CMPE 124 TEST 2

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NOTE: All circuits must be presented according to the mixed logic notations. If you make any assumption make sure you explain it. Circuit design must obey all the electrical characteristics of the devices. Obey noise margin rules. You can always use 7404. TTL Manual is not a notebook.

20 1. Use a mux (74153) to design the following function.
Signal assignments are: X, Y, F is active high and W active low.

$F = (x \oplus y \oplus z)w$

2. Design a two-bit counter that counts the following sequence: 00-11-10-01. This counter should have an input x to start and stop the counting at any state. It should generate an output when the count reaches state 01 (S1). When the power is turned on the state machine should start from state 11 (S3). Use D flip-flops 74LS74.

a. Show the state diagram — Ex Cr — 10

Φ b. Show the ASM chart

15 c. Show the transition table

15 d. Drive the equations

10 e. Show the circuit diagram

15 f. Show the necessary circuits and calculations so that state machine will start from S3. PS and CLR needs to be kept active for at least 30 ns if needs to be used.

2 g. For two clock period show the timing diagram.

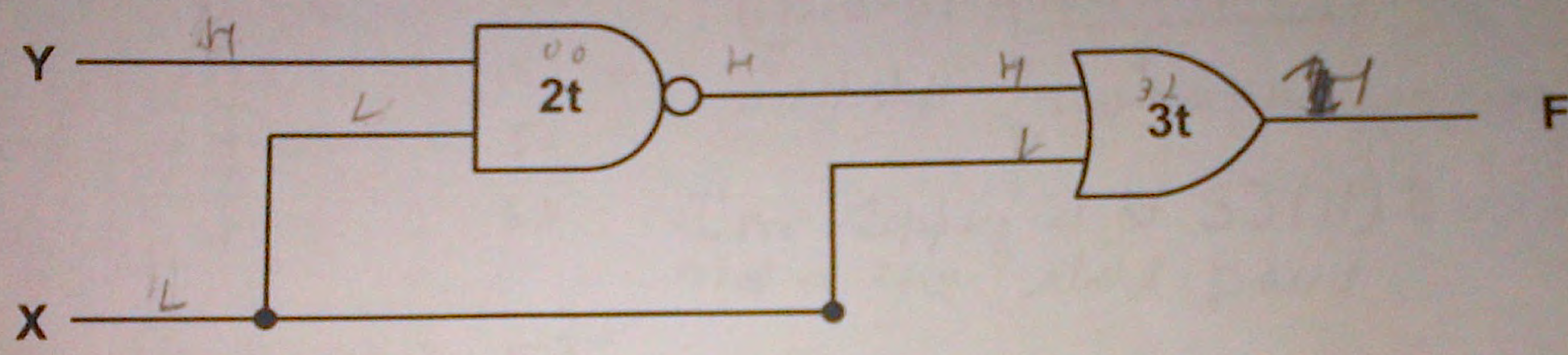
3. Below a digital circuit is given. All signals are active high.

