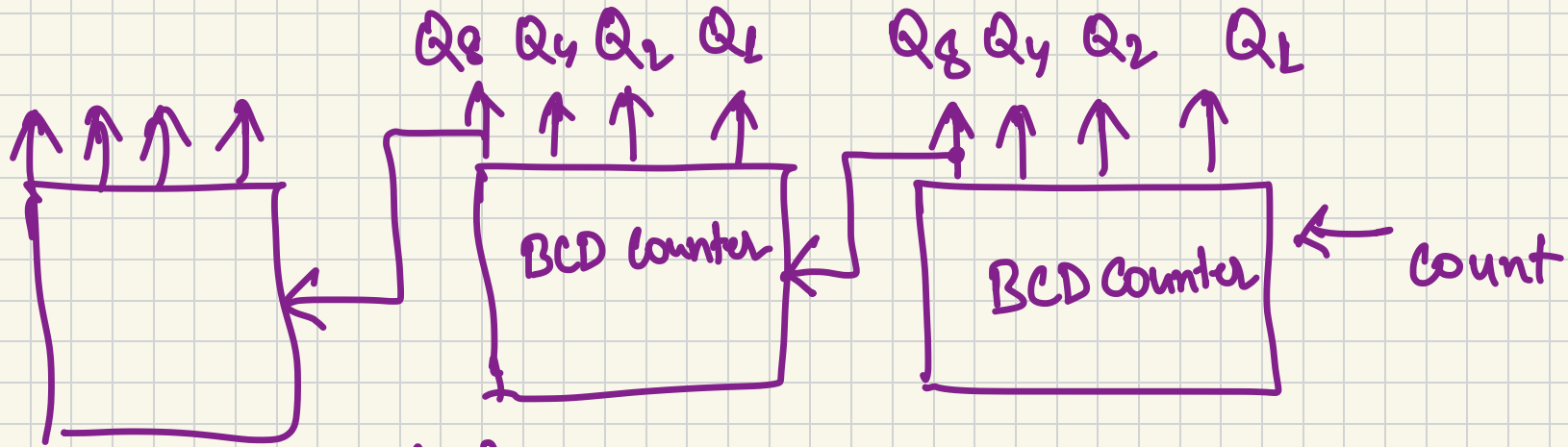


ACOL 215

Two decade counter

(19th Nov.)



(Three-decade counter)

Synchronous counters

Binary counter

→ The flip in the least significant position is complemented with every pulse.

