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zemek

TEST 2

95

November 21, 2011

Last Name ____________ First Name ____________

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
b. Show the ASM chart — 15
c. Show the transition table — 15
d. Drive the equations — 12
e. Show the circuit diagram — 8
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. — 15
g. For two clock period show the timing diagram. 10

EXTRA CREDIT: $X \cdot \bar{X}$

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)

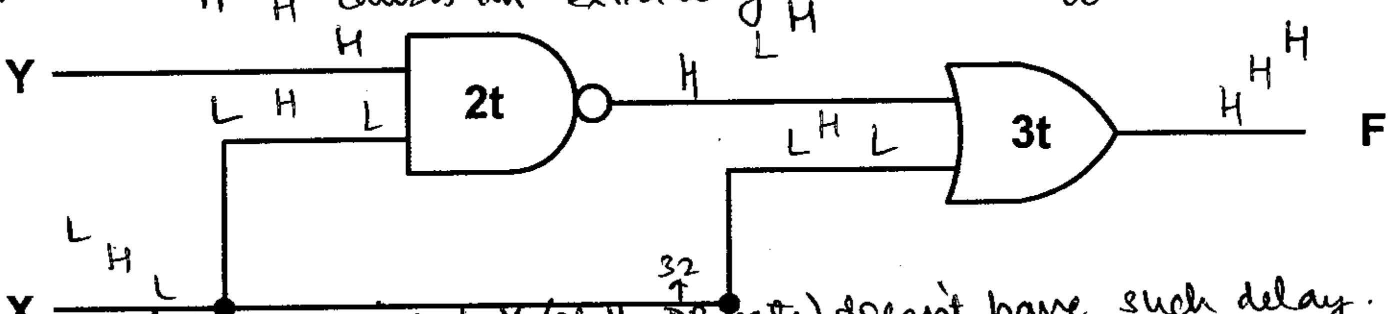
$$\boxed{F=(XY)'+X}$$
$$= \bar{Y} + \bar{X} + X = \bar{Y} + 1 = 1 \Rightarrow \boxed{F=1}$$

ME
SBB

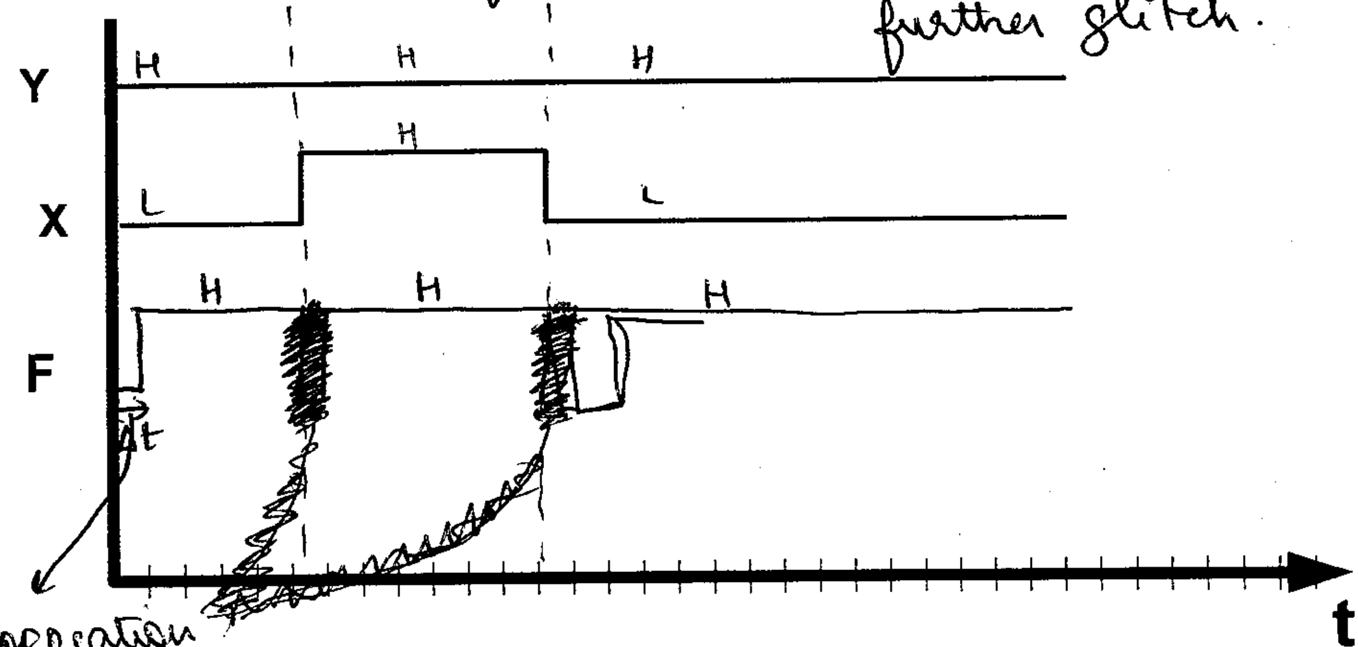
Yes, the circuit will have a glitch and that is because of the propagation delays inside the NAND(00) and OR(32) gates and because of the ~~unsym~~ unsymmetrical number of gates.