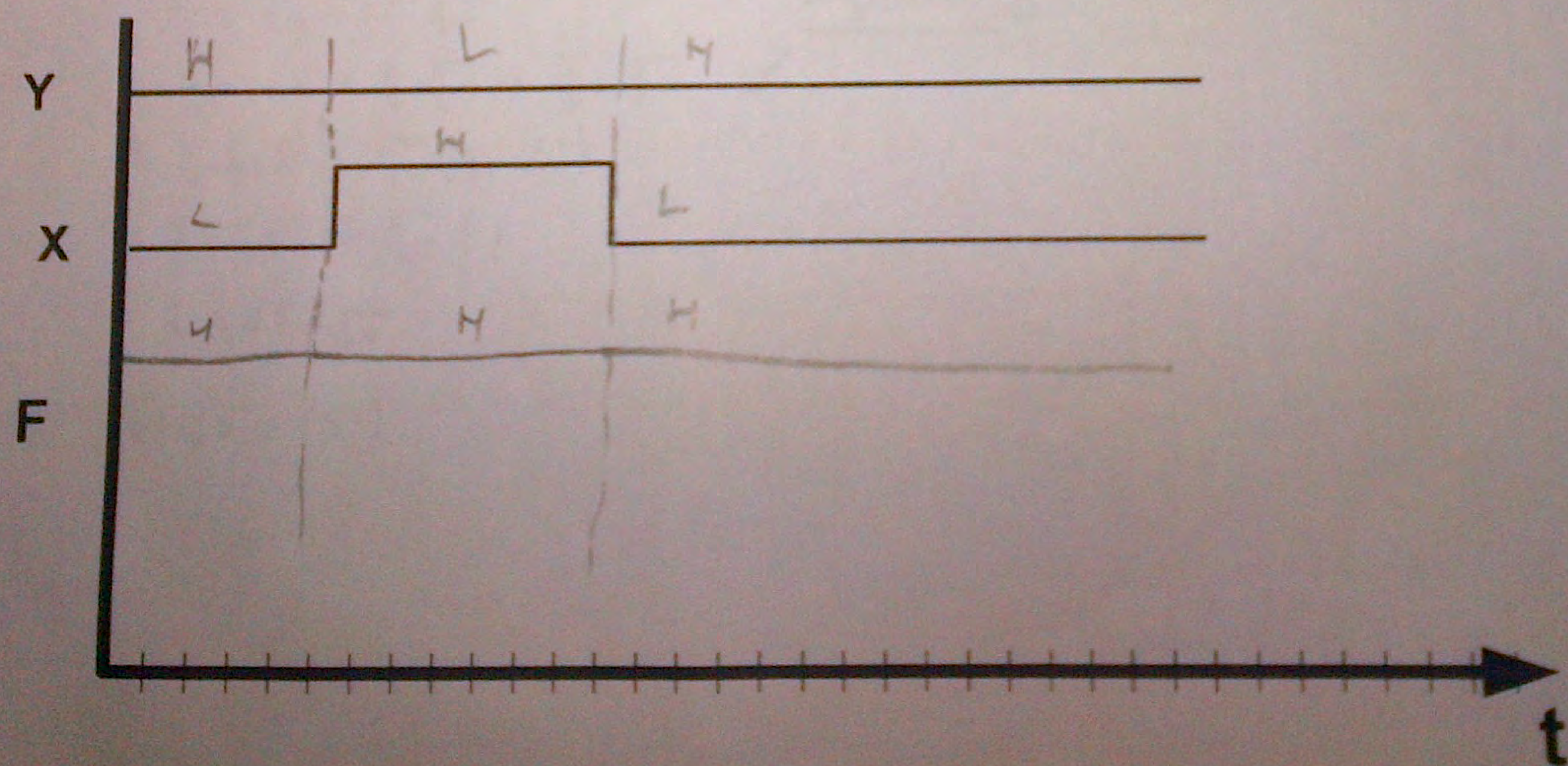
a) Would the circuit generate a glitch? Explain your answer. (Hint: first write the equation)

