Lab 4: BCD Up/Down Counter

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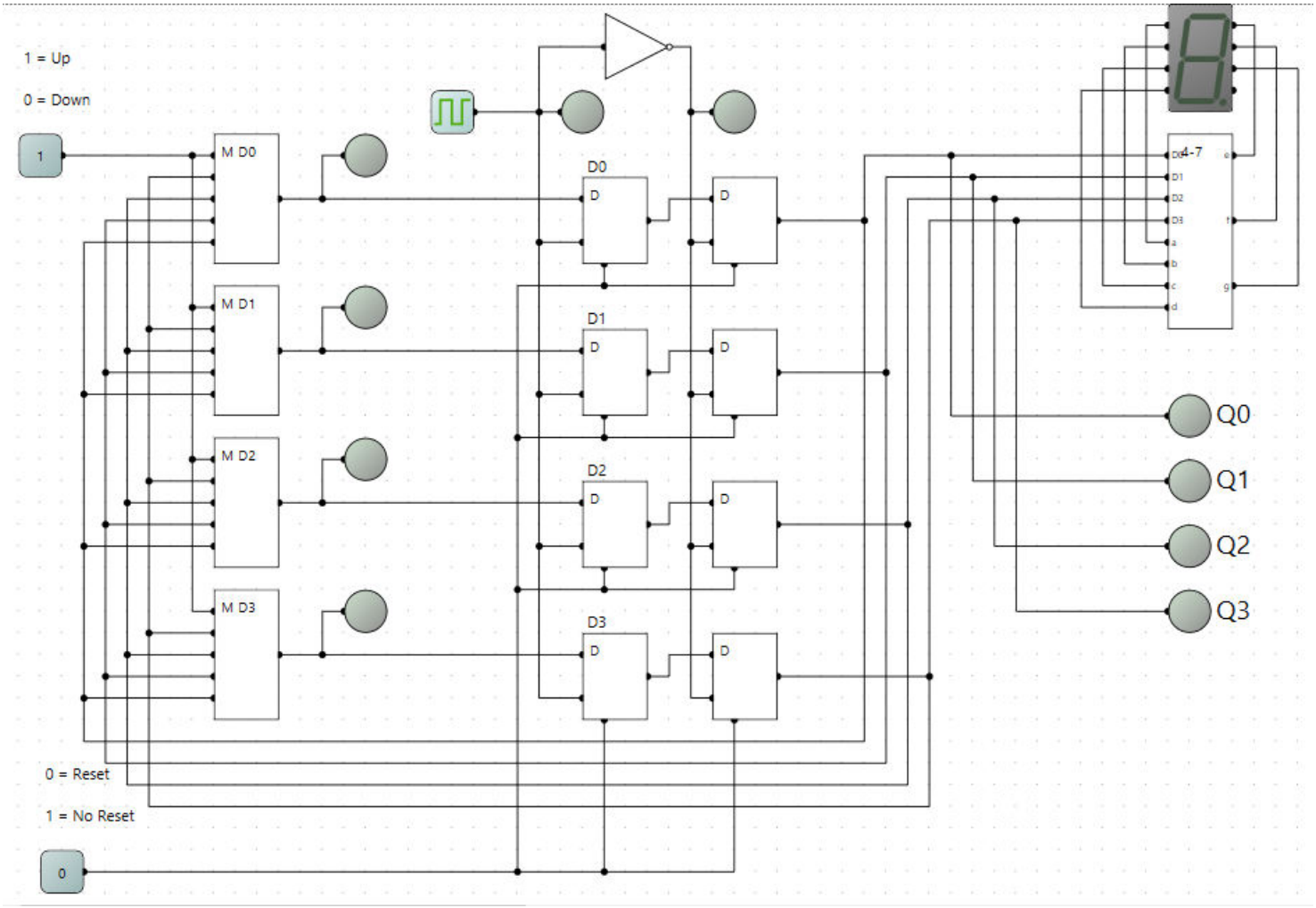
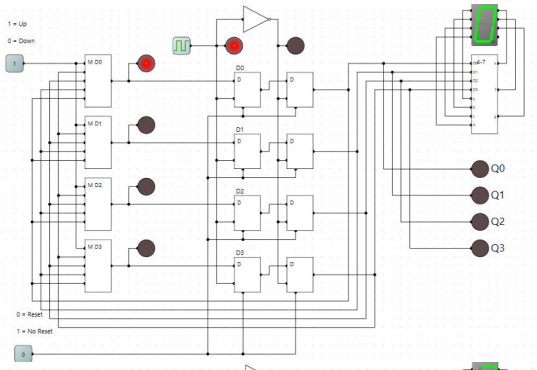
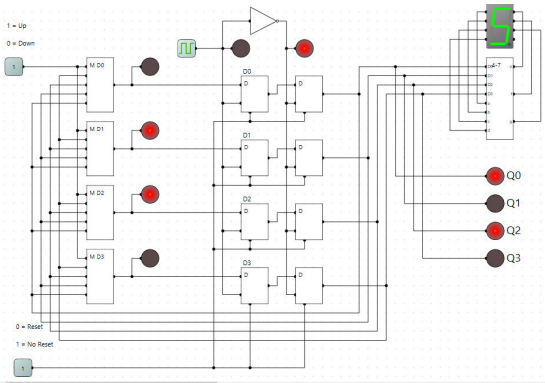
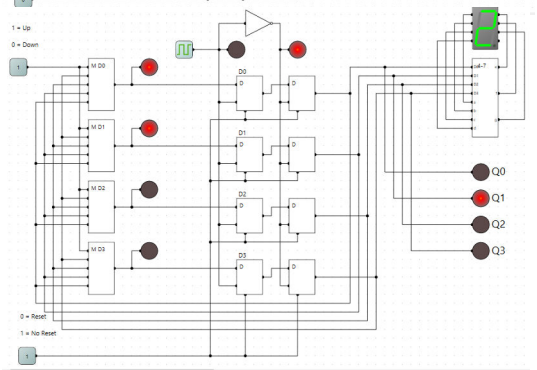
Design: This circuit is designed to print, starting at 0, numbers counting up to 9 or down from 9 depending on the state of the Up/Down bit (0 = Down, 1 = Up). It should also start at 0