   b) Draw the timing diagram for F.

~~[illegible]~~ The input (XY)' of the OR gate is coming from a NAND gate which causes an extra delay.



On the other hand, the other input X (of the OR gate) doesn't have such delay. Thus, there will be a glitch at the beginning of the cycle. But, then the ~~f~~ value of the function will become high for all values of X and Y and hence, will have no further glitch.



Propagation delay

Q2) Assume X to be +ve assigned

let w be the output at state 01 and it is also ~~the~~ positive assigned.

Q_1, Q_0 → active high

	Present state			Next state D_1 Q_1^+	D_0 Q_0^+	w (Unconditional)	
	Q_1	Q_0	X				
S_0	0	0	0	0	0	—	S_0
	0	0	1	1	1	—	S_3
S_3	1	1	0	1	1	—	S_3
	1	1	1	1	0	—	S_2
S_2	1	0	0	1	0	—	S_2
	1	0	1	0	1	—	S_1
S_1	0	1	0	0	1	1	S_1
	0	1	1	0	0	1	S_0

Equations

$$\boxed{D_1 = \overline{Q_1}\,\overline{Q_0}X + Q_1 Q_0 \overline{X} + Q_1 Q_0 X + Q_1 \overline{Q_0}\,\overline{X}}$$

$$= S_0 X + S_3 \overline{X} + S_3 X + S_2 \overline{X}$$

$$D_1 = \overline{Q_1}\,\overline{Q_0} X + \underbrace{Q_1 Q_0}_{S_3} + Q_1 \overline{Q_0}\,\overline{X}$$

you forgot.

$$\boxed{D_0 = \overline{Q_1}\,\overline{Q_0} X + Q_1 Q_0 \overline{X} + Q_1 \overline{Q_0} X} + \overline{Q_1} Q_0 \overline{X}$$

-3

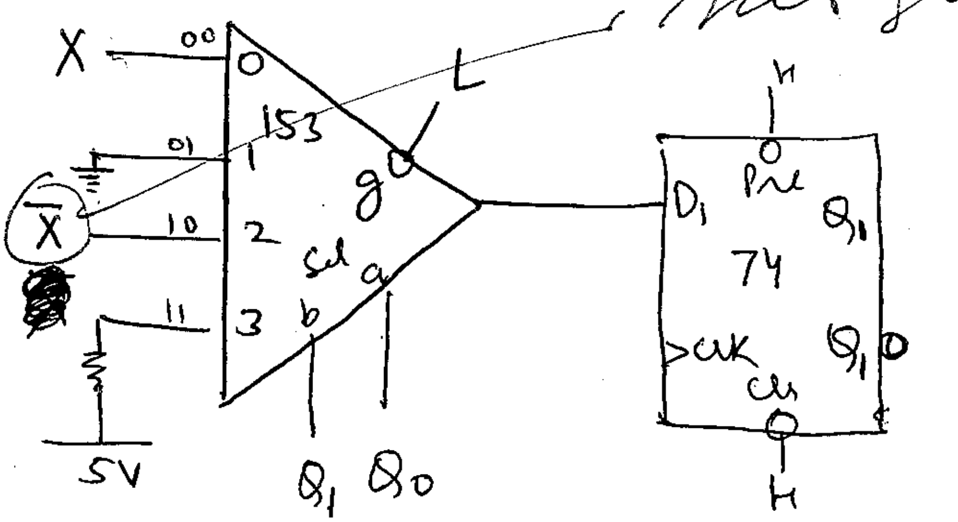
$$\cancel{\boxed{w = Q_1 \overline{Q_0} X}}$$