Equation $(XY)' + (XY)' + X$ #

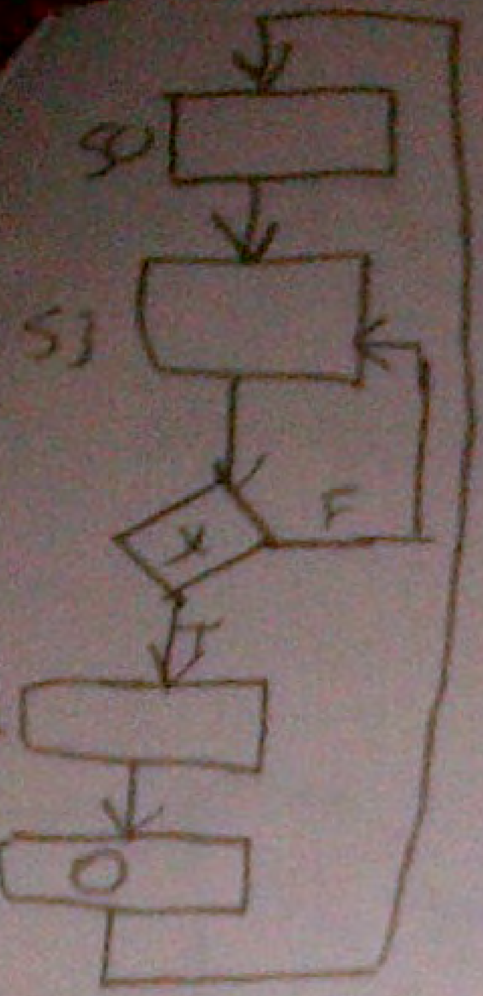
No, It won't produce a glitch if we use the redundant term $(XY)'$ as the propagation time through OO will be same.

b) Draw the timing diagram for F.





① HIRDAY MADAN

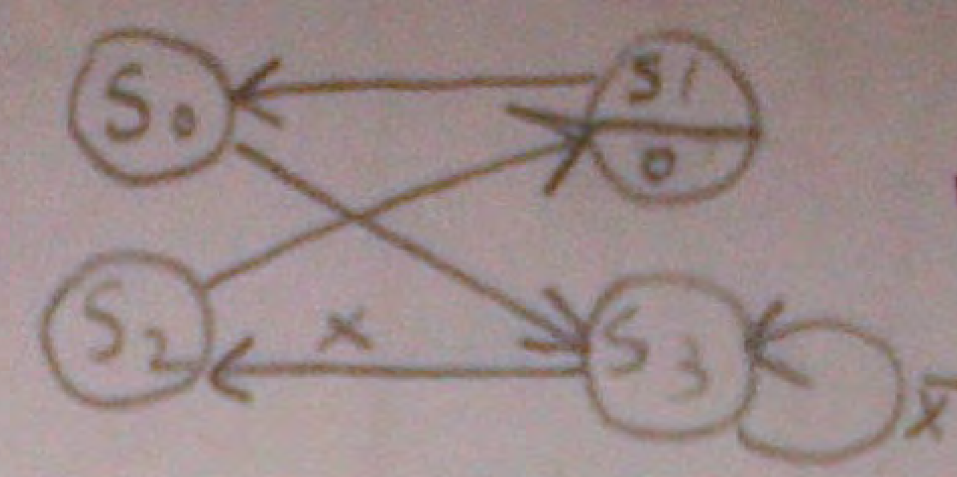


→ Moore Machine

read the problem

→ It will start from state 3
→ If x is False the counter will set at starting position i.e S3

-15



Transition Table

PS				NS			
				D_1 D_0			
States	$q_1 q_0$	x		$q_1^+ q_0^+$	O	States	
S3	1 1	0		1 1	0	S3	
	1 1	1		1 0	0	S2	
S2	1 0	-		0 1	0	S1	✓
S1	0 1	-		0 0	1	S0	
S0	0 0	-		1 1	0	S3	

starting from state 3
It is a loop so we will get

11-10-01-$\boxed{00-11-10-01}$ & so on
↓ start/stop   ↓ sequence that we want

I'm stopping it at S3(11) because that is the start point

$$q_1^+ = D_1 = q_1 q_0 \bar{x} + q_1 q_0 x + \overline{q_1}\,\overline{q_0}$$
$$= q_1 q_0 (x + \bar{x}) + \overline{q_1}\,\overline{q_0}$$
$$= q_1 q_0 \cdot 1 + \overline{q_1}\,\overline{q_0}$$
$$= q_1 q_0 + \overline{q_1}\,\overline{q_0}$$