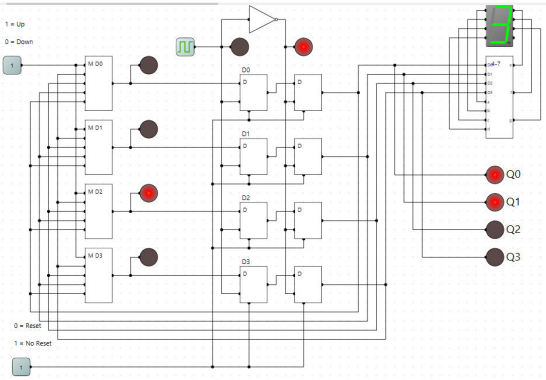
Overall Circuit Schematic:

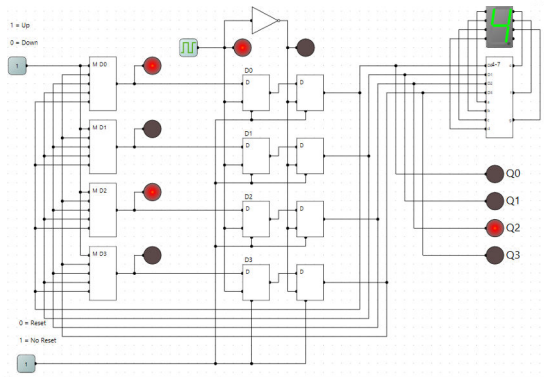


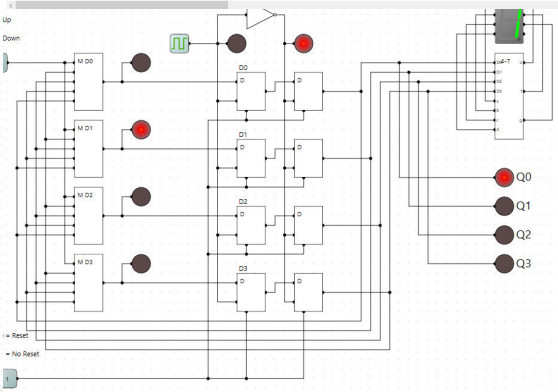

1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset

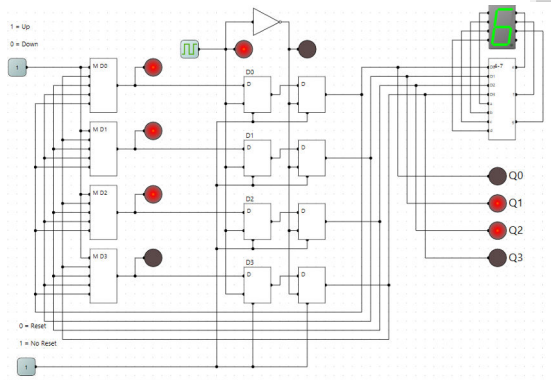

1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset

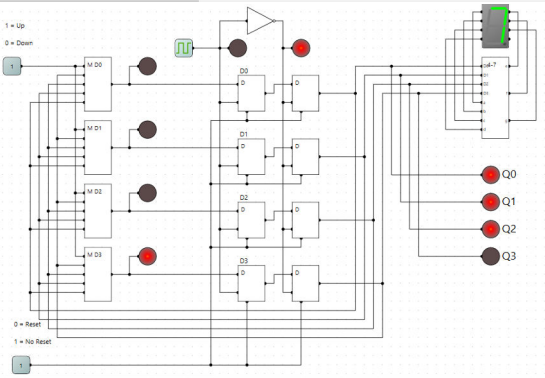

1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset

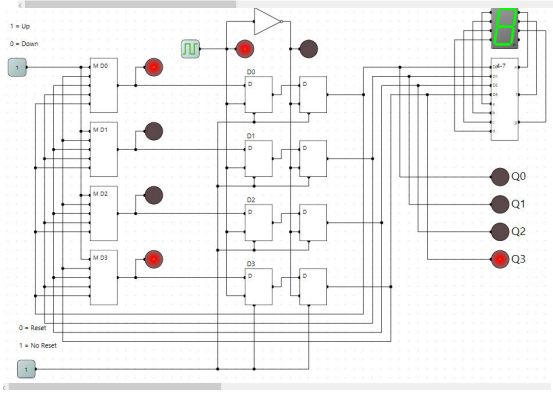

1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset

