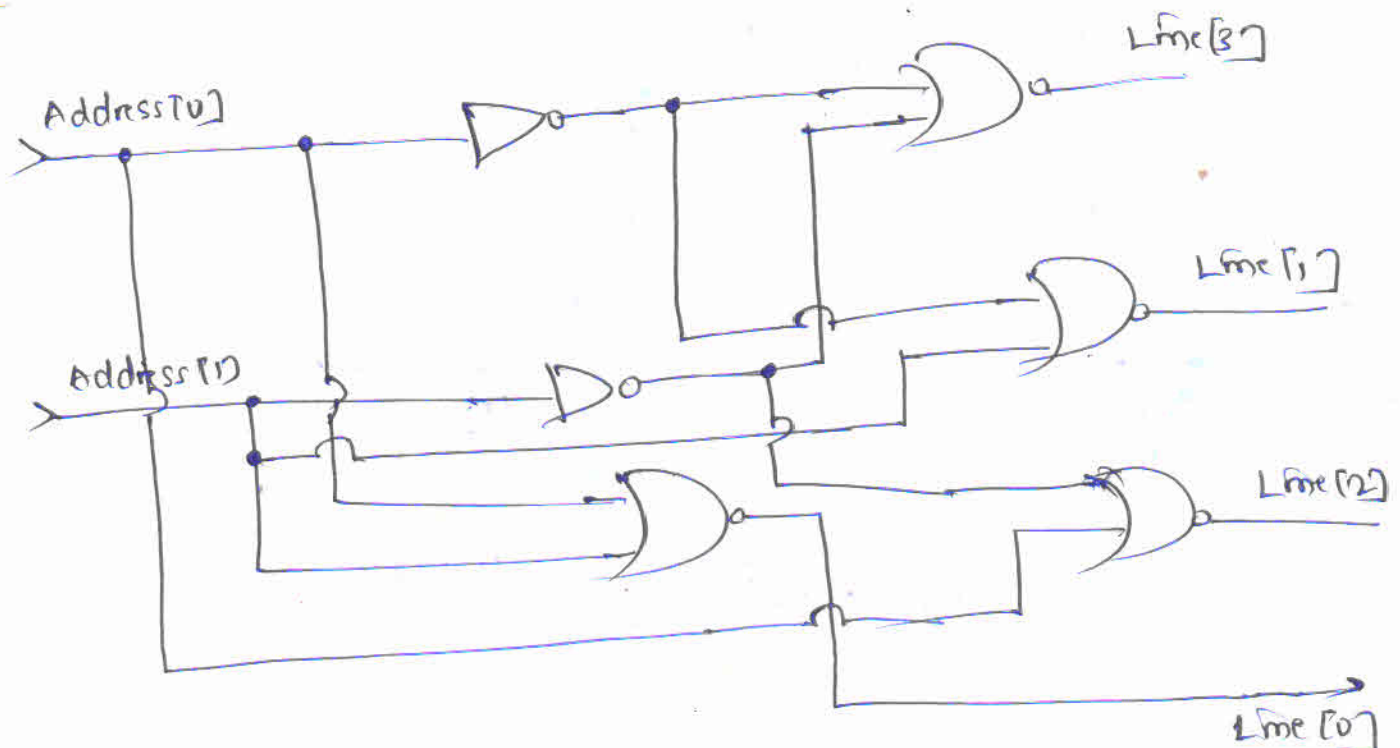
Address		Line			
1	0	3	2	1	0
0	0	0	0	0	1
0	1	0	0	1	0
1	0	0	1	0	0
1	1	1	0	0	0

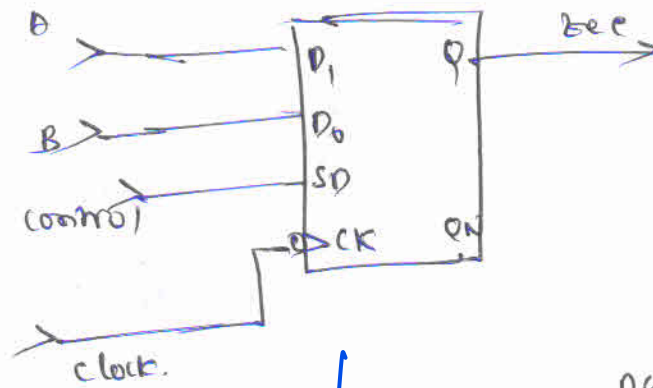Line [0] = $\overline{Address[1]} \cdot \overline{Address[0]}$

