HW4 Solutions ECE2060 Sp 2019

Lectures Covered: Lessons 14, 15, 18 and 19

Show all relevant steps. Don't just write down the answers.

Late HWs will not be accepted.

Show your work on these pages, attach additional pages if necessary.

- Be sure to organize the pages **in order** and **staple** them all together, **otherwise you will lose one point**
- Fill out the following section. **You will lose an additional point if you fail to provide these details**

Your Last Name_____ Your First Name_____

Problems start from next page. Graded problems were: 1, 2, 3, 4 and 5

The problem numbers are from your text book (both the 6th and 7th edition will work)

1) Problem 9.4 a, b (do not use any not gate)
Notice that the inputs are connected to the decoder in reverse order. The reason for this is to map the most significant input (left-most in a truth table) to the most significant port (code2 in this case).

Decoder Ports	code2	code1	code0		
Inputs	A	B	Cin	S	Cout
	0	0	0	0	0
	0	0	1	1	0
	0	1	0	1	0
	0	1	1	0	1
	1	0	0	1	0
	1	0	1	0	1
	1	1	0	0	1
	1	1	1	1	1

m_0
m_1
m_2
m_3
m_4
m_5
m_6
m_7

C S
0 0 0
0 1 1
→ 1 0 2
1 1 3

a) $S = m_1 + m_2 + m_4 + m_7$ $\quad C_{out} = m_3 + m_5 + m_6 + m_7$

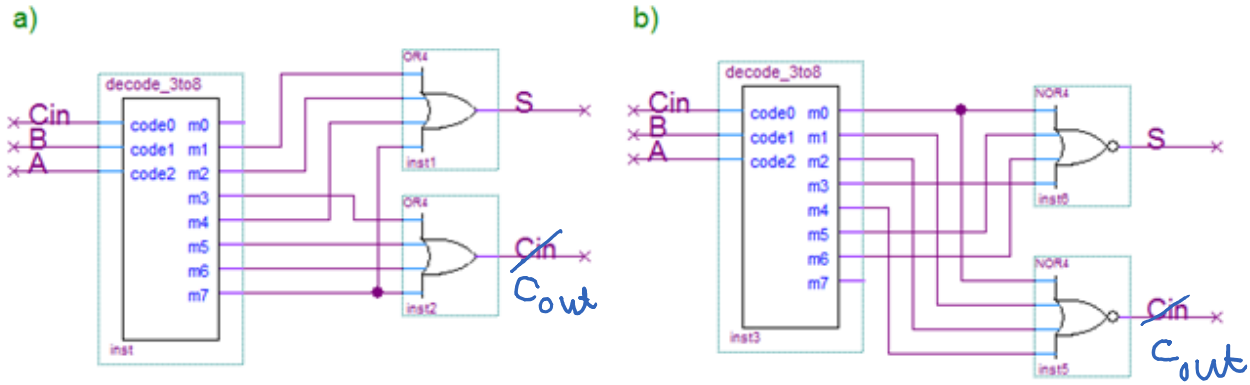
b) $S = M_0 M_3 M_5 M_6$ $\quad \overline{S} = \overline{M}_0 + \overline{M}_3 + \overline{M}_5 + \overline{M}_6$ $\quad \overline{S} = m_0 + m_3 + m_5 + m_6$

$S = \overline{m_0 + m_3 + m_5 + m_6}$

Similarly

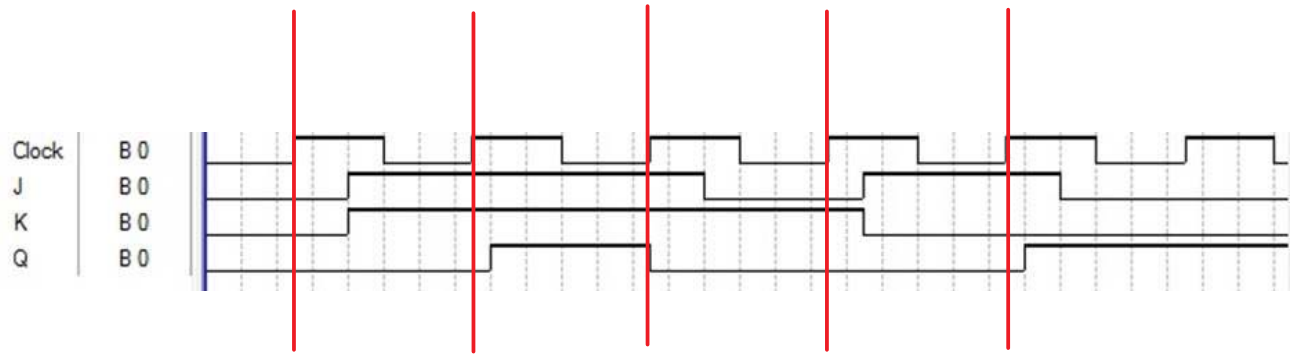
$C_{out} = M_0 M_1 M_2 M_4 = \overline{m_0 + m_1 + m_2 + m_4}$