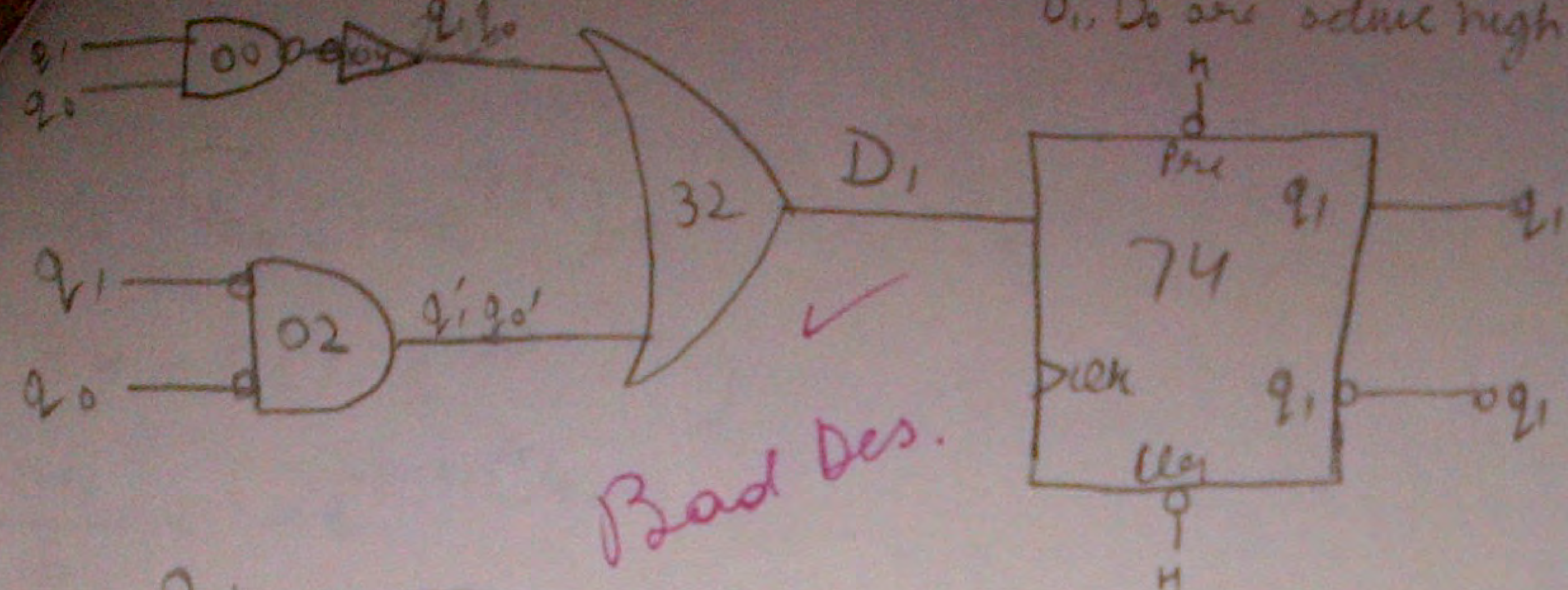
← Equations

$$q_0^+ = D_0 = q_1 q_0 \bar{x} + q_1 \overline{q_0} + \overline{q_1}\,\overline{q_0}$$
$$= q_1 q_0 \bar{x} + \overline{q_0}(q_1 + \overline{q_1})$$
$$= q_1 q_0 \bar{x} + \overline{q_0}(1)$$
$$= q_1 q_0 \bar{x} + \overline{q_0}$$