Line [1] = $\overline{Address[1]} \cdot Address[0]$

Line [2] = $Address[1] \cdot \overline{Address[0]}$
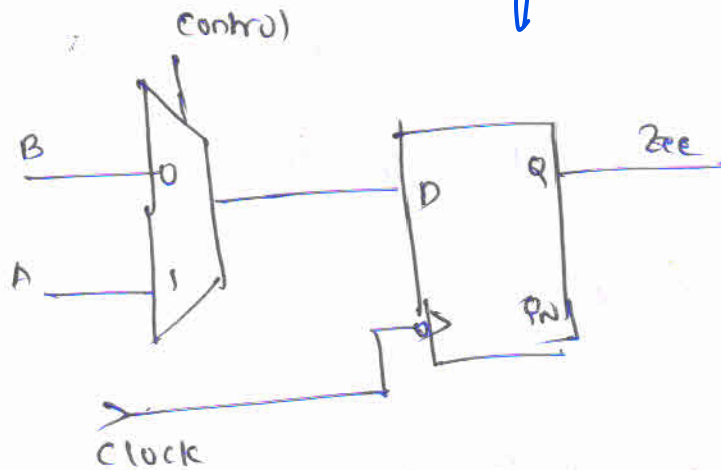
Line [3] = $Address[1] \cdot Address[0]$

Pick one!

SD → Data select input.

Incrementor

current state counter		Next state counter	
0	0	0	1
0	1	1	0
1	0	1	1
1	1	0	0

$NS[1]$

$NS[1]$	$\overline{CS[0]}$ 0	$CS[0]$ 1
$\overline{CS[1]}$	0 $_0$	1 $_1$
$CS[1]$	1 $_2$	3

$$NS[1] = CS[1]\,\overline{CS[0]} + \overline{CS[1]}\,CS[0]$$

$NS[0]$

$NS[0]$	0	1
0	1 $_0$	$_1$
1	1 $_2$	3

$$NS[0] = \overline{CS[0]}$$

The circuit diagram shows two D flip-flops with labels, blue annotations:
$(S[1] + \overline{S[0]})$
$(\overline{S[0]} + \overline{M[1]})$
$(S[0]) + \overline{M[1]}$
$(M[1])(S[0]) + (S[1])\overline{(S[0])}$

Flip-flop labels: D, Q, CK, QO, RS, Clock A, D, Q, CK, PN
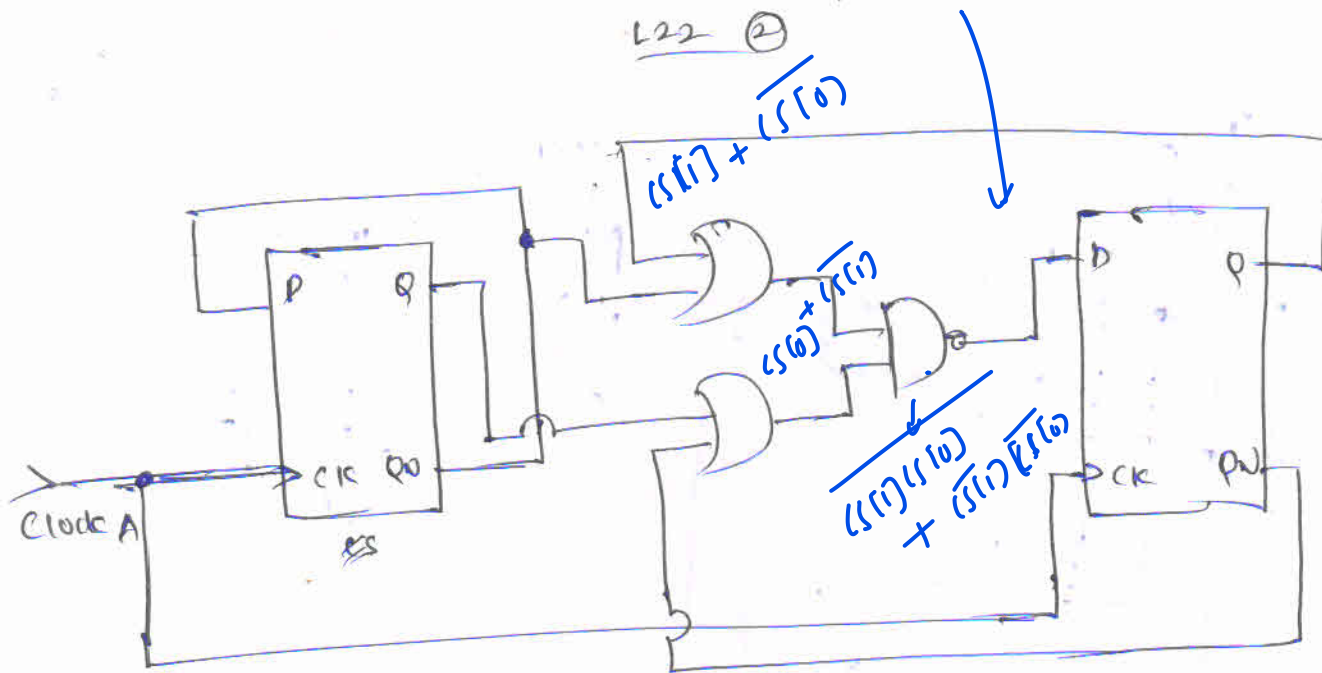
Up Down Counter