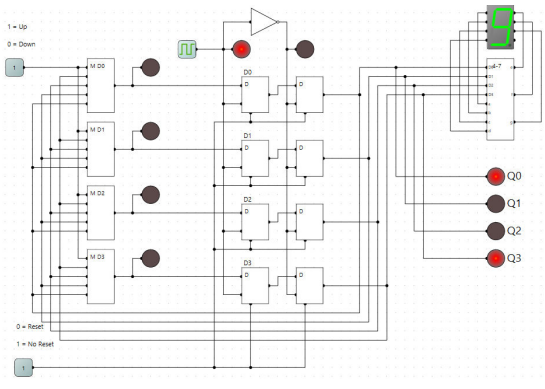

1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset


Up
Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
= No Reset

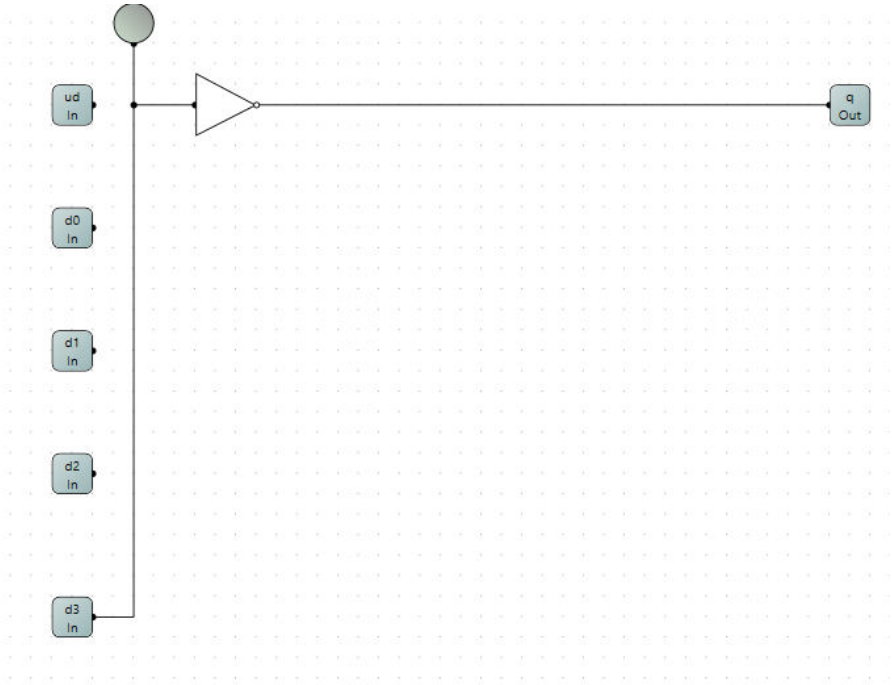

1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset


1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset

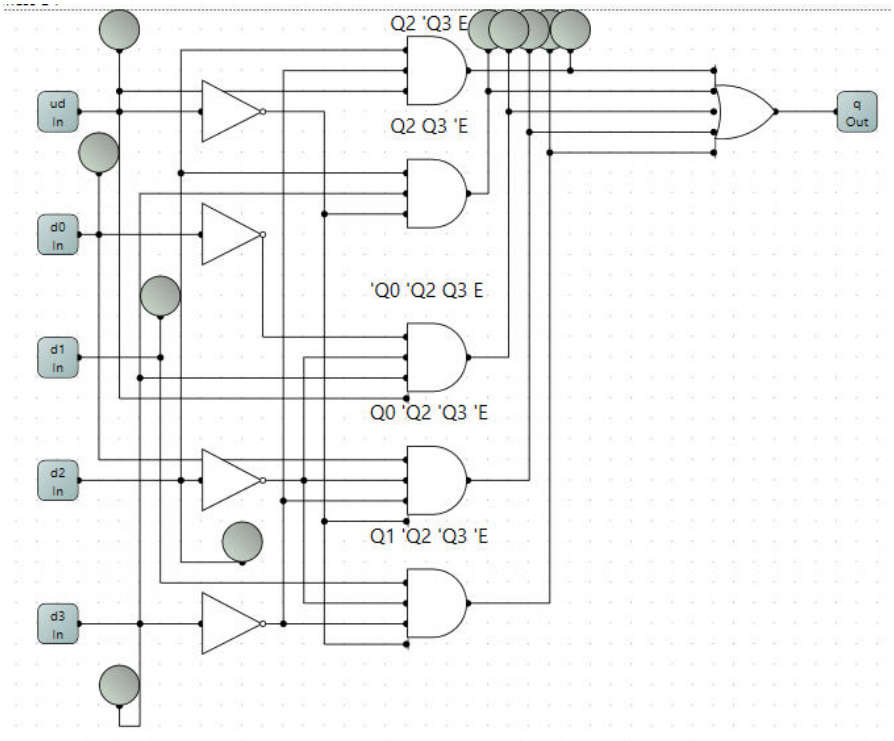

1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset


1 = Up
0 = Down
M D0
M D1
M D2
M D3
D0
D1
D2
D3
Q0
Q1
Q2
Q3
0 = Reset
1 = No Reset