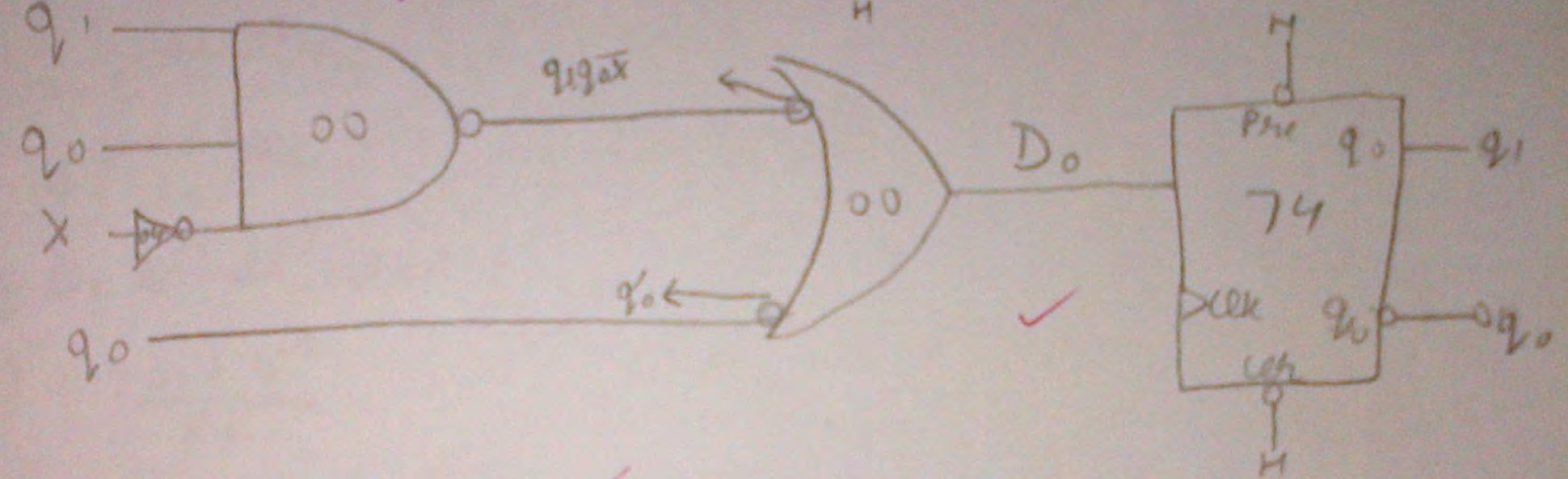
$$O = \overline{q_1} q_0 \quad (S1)$$

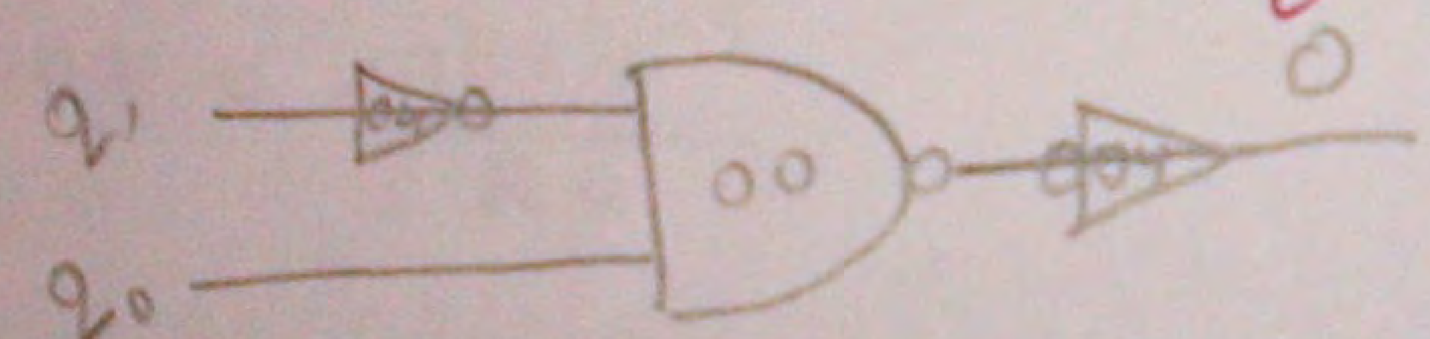
...cuit Diagrams (I assume that $q_1 q_0$, O, X are active high)

