Cmpe 124 66
Dr. Özen TEST 1 March 11, 2015

Last Name_____ First Name_____

IMPORTAND REMINDERS: You Must show all your work, Must use Mix Logic notations, Write all your assumptions, TTL Manual is not a notebook! All given circuits uses the mix logic notations.

1. Represent 291_{10} in BCD — 6 pt.

291_{10} in BCD: 0010 1001 0001 BCD

145		18		0	
2|291	R1	2|36	R0	2|1	R1
72		9			
2|145	R1	2|18	R0		
36		4			
2|72	R0	2|9	R1		
		2			
		2|4	R0		
		2|2	R0		

$100100001_2 = 291_{10}$

$256+32+2+1 = 291_{10}$ ✓

2. Perform the following arithmetic operation in BCD — 8pt.

$5_{10} + 17_{10} = 22_{10}$

$5_{10} = 00101_2$

$17_{10} = 10001_2$

$$\begin{array}{r} {\scriptstyle 1} \\ 00101_2 \\ +\ 10001_2 \\ \hline 10110_2 \end{array}$$

$10110_2 = 22_{10}$

$16+4+2 = 22$

addition Result

0010 0010 BCD

$17_{10} + 5_{10} = \underline{22}_{10}$

3. How many 7400 load can the 74LS04 safely drive ? — 8pt.

One. Because 00 is a totem pole TTL so only # output from one 00 can be connected to the input of an 04.

$$n = \frac{I_{OL}}{I_{IL}} = ? \qquad n = \frac{I_{OH}}{I_{IH}} = ?$$

4. Convert the following equation in to PofS form. — 8pt.

$F = a'b'c' + a'bc$

$F = \bar{a}\bar{b}\bar{c} + \bar{a}bc$

a	b	c	f
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

bc \ a	0	1
00	1	0
01	0	0
11	1	0
10	0	0

$F = (b+\bar{c})(c+\bar{b})(\bar{a})$

$(b+\bar{c})(c+\bar{b})(\bar{a})$ cleaner

5. Using circuit in Figure 1;

38pt. ✓

a) Write the equation for F
b) Create the K-Map for F
c) Convert K-Map in to Truth Table
d) Convert the Truth Table into Voltage Table
e) Test the circuit for minterms m_0 and m_2, explain your result

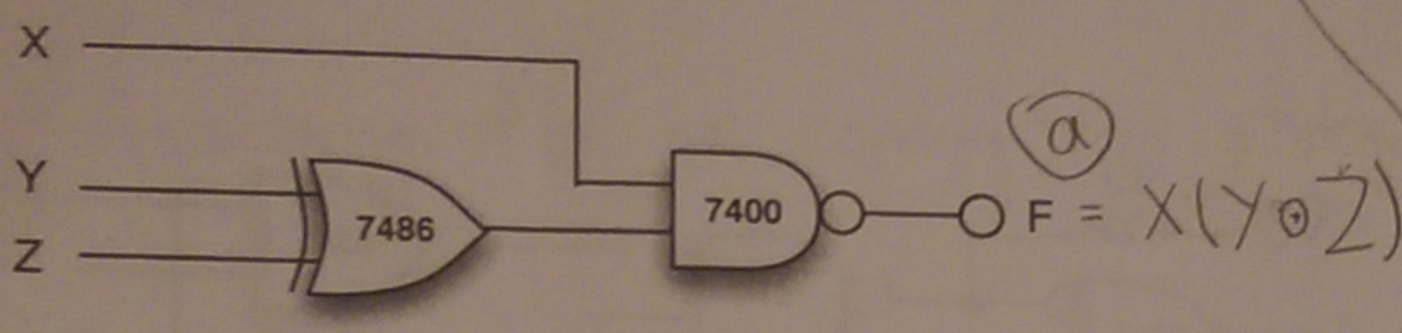


Figure 1

(a) ✓

(b) ✓

XZ \ X	0	1
00	0 (0)	0 (4)
01	0 (1)	1 (5)
11	0 (3)	0 (7)
10	0 (2)	1 (6)

