CmpE 124 Test 1 October 19, 2011
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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.

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1. Perform the following arithmetic operation in binary using **2's complement** representation. You have 7 bits to work. **Must show your work.**

Y = - 25_{10} – 46_{10}

25 = 0011001
-25 = 1100110 → one's complement
Two's complement = 1100110 + 1 = 1100111

46 = 0101110
-46 = 1010001 → one's complement

Two's complement: 1010001 + 1 = 1010010

Adding (-25) + (-46)
1100111 ✓
+ 1010010 ✓
[1] 0111001 ← Ans
↓ Discarded

-5

Checking → 1000110 + 1 = 1000111

not enough bits

Wrong ans

6 5 4 3 2 1 0
64 32 16 8 4 2 1
0 0 1 1 0 0 1
0 1 0 1 1 1 0

-25
-46
-71

15 ✓

2. Convert the following number: **Must show your work.**

354_8

a) to Binary: 011101100 (Ans) ✓ → From the table on scratch paper

b) to Hex: 0,1110,1100 = EC_{16} Ans ✓

c) to Decimal: $(3\times8^2)+(5\times8^1)+(4\times8^0) = 3\times64+40+4$ = 236_{10} Ans ✓

Φ

3. In **Figure 1** what is the capacitor charging current (Ic) for **2 time constant** after the switch is closed. The capacitor has initially 0 charge.

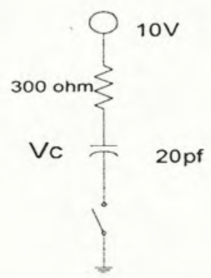

Figure 1.

SEE ME

t = 2   t = 2RC e^{-2}

$RC = 300\times20\times10^{-12}$

$V_c = V_{cc}[1-e^{-t/RC}]$

$V_c = 10[1-e^{-2/6\times10^{-9}}]$

$\frac{V_c}{10} - 1 = -e^{-2/6\times10^{-9}}$

$1-\frac{V_c}{10} = e^{-2/6\times10^{-9}}$

Applying ln on both sides

$\ln 1 - \ln V_c - \ln 10 = \frac{-2}{6\times10^{-9}} \ln e$

$0 - \ln V_c - 2.3 = -0.33\times10^{9}$

$-\ln V_c = 2.3 - 0.33\times10^{9}$

$\ln V_c = 1.97\times10^{7}$ V_c = 7170 6764.88 V

What is this?

$I_c = \frac{V_c}{RC}$

$= \frac{71706764.88}{300\times20\times10^{-12}}$

Ans = 11951×10^{12} A

. Design the given equation:

a) Using **only 7402 and 7404.** Do not change the equation

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F = X*Y + Z*(X + Y) **X MSB AND Z LSB.**

Z is negative assigned
XY and F are positive assigned)

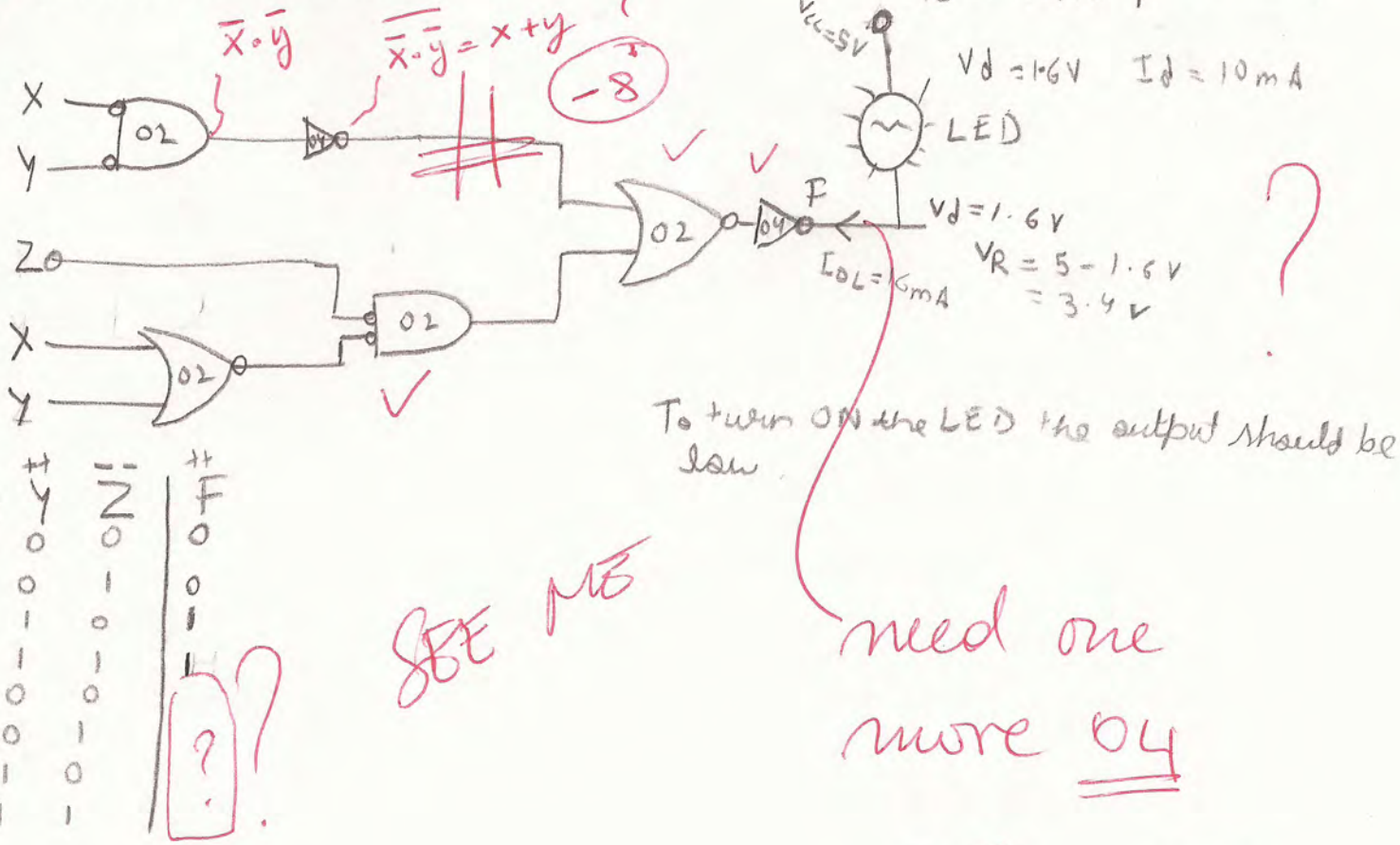
5 **b)** The output of the circuit should turn a **LED on whenever it is true**.