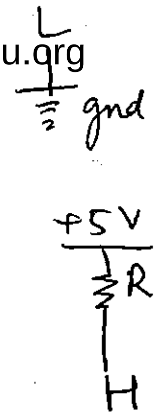
$$w = \overline{Q_1} Q_0 \overline{X} + \overline{Q_1} Q_0 X$$

$$\boxed{w = \overline{Q_1} Q_0} = S_1$$

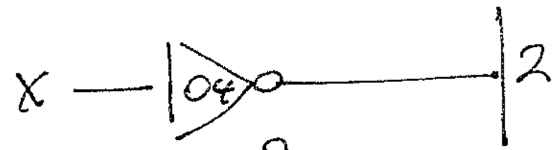
Q2) e) Circuit Diagram

not good



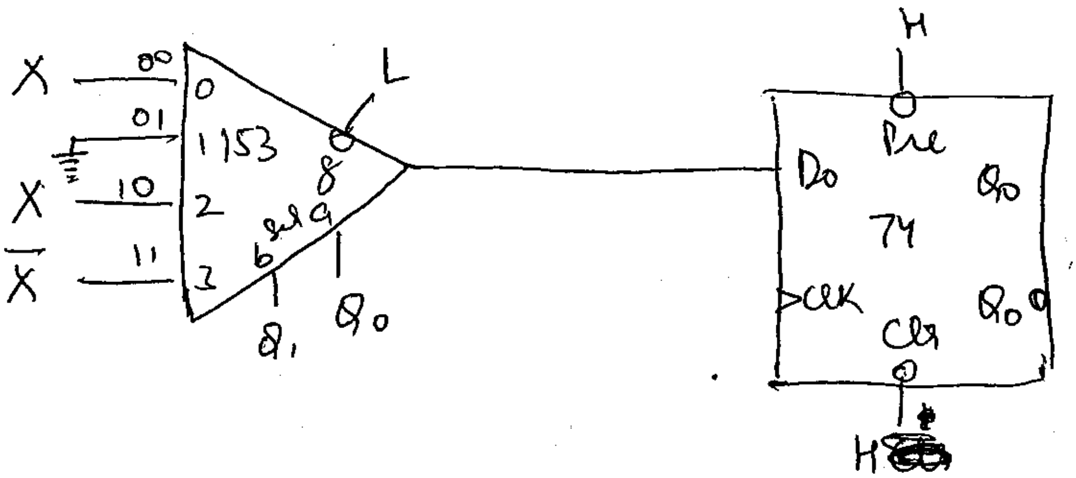


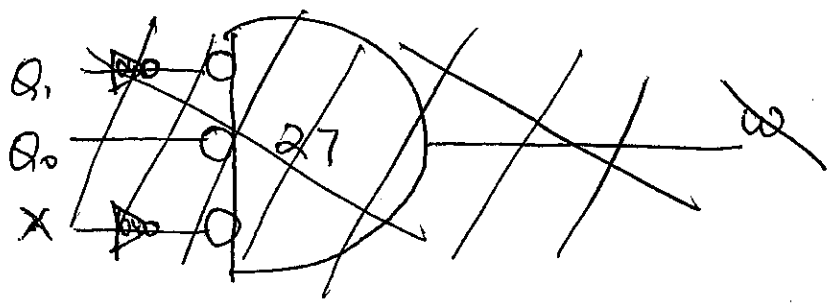
you must show 04

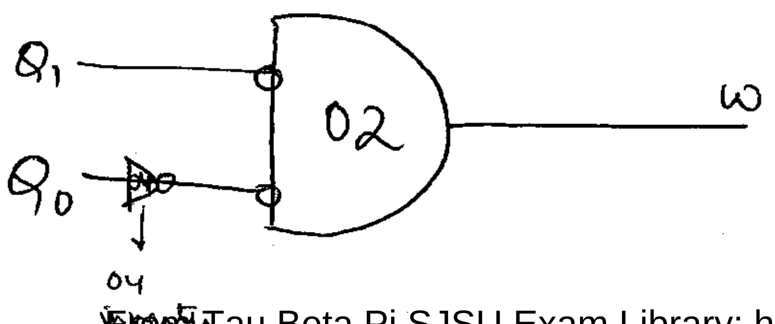


Because of testing.

