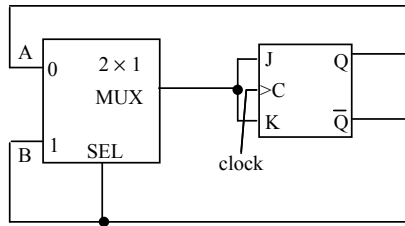


Problem 1 (20 points)

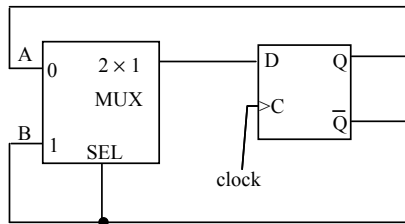
Fill in the timing diagrams (tables) for the sequential circuits below.

a) (10 pts.)



t	0	1	2	3
Q	0			
SEL				
A				
B				

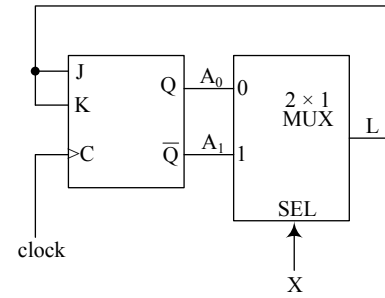
b) (10 pts.)



t	0	1	2	3
Q	0			
SEL				
A				
B				

Problem 1 (15 points)

a) [12 pts.] Fill in the table below for consecutive clock pulses.



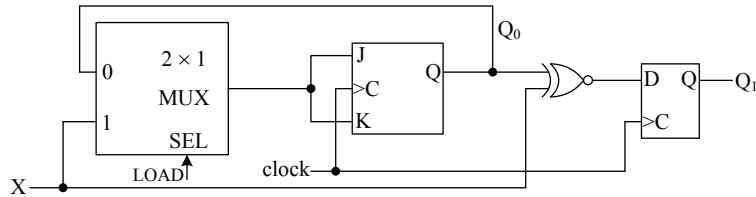
t	0	1	2	3	4
Q	0				
A ₀					
A ₁					
X	0	1	1	1	0
L					

b) [3 pts.] Would the answers be different for a D flip-flop (instead of the JK) with D = L?

Yes

No

Problem 1 (20 points)



a) [14 pts.] Complete the table for the given circuit.

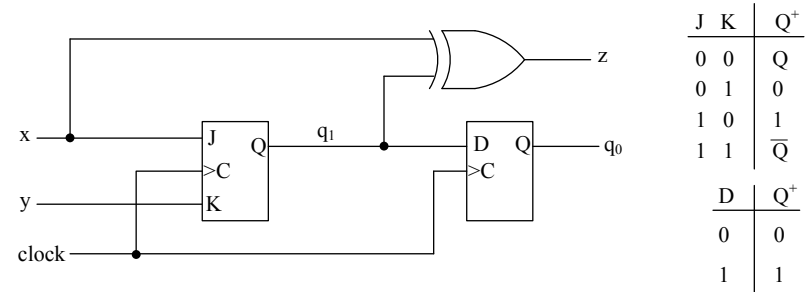
LOAD	Q ₀	X	J	K	Q ₀ ⁺	Q ₁ ⁺
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				

b) [6 pts.] Using your results in a) and assuming $LOAD = 1$, fill out the table below for consecutive clock pulses. Initially $Q_0(0) = 0$ and $Q_1(0) = 0$.

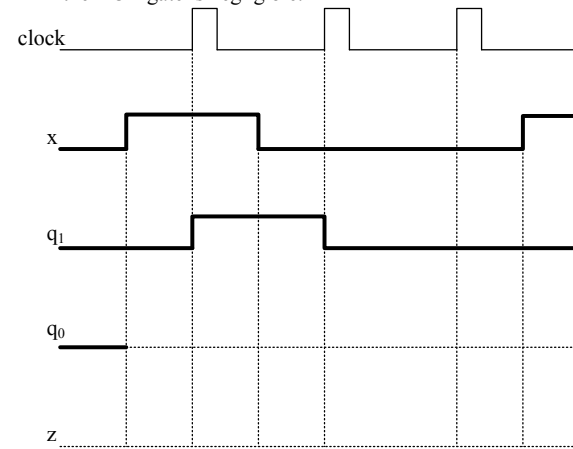
clock pulse	0	1	2	3
Q ₀	0			
Q ₁	0			
X	1	1	0	0

Problem 2 (20 points)

The sequential circuit below has positive-edge-triggered flip-flops and an XOR gate. The characteristic tables of the flip-flops are given.



a) [14 pts.] Complete the timing diagram below for the values of q_0 and z . Assume that the delay in the XOR gate is negligible.