1) continued


a)
decode_3to8
Cin
B
A
code0
code1
code2
m0
m1
m2
m3
m4
m5
m6
m7
inst
OR4
inst1
inst2
S
Cin
Cout
b)
decode_3to8
Cin
B
A
code0
code1
code2
m0
m1
m2
m3
m4
m5
m6
m7
inst3
NOR4
inst6
inst5
S
Cin
Cout

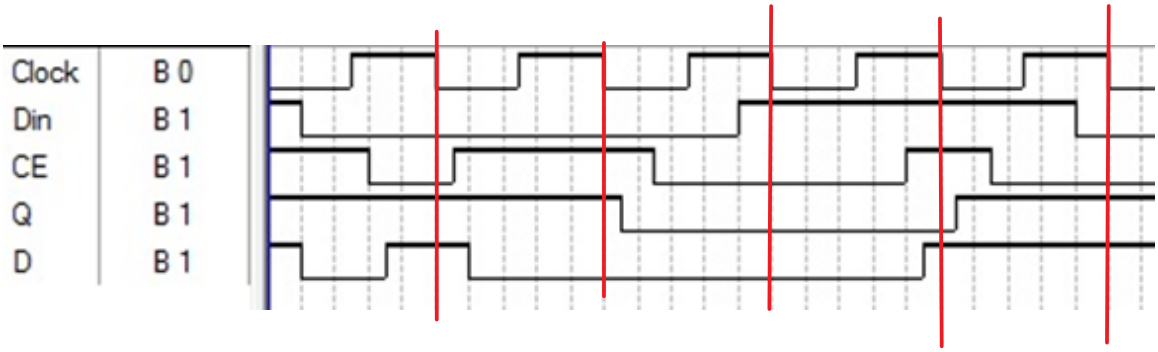
11.7) Q only changes at the Rising Edge of the clock

Rising Edge	J	K	Mode	Q
1	0	0	No Change	0
2	1	1	Toggle	1
3	1	1	Toggle	0
4	0	1	Reset	0
5	1	0	Set	1
6	0	0	No Change	1



The problem numbers are from your text book (both the 6th and 7th edition will work)

3) Problem 11.8a
Q reads in the value of Din when CE=1 and the clock is falling.



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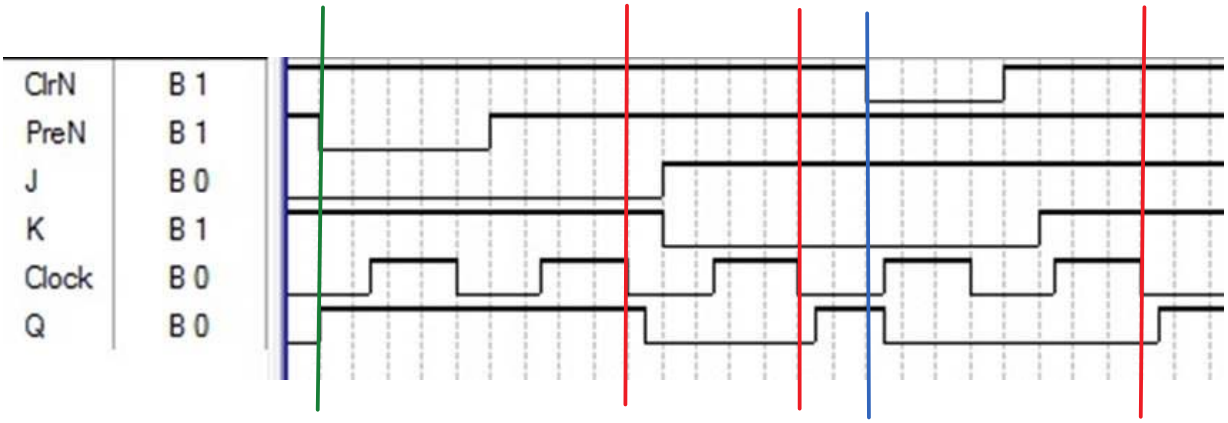
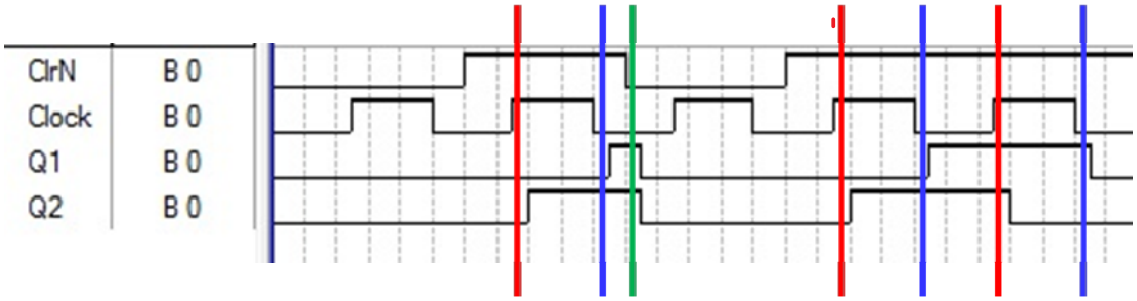
4) Problem 11.9