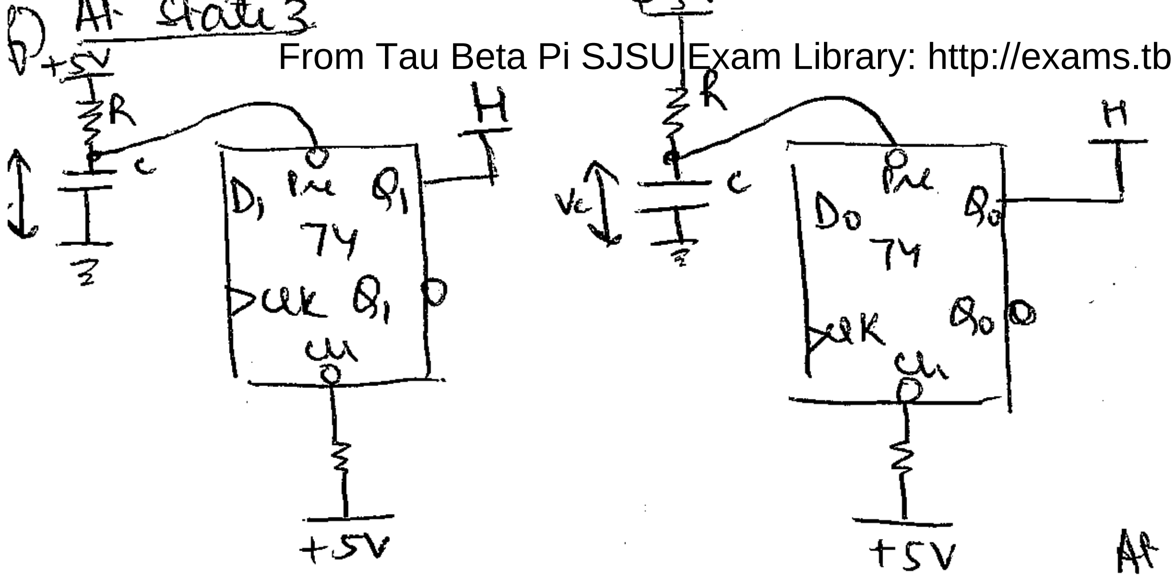
-2



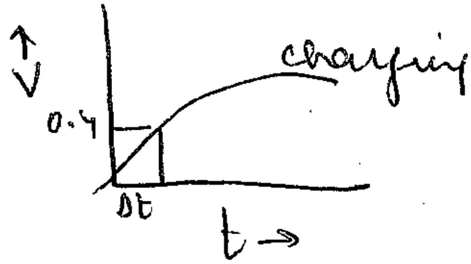




D) At state 3



At Power up, voltage is low



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

$$0.4 = 5(1 - e^{-T/\tau})$$

$$.08 = 1 - e^{-T/\tau}$$

$$e^{-T/\tau} = .92$$

$$\cancel{-}\frac{T}{\tau} = \cancel{-}.083$$