Method 8:

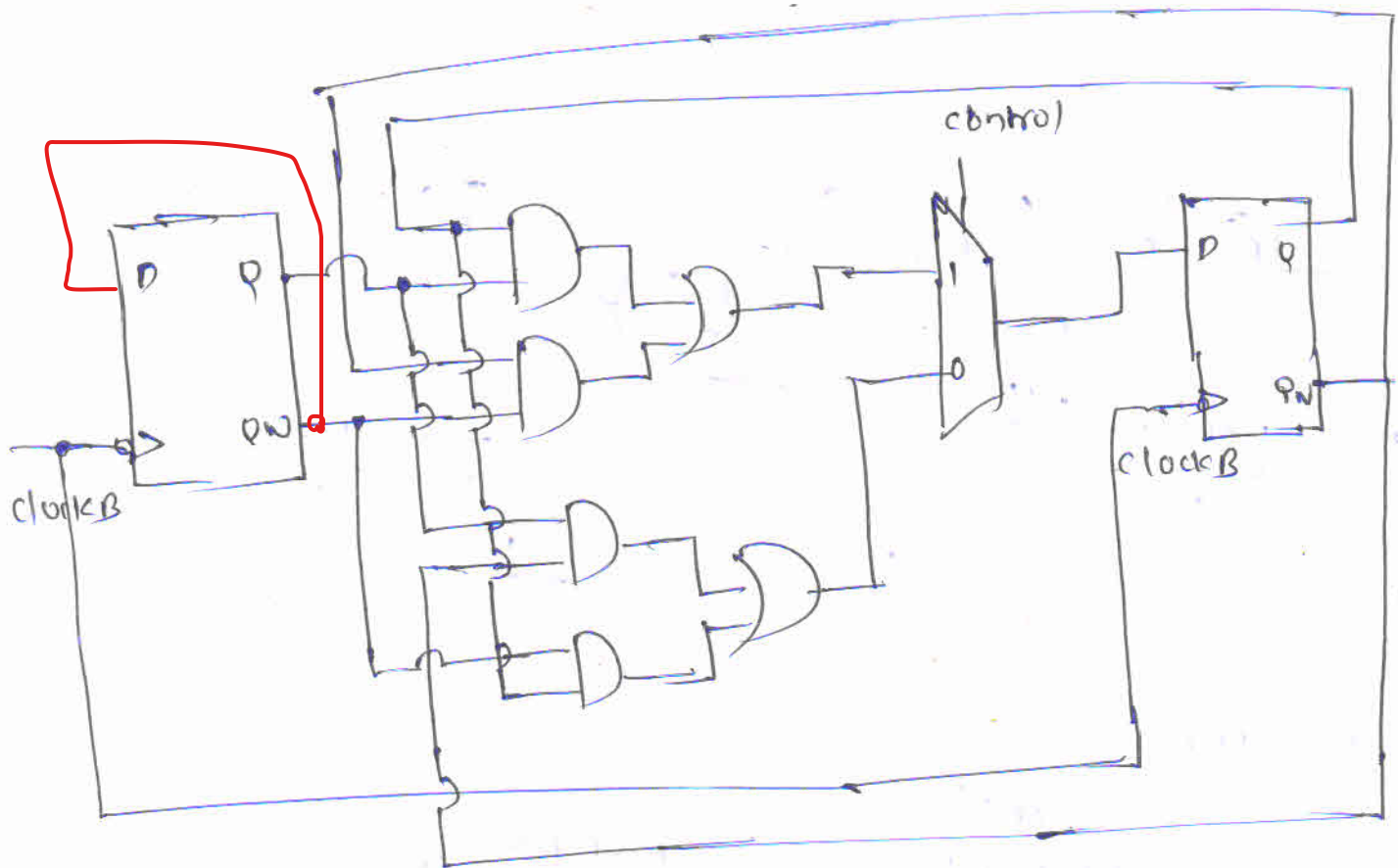| control	current state (CS) counter		Next state (NS) counter	
	1	0	1	0
0	0	0	1	1
0	0	1	0	0
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	1
1	1	1	0	0

