

University of California at Berkeley
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EECS 150
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Homework Quiz # 6 (9 March)

Name: _____ **SID:** _____

Consider a 3-bit counter that behaves as follows. The counter has a mode input M. When M is true, the counter counts in the sequence 0, 2, 4, 6, 1, 3, 5, 7, 0 and repeat. When M is false, the counter counts in the sequence 0, 1, 6, 7, 2, 3, 4, 5, 0 and repeat. The M input can change at anytime to cause the counter to change into either mode.

(a) Complete the Encoded STATE TRANSITION TABLE for this counter.

D2	D1	D0	M	Q2	Q1	Q0	D2	D1	D0	M	Q2	Q1	Q0
0	0	0	0	0	0	1	1	0	0	0	1	0	1
0	0	0	1	0	1	0	1	0	0	1	1	0	0
0	0	1	0	1	1	0	1	0	1	0	0	0	0
0	0	1	1	0	1	1	1	0	1	1	1	1	1
0	1	0	0	0	1	1	1	1	0	0	1	1	1
0	1	0	1	1	0	0	1	1	0	1	0	0	1
0	1	1	0	1	0	0	1	1	1	0	0	1	0
0	1	1	1	1	0	1	1	1	1	0	0	0	0

(b) Use the K-maps below to find the minimized two-level implementation of the counter's next state functions.

	D2					D2					D2			
Q2	0	0	1	1	Q1	0	1	1	0	Q0	1	1	1	1
	0	1	0	1		1	0	0	1		0	0	1	0
	0	1	0	1		1	0	0	1		1	1	0	1
D0	1	1	0	0	D0	1	0	1	0	D0	0	0	0	0
	D1					D1					D1			

$$Q2 = M' D0 D2' + M D1 D2' + M' D0' D2 + M D1' D2$$

$$Q1 = M D1' + D0 D1' D2' + M' D1 D2 + M' D0' D1$$

$$Q0 = M' D0' + D0' D1 D2 + M D0 D2' + M D0 D1'$$