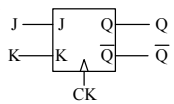


b) [6 pts.] Suppose you know that the value of y is a constant. Determine the value of y . Explain your reasoning.

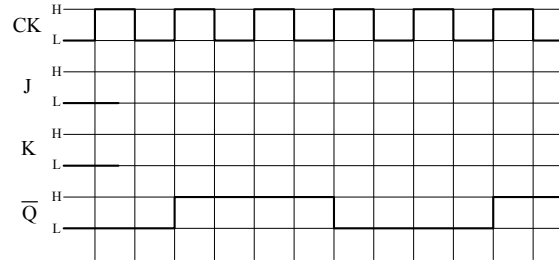
Problem 3 (15 points)

For each problem, fill in the diagram. You must draw clearly and unambiguously to get credit. No credit for messy diagrams. Draw clearly on H or L line.

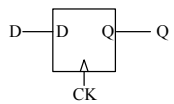
a) [10 pts.]



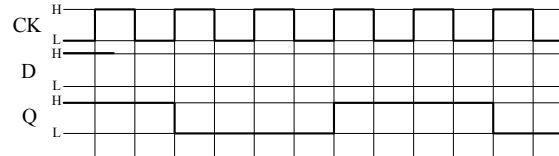
Draw J and K in the diagram. Any solution that works is OK.



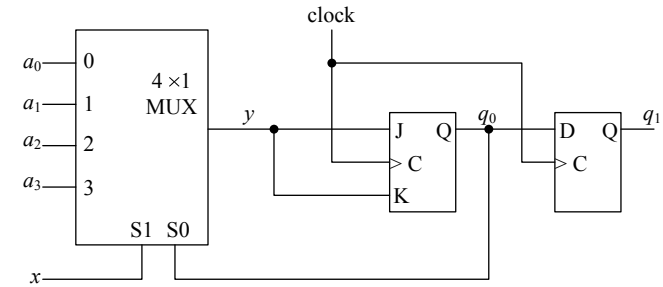
b) [5 pts.]



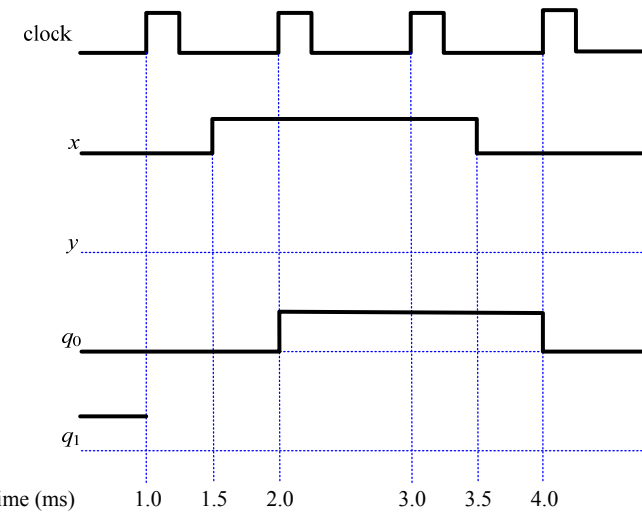
Draw D in the diagram. Any solution that works is OK.



Problem 5 [20 points] This sequential circuit has positive-edge-triggered flip-flops and a 4x1 multiplexer.



Inputs a_0, a_1, a_2, a_3 are constants. Determine the waveforms for y and q_1 , and the values a_0, a_1, a_2, a_3 . The initial value of q_1 is 1. **Explain your reasoning** for values of y, a_0, a_1, a_2, a_3 .



$a_0 = \square$ $a_1 = \square$ $a_2 = \square$ $a_3 = \square$