NS[1]

	00	01	11	10
Control	1		1	
Control		1	1	1

NS[0]

	00	01	11	10
	1			1
	1			1

$$NS[1] = \overline{(M)}\,(S[1])\,\overline{(S[0])} + \overline{(M)}\cdot[CS[1]]\cdot[S[0]]$$
$$+ (M)\cdot\overline{CS[1]}\cdot CS[0] + (M)\cdot CS[1]\cdot\overline{CS[0]}$$

$$NS[0] = \overline{(S[0])}$$

Method. II :

Ctrl	current state R_1 R_0		Next state 1 D_1 n_0		0 D_1 n_0	
			0	1	0	1
0	0	0	0	0	0	0
0	0	1	0	0	0	0
0	1	0	0	0	0	1
0	1	1	0	1	0	0
1	0	0	0	0	1	0
1	0	1	1	0	0	0
1	1	0	1	0	1	0
1	1	1	0	0	0	0

NS[1]

D_1

	00	01	11	10
0				
1		1		1

NS[1]

$D_1 = \text{ctrl} . \overline{\text{cs}[1]} . \text{cs}[0]$

$+ \overline{\text{ctrl}} . \text{cs}[1] \overline{\text{cs}[0]}$

NS[0]

D_1

	00	01	11	10
0				
1	1			1

NS[0]

$D_1 = \text{ctrl} . \overline{\text{cs}[0]}$

NS[1]

D_0

	00	01	11	10
0	1		1	
1				

NS[1]

$D_0 = \overline{\text{ctrl}} . \overline{\text{cs}[1] . \text{cs}[0]}$

$+ \overline{\text{ctrl}} . \text{cs}[1] \text{cs}[0]$
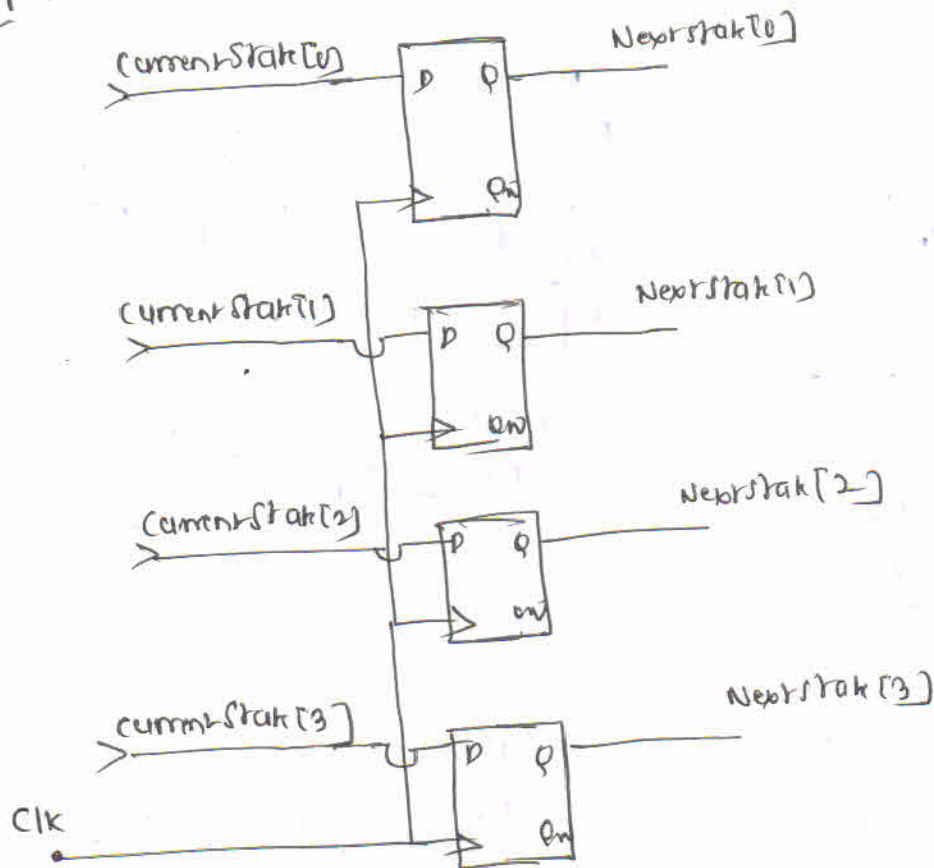
NS[0]

