Final : Chap 6 → Chap 15

5 questions : 120 mins

Design an asynchronous counter that have M = 8, and have up/down control button. Show step-by-step.

$M = 8 \Rightarrow 2^n = 8 \Rightarrow n = 3$.

So, we use 3-FF j-k. Count from 0 → 7

M = 0, Q is considered to the CLK

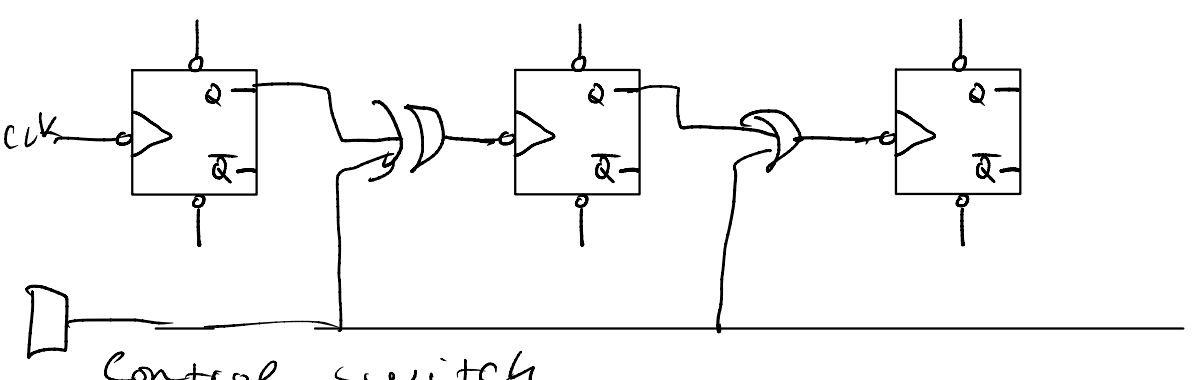
M = 1, $\bar{Q}$ is considered to the CLK

M	Q	$\bar{Q}$	Y
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

M Q \ $\bar{Q}$	0	1
00	0	0
01	1	1
11	0	1
10	0	1

$Y = M \oplus Q$

$\bar{M} Q + M \bar{Q} =$



2/ Synchronous , M = 16 count up

Present state				Next-State				J_3 K_3	J_2 K_2	J_1 K_1	J_0 K_0
Q_3	Q_2	Q_1	Q_0	Q_3^+	Q_2^+	Q_1^+	Q_0^+				
0	0	0	0	0	0	0	1	0 X	0 X	0 X	1 X
0	0	0	1	0	0	1	0	0 X	0 X	1 X	X 1
0	0	1	0	0	0	1	1	0 X	0 X	X 0	1 X
0	0	1	1	0	1	0	0	0 X	1 X	X 1	X 1
0	1	0	0	0	1	0	1	0 X	X 0	0 X	1 X
0	1	0	1	0	1	1	0	0 X	X 0	1 X	X 1
0	1	1	0	0	1	1	1	0 X	X 0	X 0	1 X
0	1	1	1	1	0	0	0	1 X	X 1	X 1	X 1
1	0	0	0	1	0	0	1	X 0	0 X	0 X	1 X
1	0	0	1	1	0	1	0	X 0	0 X	1 X	X 1
1	0	1	0	1	0	1	1	X 0	0 X	X 0	1 X
1	0	1	1	1	1	0	0	X 0	1 X	X 1	X 1
1	1	0	0	1	1	0	1	X 0	X 0	0 X	1 X
1	1	0	1	1	1	1	0	X 0	X 0	1 X	X 1
1	1	1	0	1	1	1	1	X 0	X 0	X 0	1 X
1	1	1	1	0	0	0	0	X 1	X 1	X 1	X 1

$Q_3 Q_2$ \ $Q_1 Q_0$	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	X	X	X	X
10	X	X	X	X

$J_1 = Q_0$

$K_1 = Q_0$

$Q_3 Q_2$ \ $Q_1 Q_0$	00	01	11	10
00	X	X	X	X
01	X	X	X	X
11	0	0	1	0
10	0	0	0	0