a) Ignore any normal inputs when an asynchronous input is active.

Event	J	K	Mode	Q
Preset Active	ignore	ignore	Set	1
2nd falling edge	0	1	Reset	0
3rd falling edge	1	0	Set	1
Reset Active	ignore	ignore	Reset	0
5th falling edge	1	1	Toggle	1



b) Q1 toggles on the **falling edge**. Q2 toggles on the **rising edge**. Both are cleared while ClrN is **active**.



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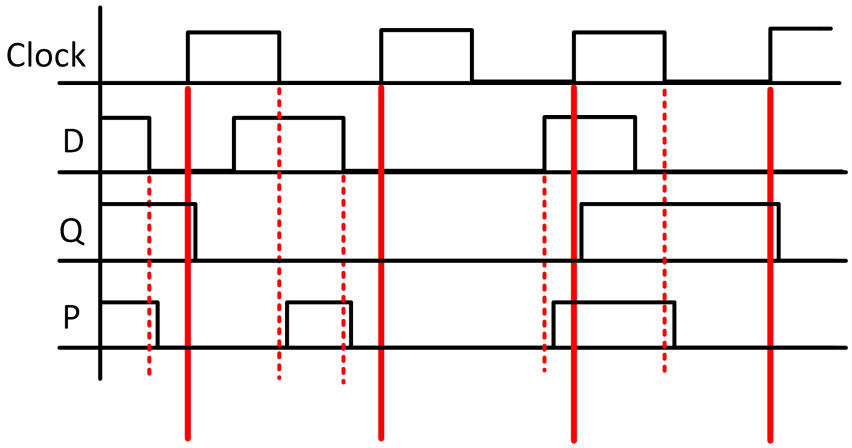
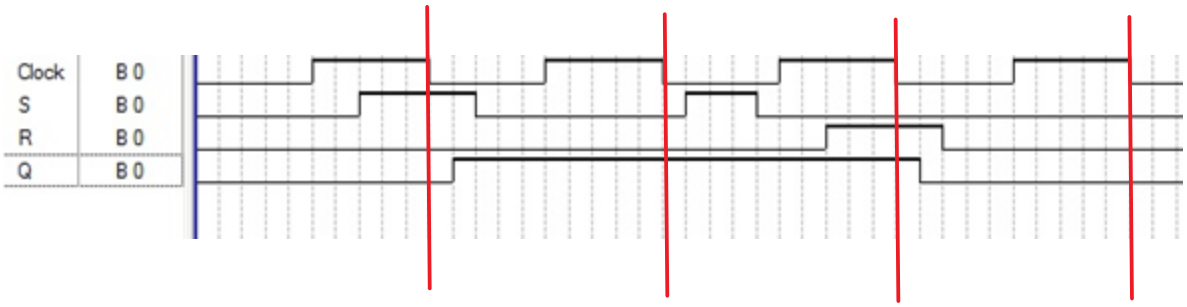
5) Problem 11.19. Notice that solid red vertical lines stand for rising edge clock times while dashed red ones show changes in Q or P. Propagation delays are taken into account in the timing diagram.



The problem numbers are from your text book (both the 6th and 7th edition will work)

6) Problem 11.21



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7) Problem 11.24 Notice the large delay between the clock and the change in Q_2. This is due to clock gating. If it can be helped, you should never put anything on the clock line other than the clock.