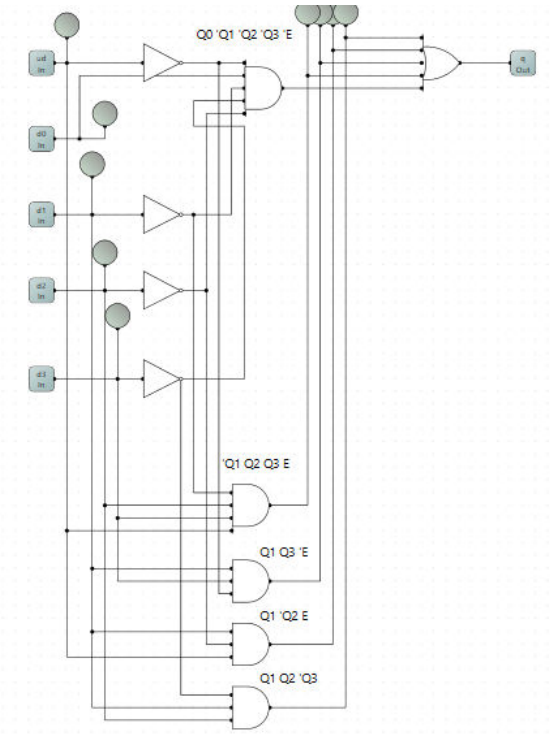
M 0, or Bit 0



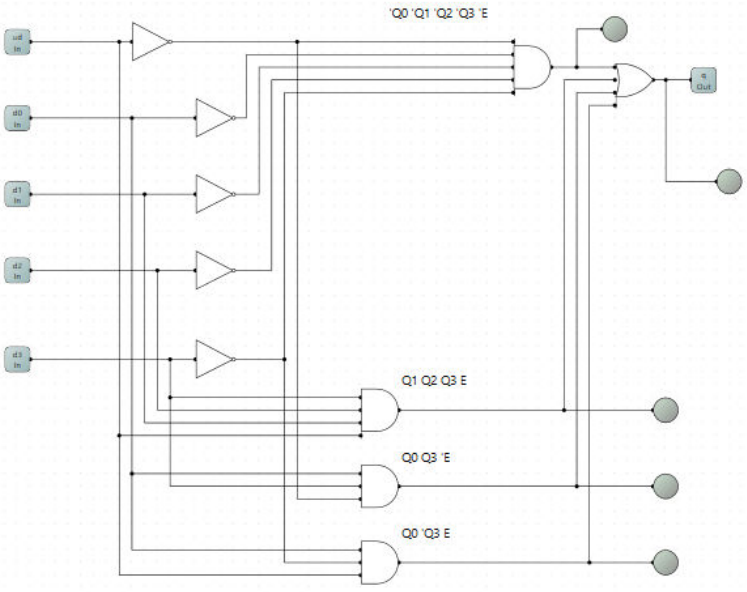
M 1, or Bit 1



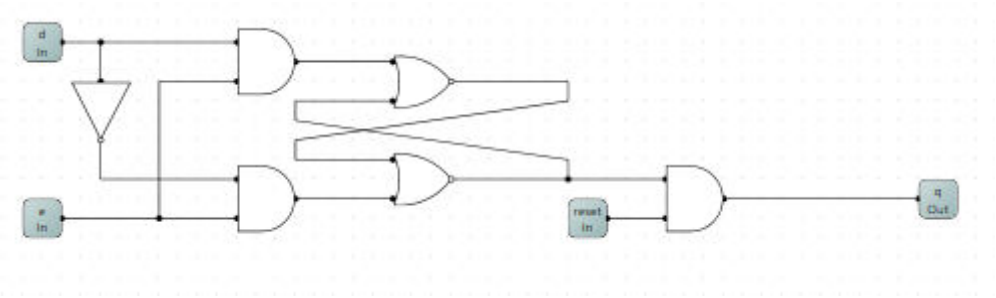
M 2, or Bit 2



M3 or Bit 3



D-Latch

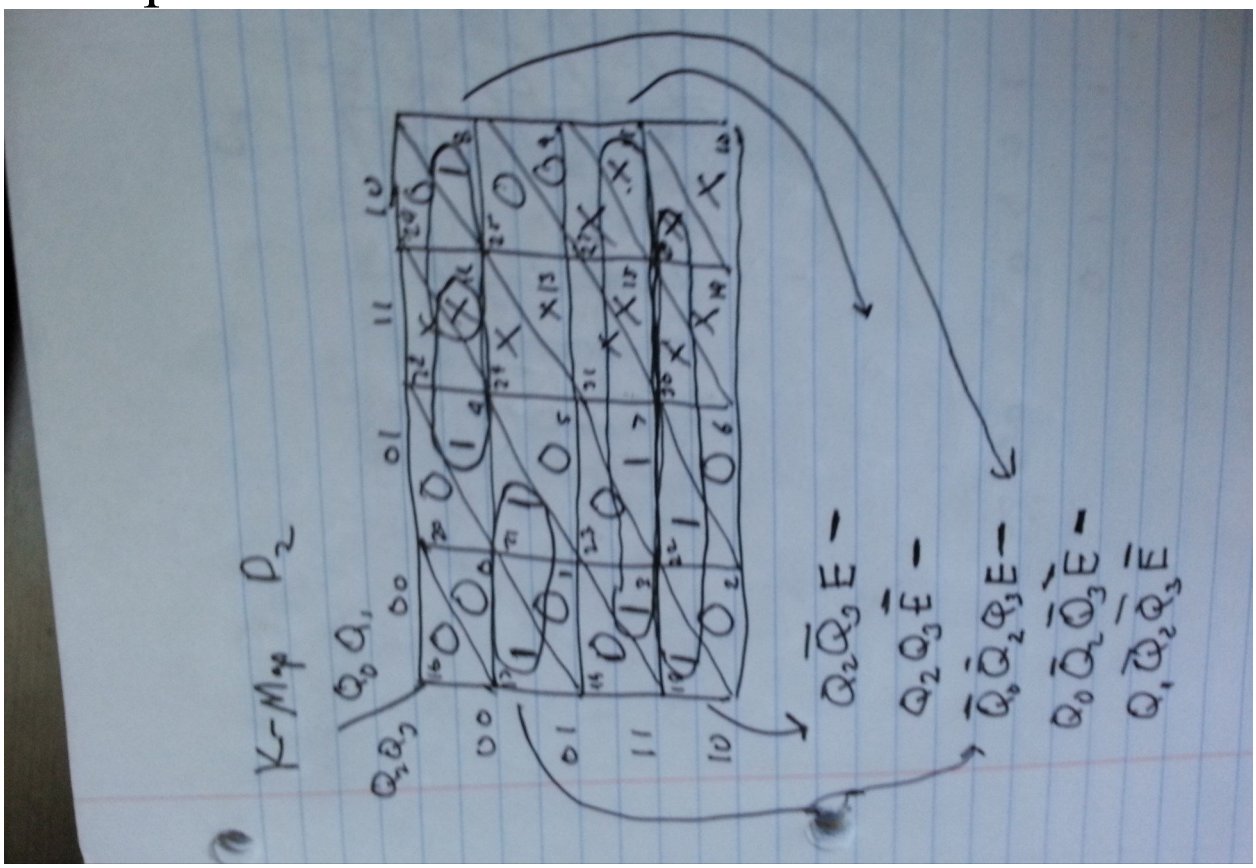


Oscilloscope: For some reason, the Oscilloscope was grayed out no matter whether it was running or not, and with a clock in. I hope the previous pictures provided are enough to show that it works, but I will talk to you today about this.