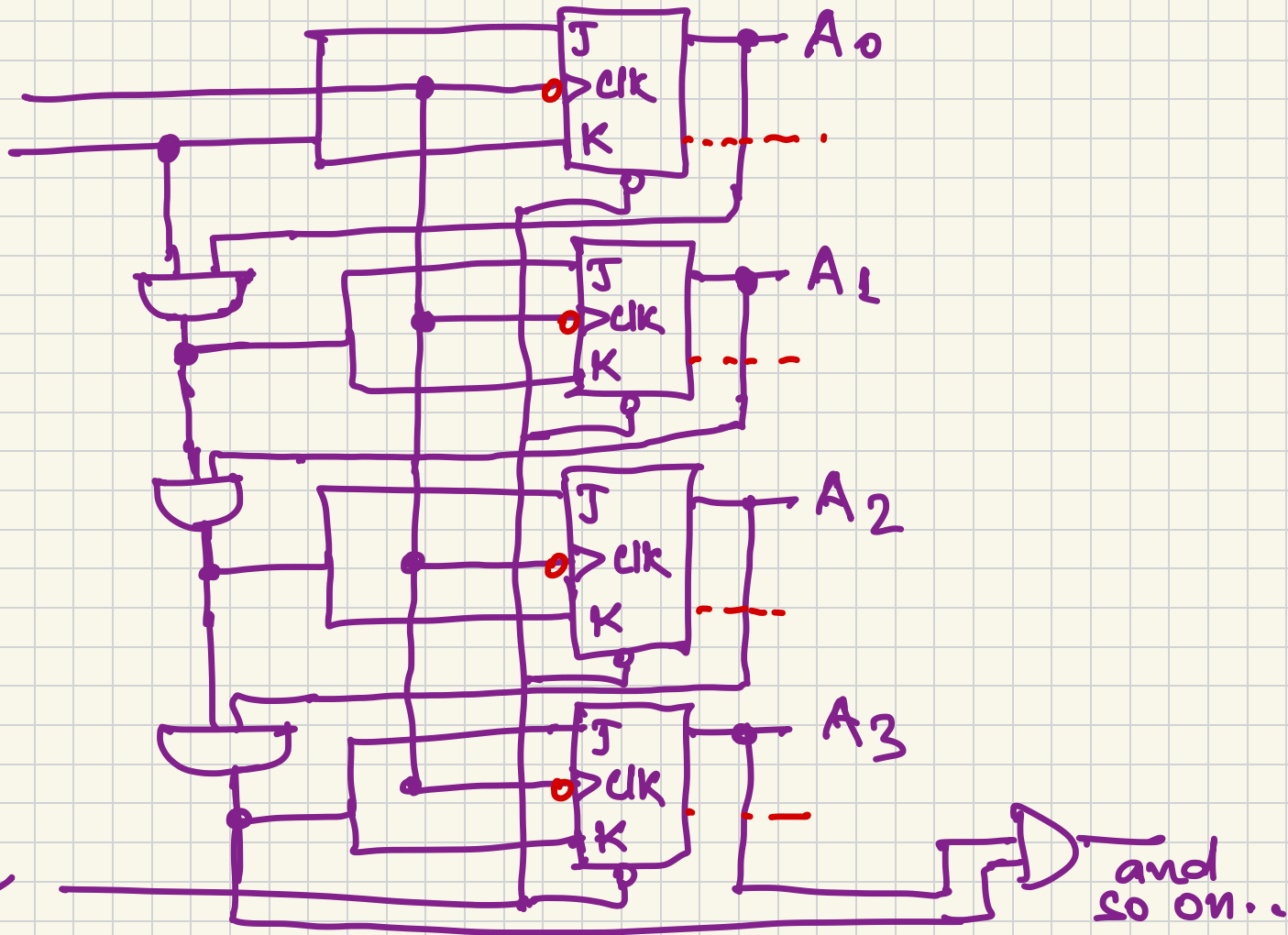
→ A flip-flop in any other position is complemented when all the lower bits are 1.



0 0 0 0	←	0 0 0 1
0 0 0 1	←	0 0 1 0
0 0 1 0	←	0 0 1 1
0 0 1 1	←	0 1 0 0
0 1 0 0	←	0 1 0 1
0 1 0 1	←	0 1 1 0
0 1 1 0	←	0 1 1 1
0 1 1 1	←	1 0 0 0
1 0 0 0	←	1 0 0 1