✓

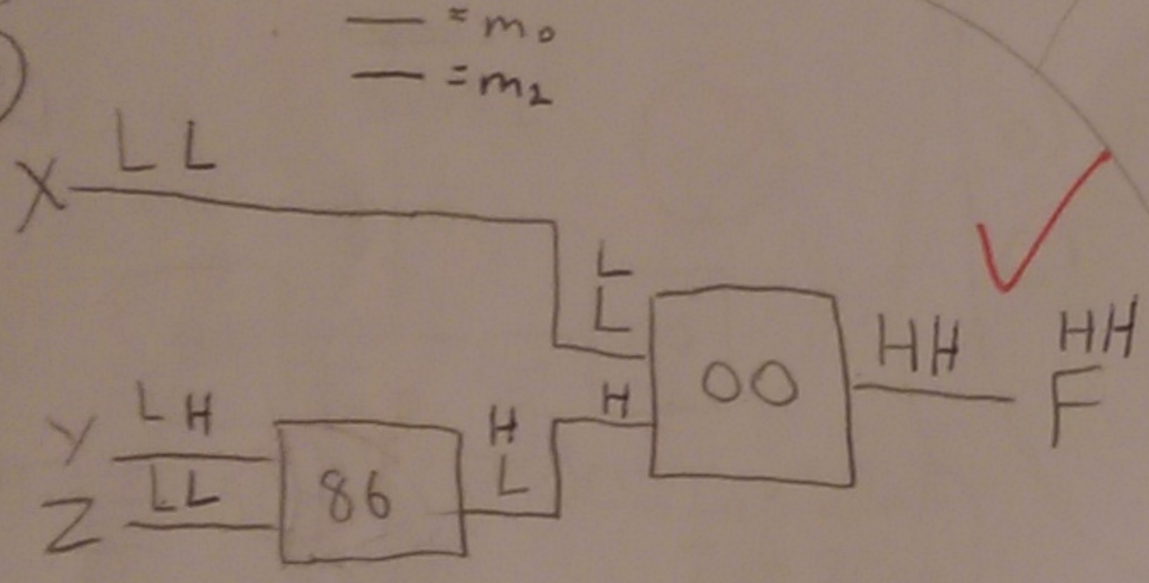
(c) ✓

	X	Y	Z	F
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	0
4	1	0	0	0
5	1	0	1	1
6	1	1	0	1
7	1	1	1	0

(d) ✓

	$\overline{X}$	$\overline{Y}$	$\overline{Z}$	$\overline{F}$
0	L	L	L	H
1	L	L	H	H
2	L	H	L	H
3	L	H	H	H
4	H	L	L	H
5	H	L	H	L
6	H	H	L	L
7	H	H	H	H

(e) ✓



A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

A	B	$\overline{Y}$
L	L	H
L	H	H
H	L	H
H	H	L

✓

When this circuit was tested with m_0 & m_2, a resulting voltage high was expected on $\overline{F}$. This result was acquired quickly due to both minterms having a Low on X, as input to a 7400, which always results in a High output voltage.

6. Using circuit in Figure 2; ~~32pt.~~

a) Verify if the design, if it is not correct make necessary corrctions and calculations without changing any of the existing parts.

b) Write the equation for F

c) Simplify the equation algebraickly.

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Assuming A is not coming from a totem-pole output.