D_1, D_0 are active high

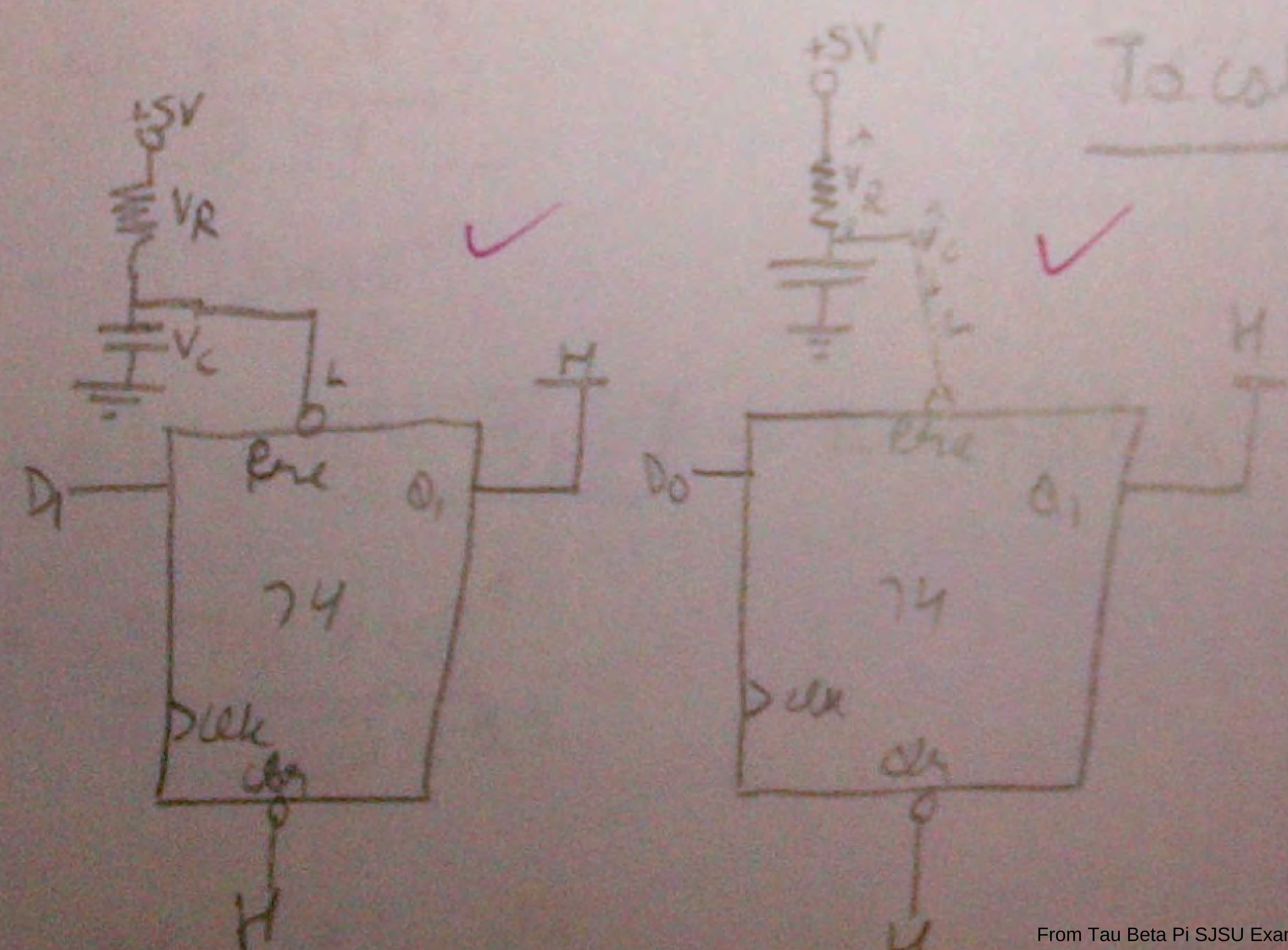