LED Id = 10mA, Vd =1.6 V

Data for 7402

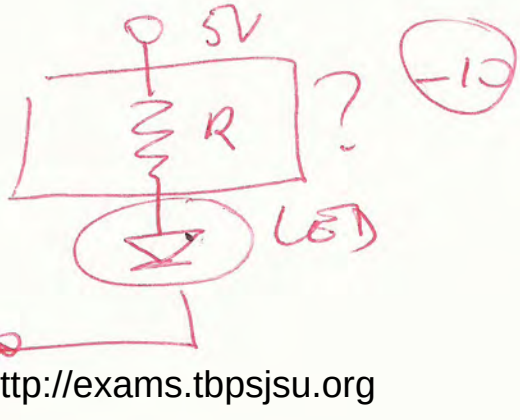
$V_{CC} = 5$	$V_{OH} = 2.4\,V$
V_{IH} 2 V	$V_{OL} = 0.4\,V$
$V_{IL} = 0.8\,V$	$I_{OH} = -0.4\,mA$
$I_{IH} = 40\,\mu A$	$I_{OL} = 16\,mA$
$I_{IL} = -1.6\,mA$	

10 **c)** Test your circuit for **minterm 3**.

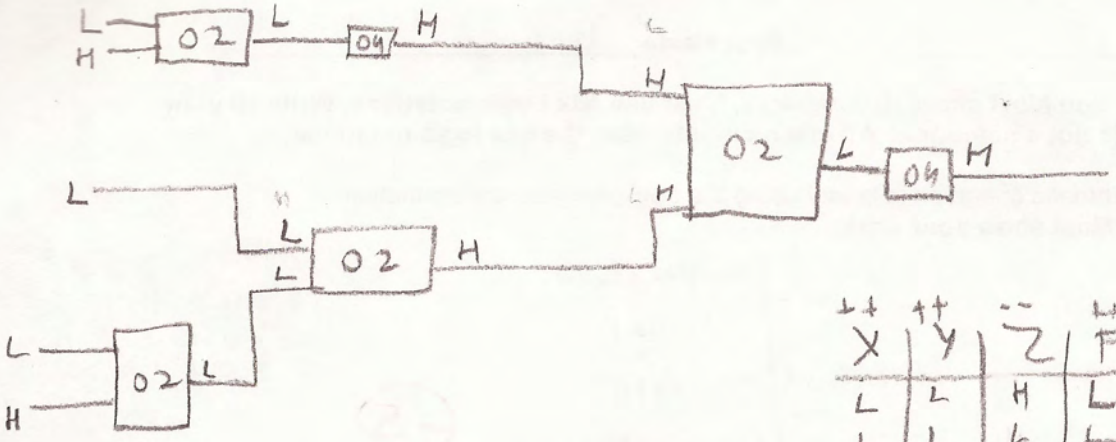


X	Y	Z	F
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

-5



Test Circuit



X	Y	Z	F
L	L	H	L
L	L	L	L
L	H	H	H
L	H	L	
H	L	H	H
H	L	L	
H	H	H	
H	H	L	

Minterm 3

In Minterm 3

X = L

Y = H

Z = L

Hence, For Minterm 3 LED will not turn ON at output is High and $I_{OH} = 0.4\,mA$

How did you get this table?