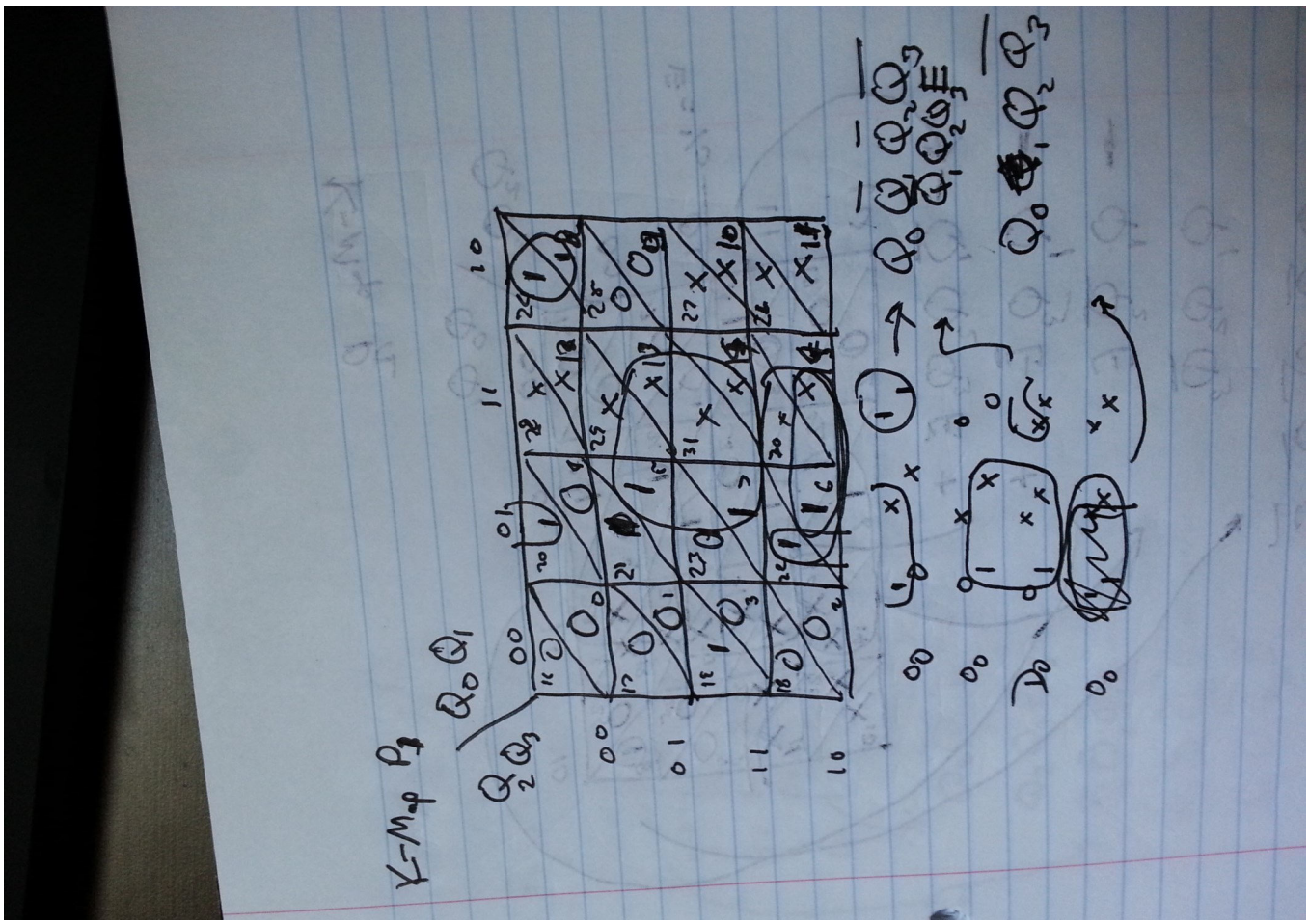
Video of Up Counter: http://recordit.co/RhAVVwNG7k