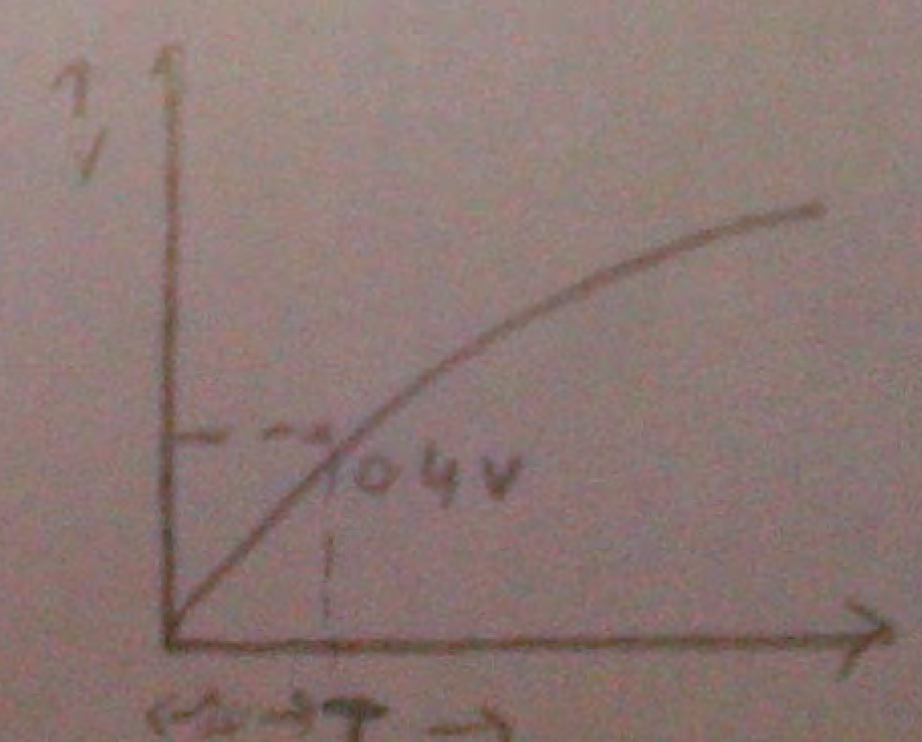
Bad Des.