$T = 30\,ns$

$$\tau = \frac{30 \times 10^{-9}}{.083}$$

$$\tau = 361.4 \times 10^{-9}$$

$$\boxed{RC = 361.4 \times 10^{-9}}$$

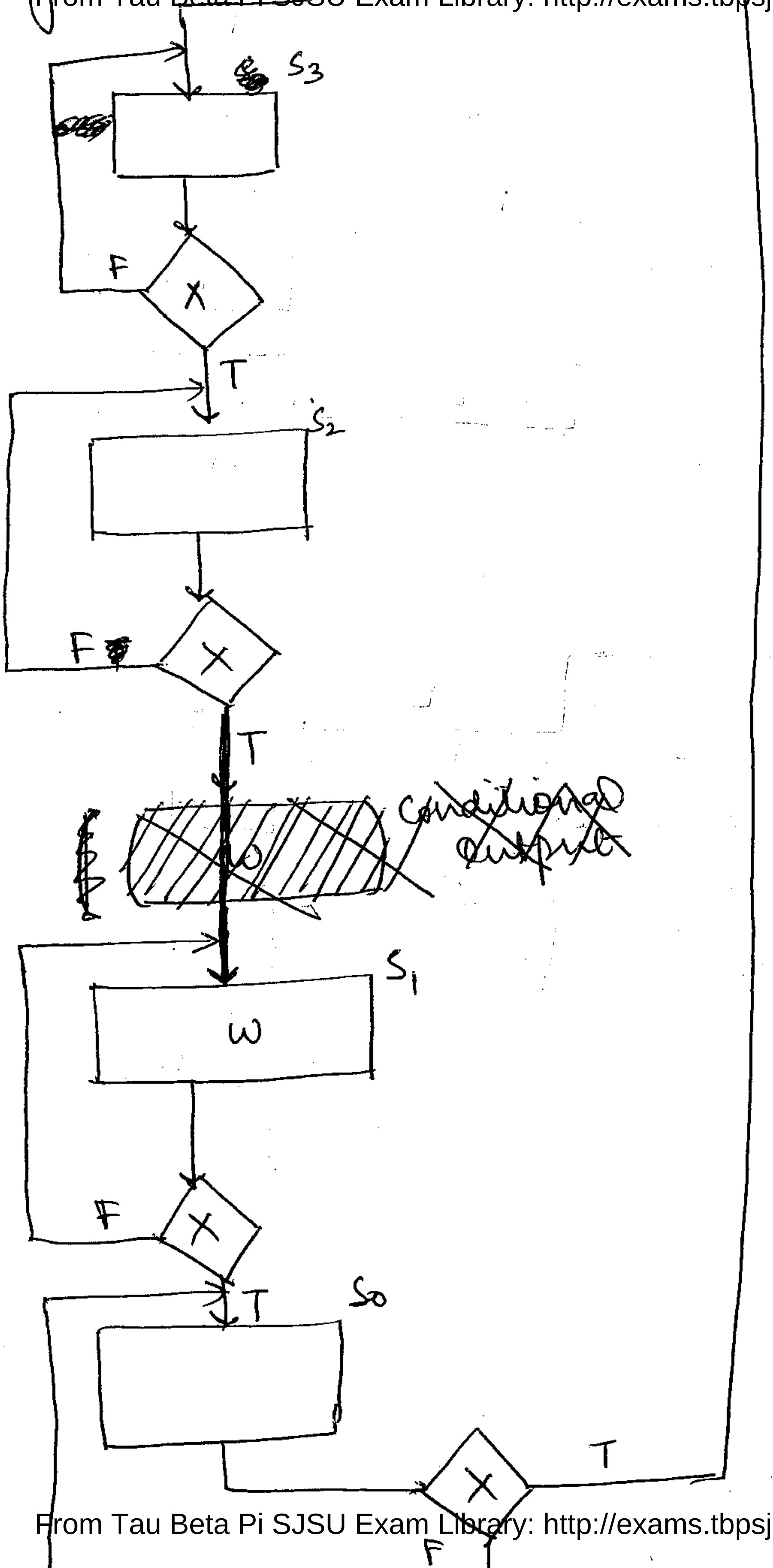
Assume $\boxed{C = 20\,pF}$

$$R = \frac{361.4 \times 10^{-9}}{20 \times 10^{-12}} = 18.07 \times 10^{3}\,\Omega$$