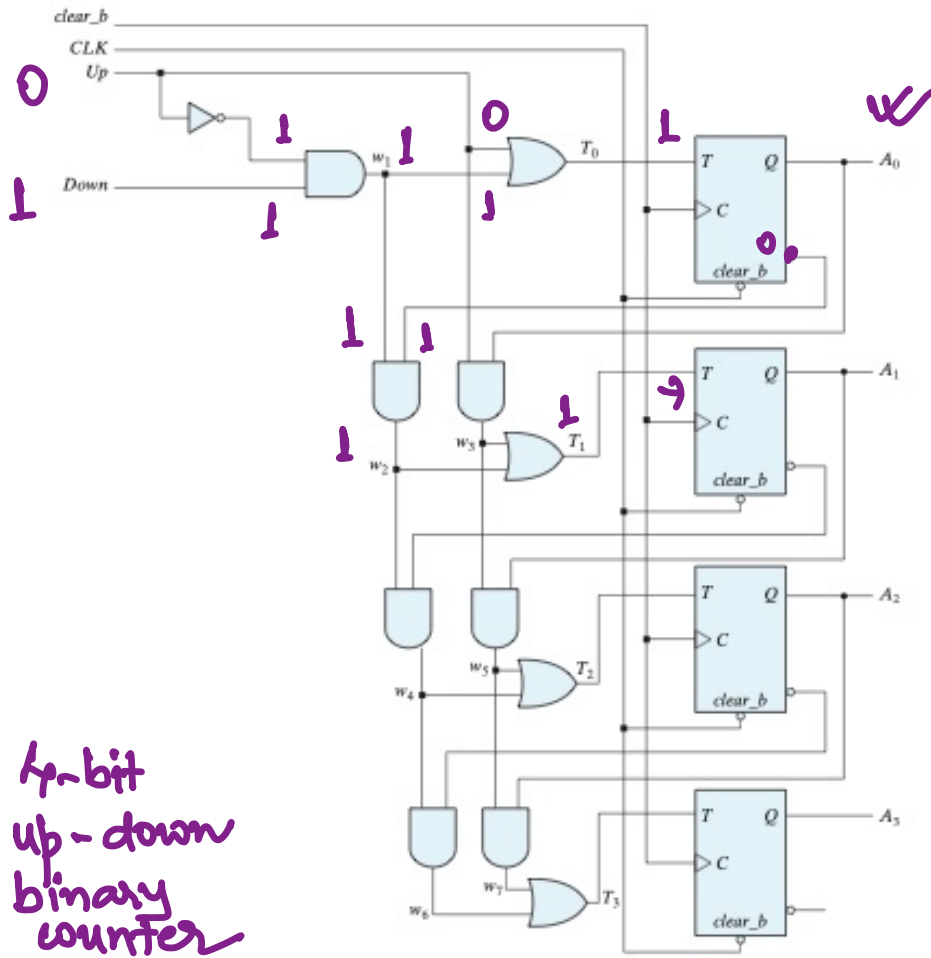
Clock
Count

clear



up 1 down X
 → counts up
 up 0 down 1
 → counts down
 up 0 down 0
 → no change

4-bit
 up-down
 binary
 counter



Synchronous BCD Counter

<u>Present State</u>				<u>Next State</u>			
Q_8	Q_4	Q_2	Q_1	Q_8	Q_4	Q_2	Q_1
0	0	0	0	0	0	0	1
0	0	0	1	0	0	1	0
0	0	1	0	0	0	1	1
0	0	1	1	0	1	0	0
0	1	0	0	0	1	0	1
0	1	0	1	0	1	1	0
0	1	1	0	0	1	1	1
0	1	1	1	1	0	0	0
1	0	0	0	1	0	0	1
1	0	0	1	0	0	0	0

<u>Output</u>	<u>Flip-flop inputs</u>			
Y	T_{Q_8}	T_{Q_4}	T_{Q_2}	T_{Q_1}
0	0	0	0	1
0	0	0	1	1
0	0	0	0	1
0	0	1	1	1
0	0	0	0	1
0	0	0	1	1
0	0	0	0	1
0	0	1	1	1
1	1	0	0	1
1	1	0	0	1

$$\underline{T_{Q_1} = 1}$$

$$T_{Q_4}$$

$$= \underline{Q_2 Q_1}$$

$$\underline{T_{Q_2} = Q_8' Q_1}$$

$$y = \underline{Q_8 Q_1}$$

$Q_2 Q_1$

$Q_8 Q_4$

	00	01	11	10
00	0	0	1	0
01	0	0	1	0
11	X	X	X	X
10	0	0	X	X

$$\textcircled{T_{Q_8} =}$$

Exercise (draw the logic diagram)

T_{Q_2}

$Q_2 Q_1$

Q_1

$Q_8 Q_4$

Q_8'

Q_8

	00	01	11	10
00	0	1	1	0
01	0	1	1	0
11	X	X	X	X
10	0	0	X	X

y

Q_1

Q_8

0	0	0	0
0	0	0	0
X	X	X	X
0	1	X	X