To calculate R & C





... Power Up

$V_c = 0.4V$

$V_c = V_{cc}(1 - e^{-T/C})$

$0.4 = 5(1 - e^{-30\times10^{-9}/RC})$

$\frac{0.4}{5} = 1 - e^{-30\times10^{-9}/RC}$

$1 - 0.08 = e^{-30\times10^{-9}/RC}$

$0.92 = e^{-30\times10^{-9}/RC}$

Taking ln on both sides

$\ln(0.92) = \frac{-30\times10^{-9}}{RC}$

$\cancel{-}0.08 = \frac{\cancel{-}30\times10^{-9}}{RC}$

$RC = \frac{30\times10^{-9}}{0.08}$

$RC = 375\times10^{-9}$

Let us take $\boxed{C = 15pF}$ → Assumption

$R = \frac{375\times10^{-9}}{15\times10^{-12}}$

$= 25\times10^{-9}\times10^{12}$

$= 25\times10^{3}\,\Omega$

$\boxed{R = 25\,k\Omega}$

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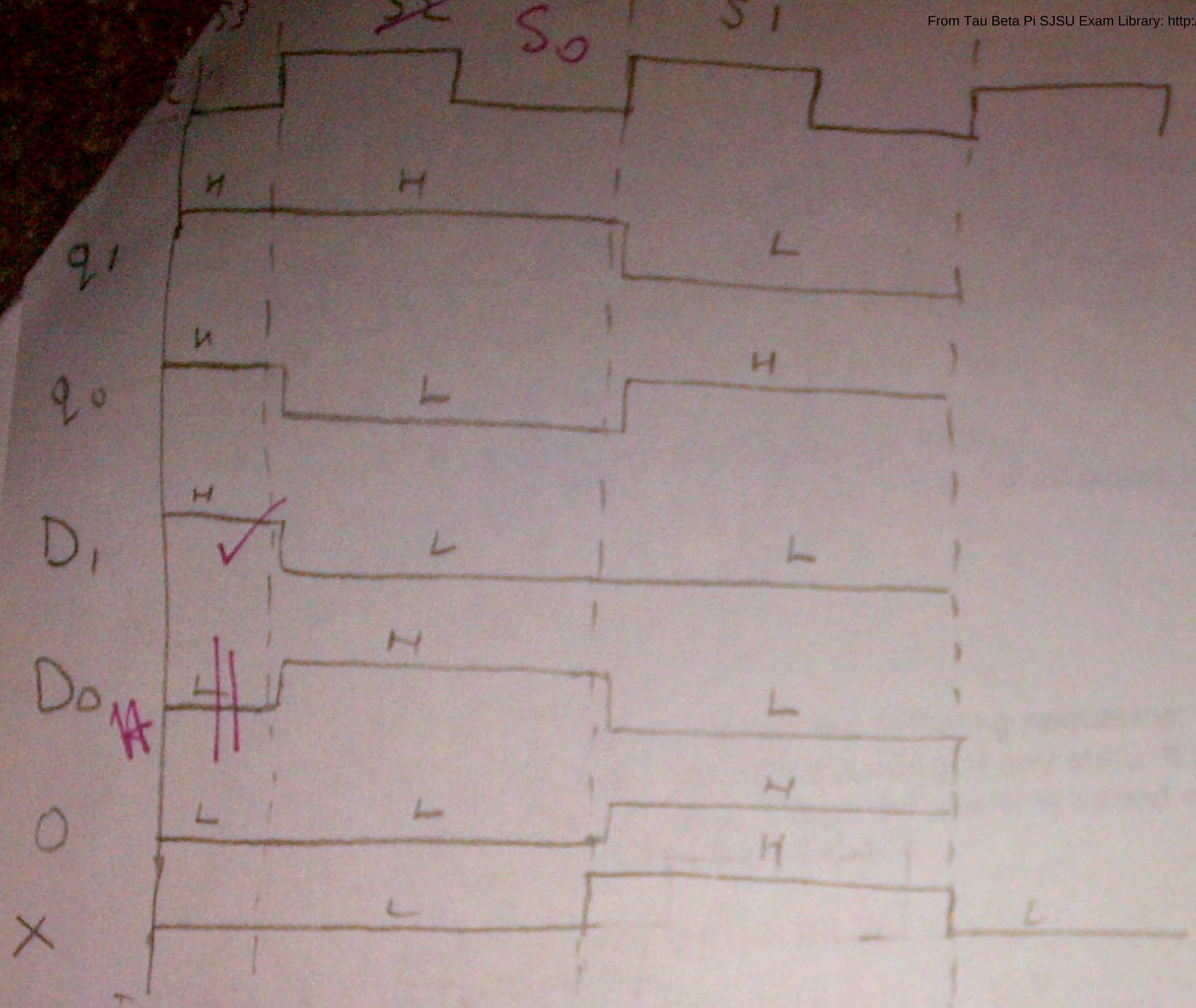
Timing Diagram



Q1) X Y F W

$F = (x \oplus y \oplus z)w$

$= \{(xy' + x'y) \oplus z]w$

R $= [(xy' + x'y)z' + (xy' + x'y)'z]w$

L $\{(xy' + x'y)z' + [(x'+y)\cdot(x+y')]z]w$

$= xy'z' + x'yz' + [1 + xy + x'y' + 1]z]w$

$= [xy'z' + x'yz' + xyz + x'y'z]w$