$$\boxed{R = 18.07\,k\Omega}$$

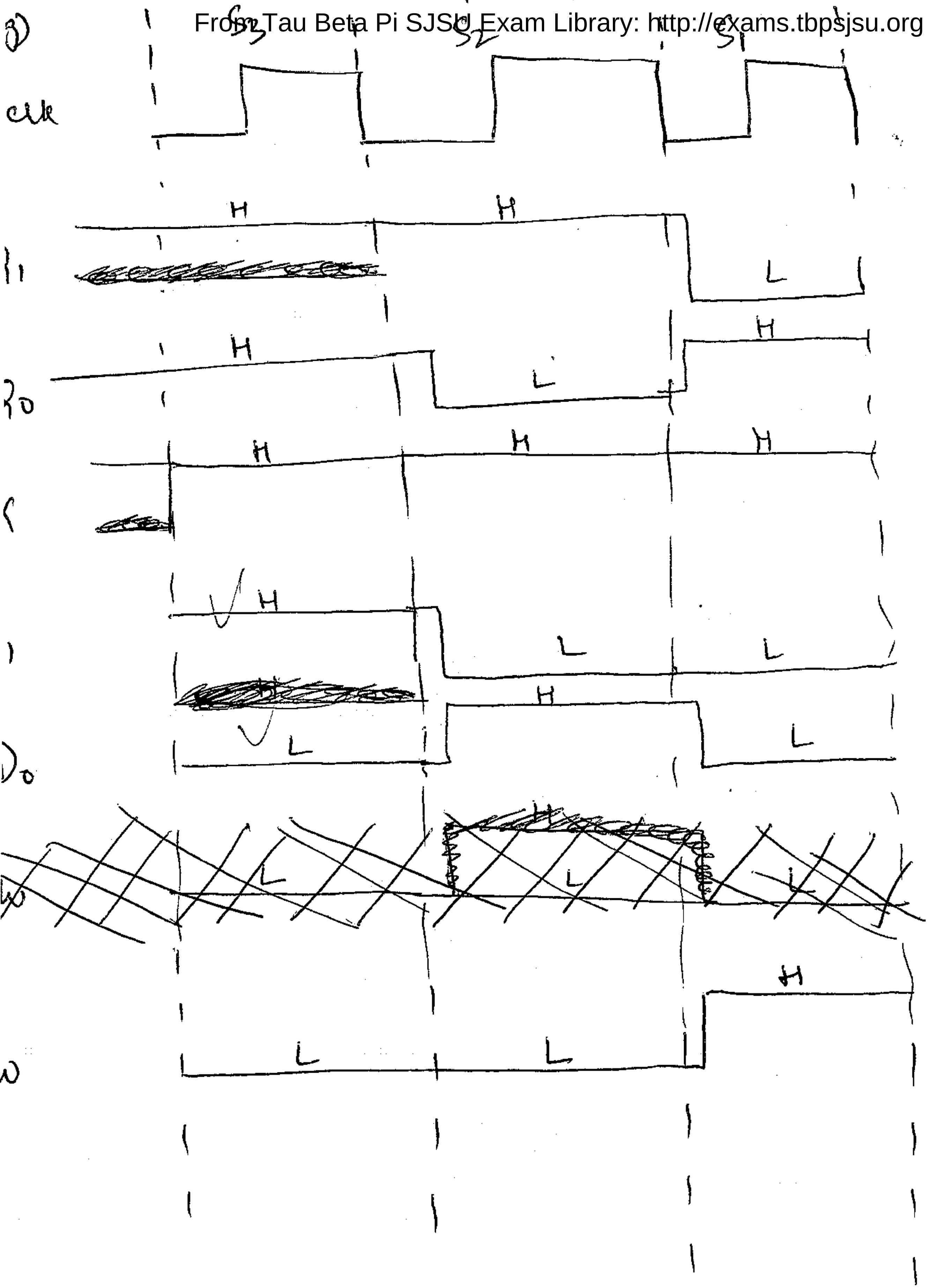
For the circuit to be kept active we use a resistance of 18.07KΩ and a capacitor of 20pF

Q2) State Diagram



TIMING DIAGRAM.