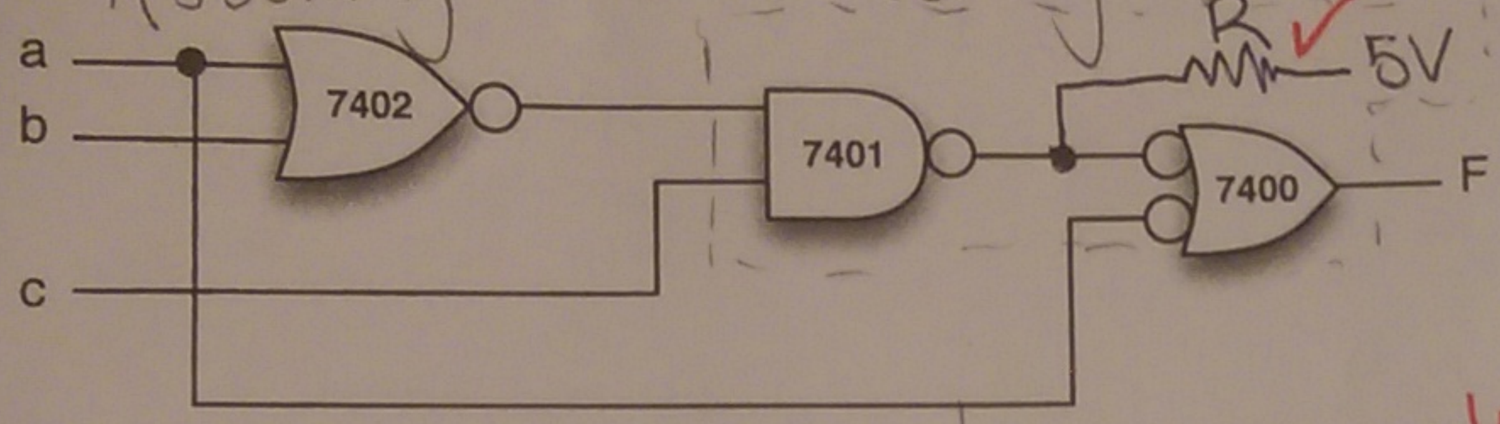
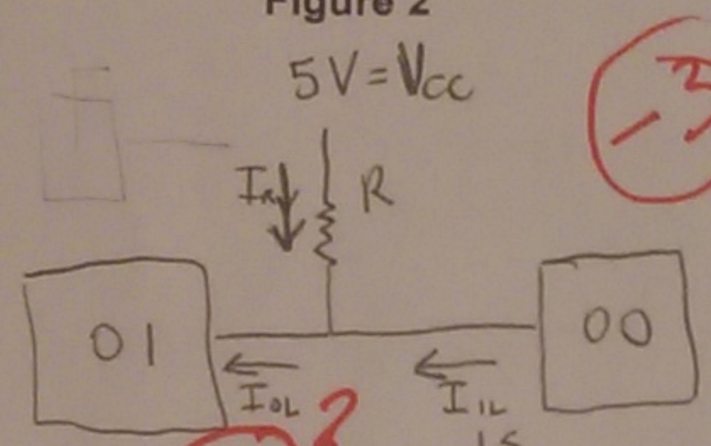


Figure 2

a) $5V = V_{cc}$



-3

7401: $I_{OL} = 8mA$? 74LS00: $I_{IL} = -.4mA$

$I_{OH} = .1mA$ $I_{IH} = 20mA$

$V_{OL} = .5V$ $V_{OH} = 2.7V$

Assuming

$V_{cc} = V_R + V_{OL}$

$5V - .5V = RI_R \rightarrow \frac{4.5V}{I_R} = \frac{4.5V}{.4mA} = R_{min}$

$I_{OL} = I_{IL} + I_R$

$.8mA - .4mA = I_R$

$2 .4mA = I_R$

$I_{OH} = I_{IH} + I_R$

$.1mA - 20mA = I_R$

$80mA = I_R$

$V_{cc} = V_R - V_{OH}$

$5V - V_R - 2.7V$

$5V - 2.7V = V_R = I_R R_{max}$

$\frac{2.3V}{I_R} = R_{max} \rightarrow \frac{2.3V}{80mA} = R_{max}$

$I_R = I_{OL} - I_{IL}$

$16mA - 1.6mA$

$I_R = I_{OH} + I_{IH}$

This circuit will only operate with a pullup resistor added with a value between $\frac{4.5}{400 \cdot 10^{-6}}\ \Omega$ and $\frac{2.3}{80 \cdot 10^{-6}}\ \Omega$.

b) $F = \overline{(\overline{A+B})C + \bar{A}}$

c) $= (\overline{A+B}) + \bar{C} + \bar{A}$

$= A + B + \bar{C} + \bar{A}$

$= B + \bar{C}$

Why? -9

#

$F = \overline{(a+b) \cdot c + \bar{a}}$

$= \bar{a}\bar{b}c + \bar{a}$

$= \bar{a}(\bar{b}c + 1)$

1

$F = \bar{a}$