D_0

	00	01	11	10
0	1			1
1				

NS[0] $D_0 = \overline{\text{ctrl}} . \overline{\text{cs}[0]}$

Flip Flop :

Current State[0] — [D Q] — Next State[0]
[> Qn]

Current State[1] — [D Q] — Next State[1]
[> Qn]

Current State[2] — [D Q] — Next State[2]
[> Qn]

Current State[3] — [D Q] — Next State[3]
Clk — [> Qn]

Global Reg :

Current State[0] — [D Q] — Next State[0]
[Ck Qn]

Current State[1] — [D Q] — Next State[1]
[Ck Qn]

Current State[2] — [D Q] — Next State[2]
[Ck Qn]

Current State[3] — [D Q] — Next State[3]
Clk — [Ck Qn]

Reg UseDef

Current state0

Next state0

Current state1

Next state1

Clk

Current state2

Next state2

Current state3

Next state3
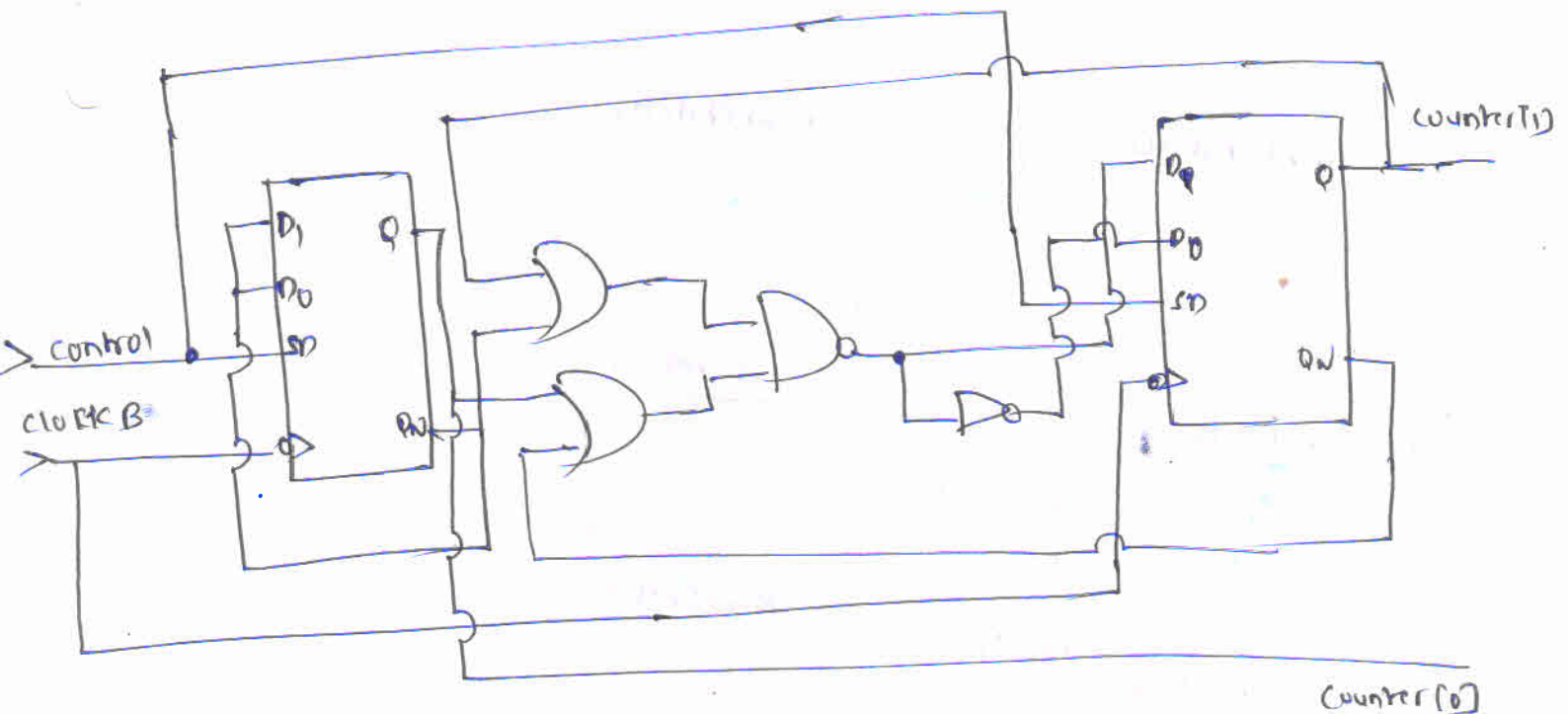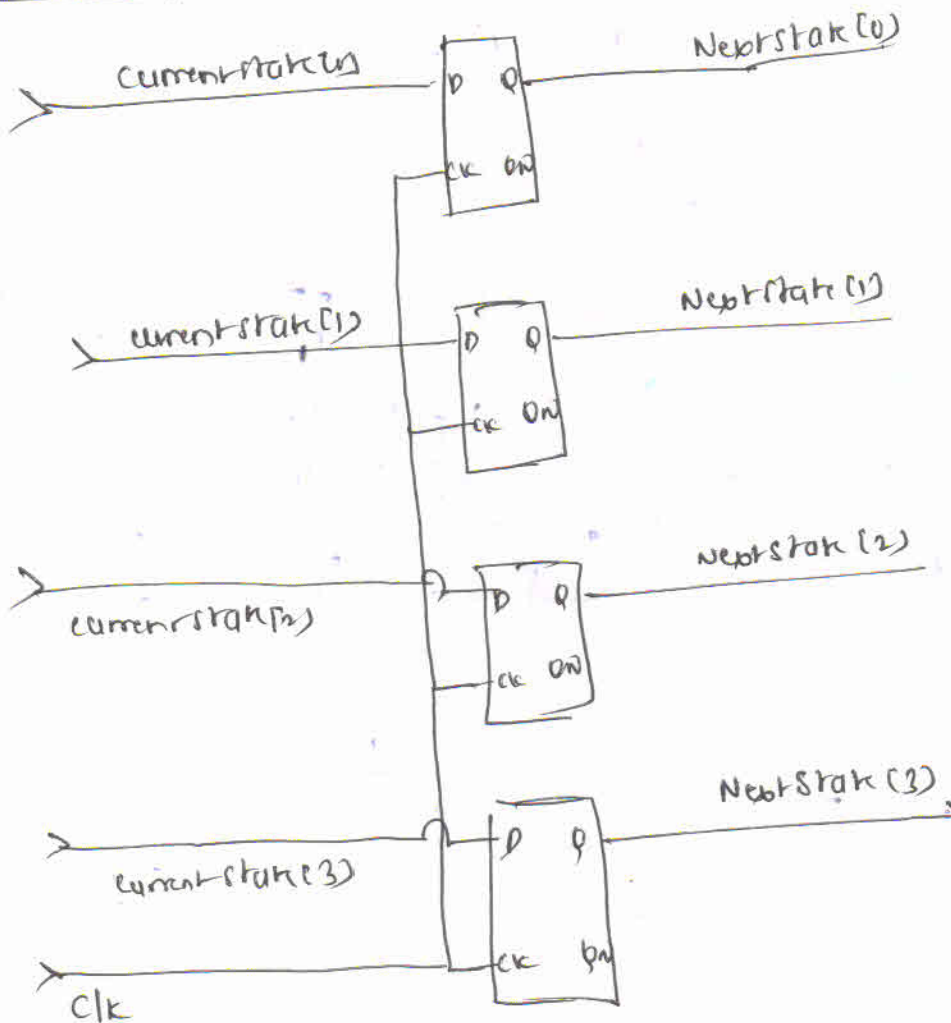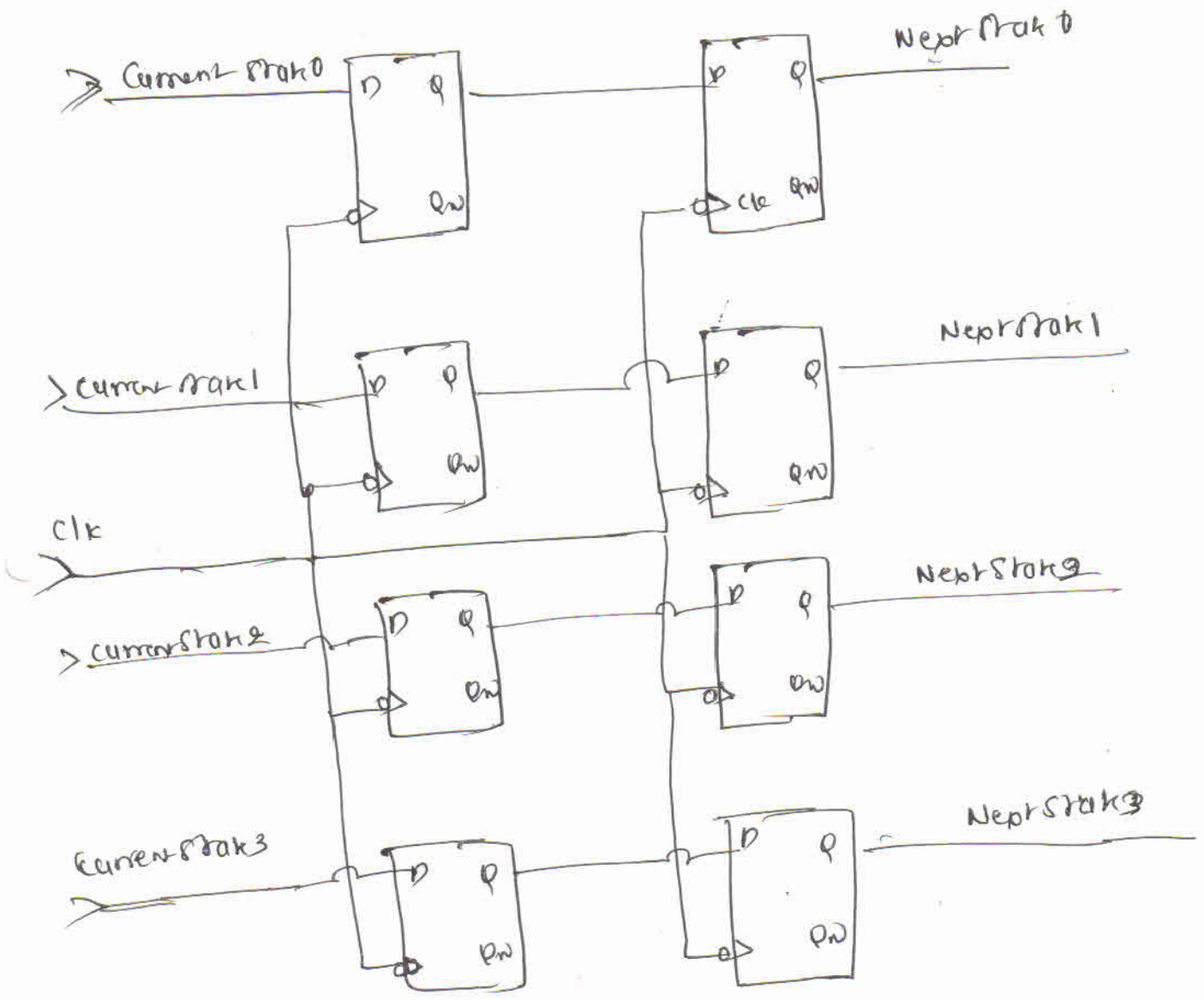
Local Var Assign Use / Local Var Use Assign

current state0

Next state0

current state1

Next state1

Clk

current state 2

Next state 2

Current state 3

Next state 3