3)



* Assuming X to be high for first three clock periods

Q1) $F = (x \oplus y \oplus z) w = ((x\bar{y} + \bar{x}y) \oplus z) w$

$^{+}X^{+}$ $^{+}Y^{+}$ F^{+}

$\bar{W}$

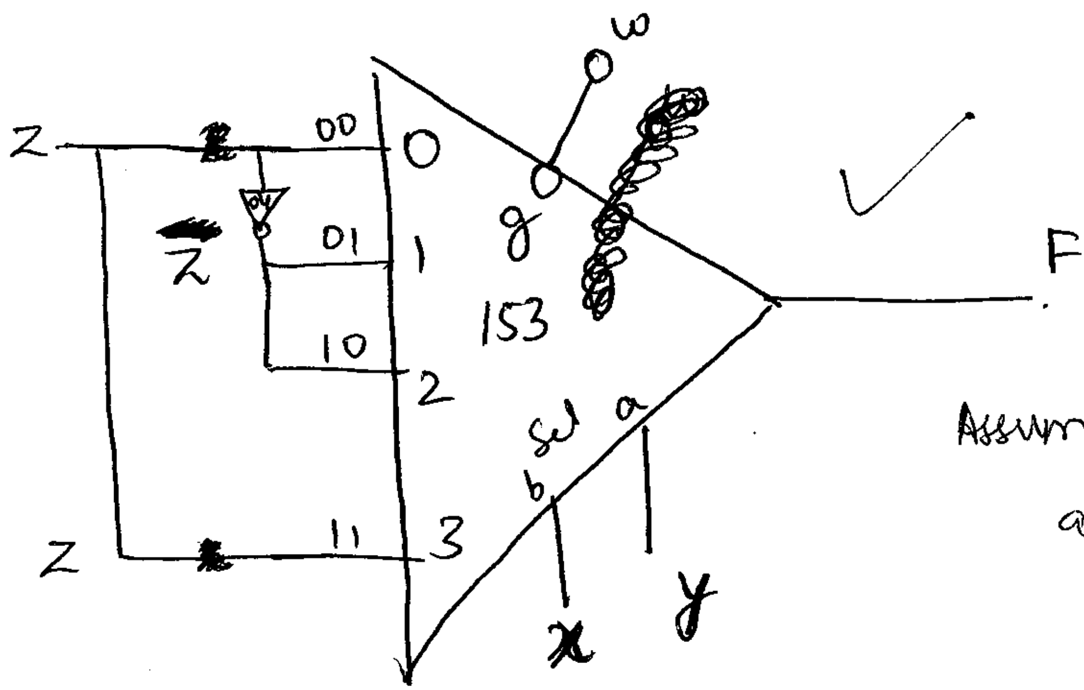
$$= [(x\bar{y} + \bar{x}y)\bar{z} + (x\bar{y} + \bar{x}y)'z] w$$

$$\cancel{= [x\bar{y}z + \bar{x}yz}$$

$$F = [x\bar{y}\bar{z} + \bar{x}y\bar{z} + [(\bar{x}+y)(x+\bar{y})z]] w$$

$$= \{x\bar{y}\bar{z} + \bar{x}y\bar{z} + [(\cancel{x\bar{x}} + \bar{x}\bar{y} + xy + \cancel{y\bar{y}})z]\} w$$

$$= [x\bar{y}\bar{z} + \bar{x}y\bar{z} + \bar{x}\bar{y}z + xyz] w.$$



Assuming z to be active high