Video of Down Counter: http://recordit.co/RVqfb4Ojp2

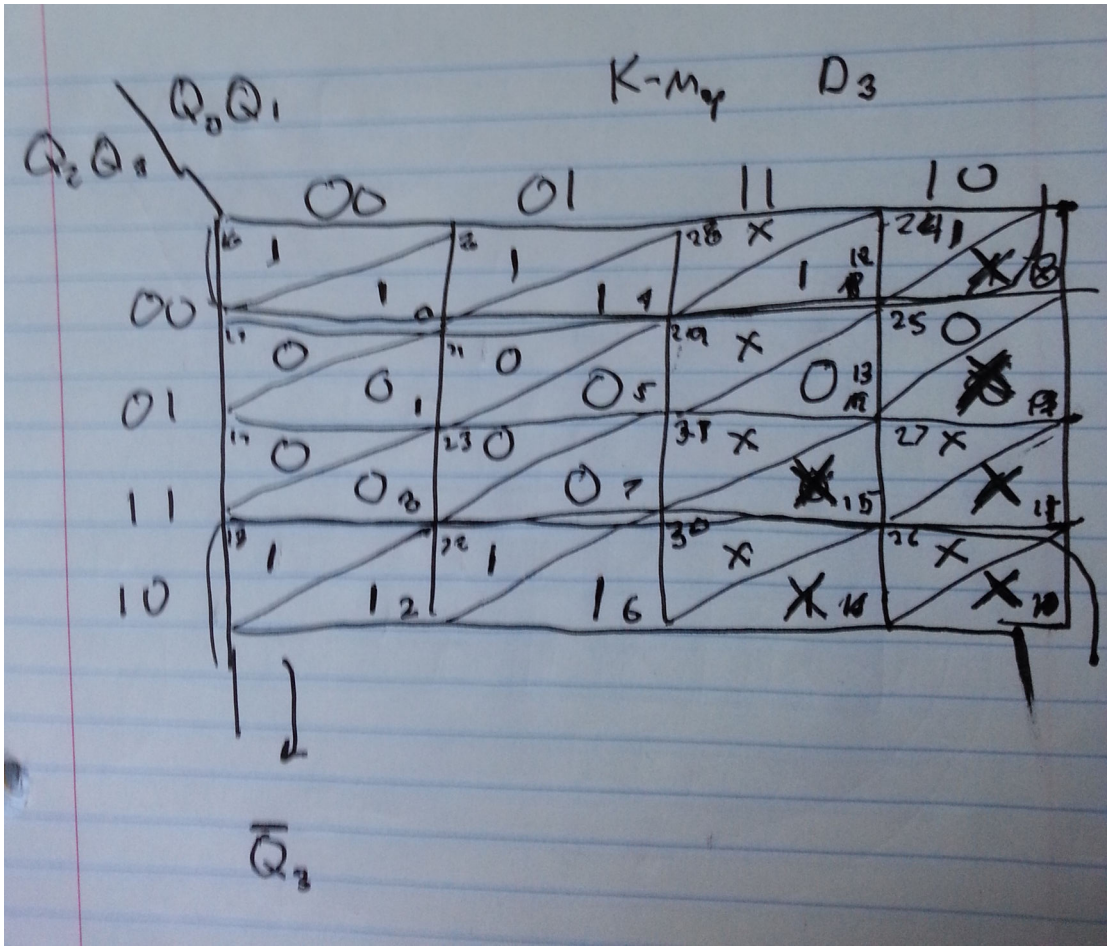
KMap D2



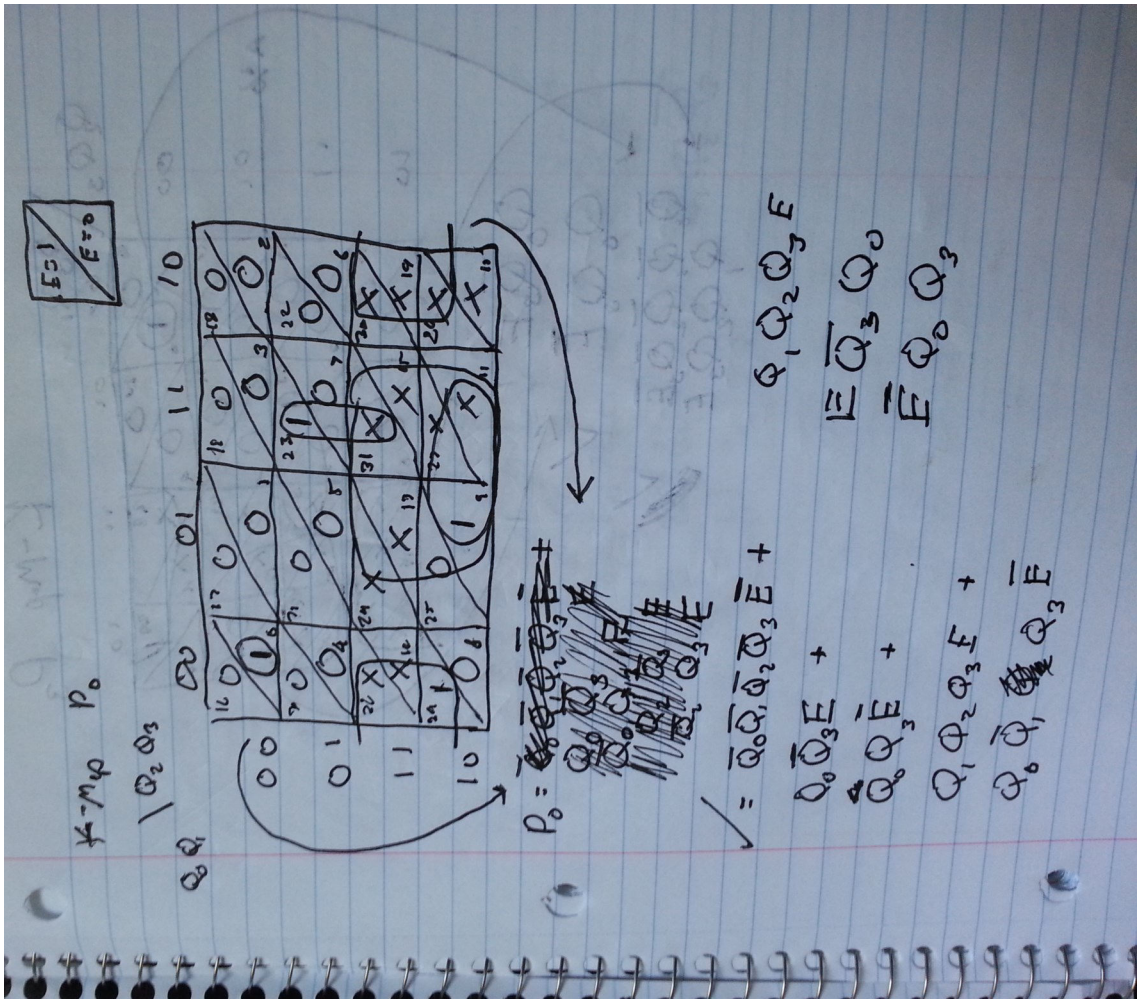
KMap D3



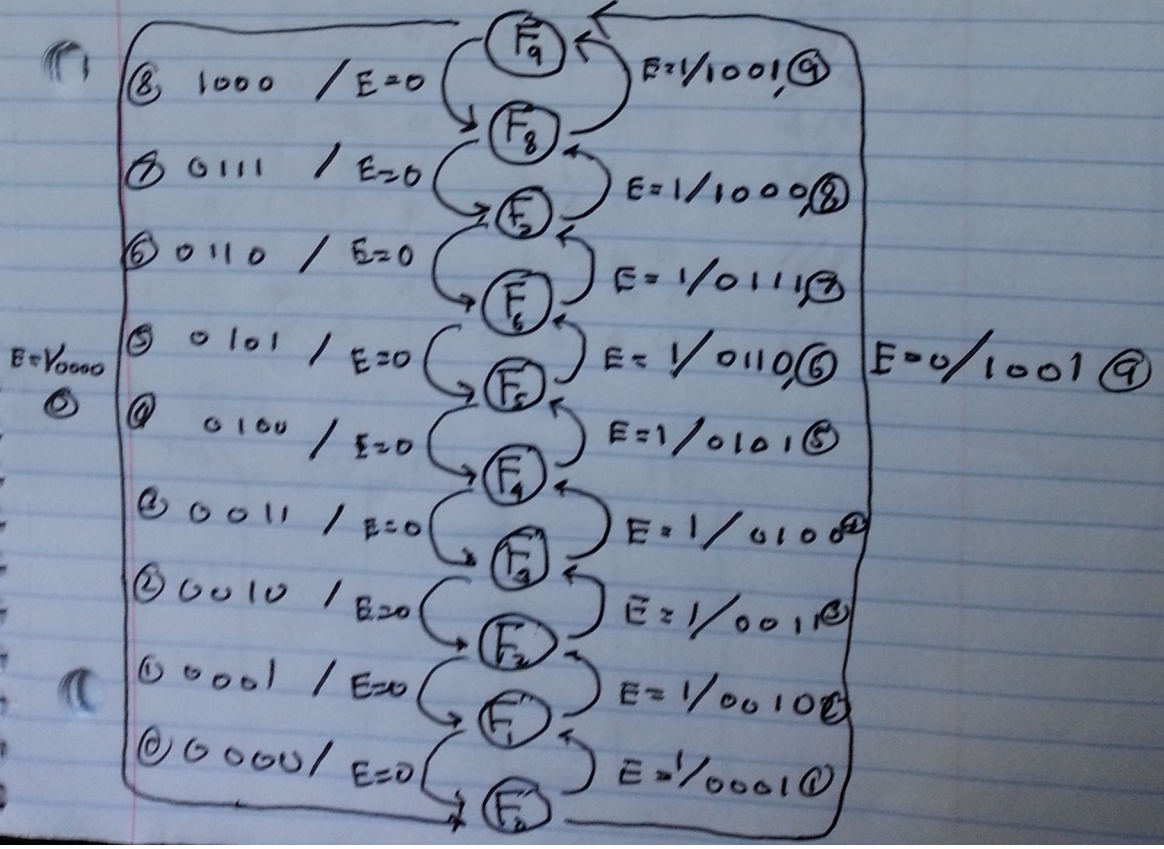
KMap D3



KMap D0



Total

	Q_0	Q_1	Q_2	Q_3	#
F_0	0	0	0	0	0
F_1	0	0	0	1	1
F_2	0	0	1	0	2
F_3	0	0	1	1	3
F_4	0	1	0	0	4
F_5	0	1	0	1	5
F_6	0	1	1	0	6
F_7	0	1	1	1	7
F_8	1	0	0	0	8
F_9	1	0	0	1	9

$Q_0\ Q_1\ Q_2\ Q_3$	
E=1	E=0
0 0 0 1	1 0 0 1
0 0 1 0	0 0 0 0
0 0 1 1	0 0 0 1
0 1 0 0	0 0 1 0
0 1 0 1	0 0 1 1
0 1 1 0	0 1 0 0
0 1 1 1	0 1 0 1
1 0 0 0	0 1 1 0
1 0 0 1	0 1 1 1
0 0 0 0	1 0 0 0