60

CmpE 124
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Test 1

Oktober 19, 2011

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.

10

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

$Y = -25_{10} - 46_{10}$

	Binary	Sign Magnitude	1's comp.	2's comp
-25	0011001	1011001	1100110	1100111
-46	0101110	1101110	1010001	1010010

Checking the result
2's → 10111001
−1
1's 10111000
01000111
↓
which is 71

Arithmetic operation in 2's comp. can not be done (-5)
-25 → 1100111
-46 → +1010010
carry 1 0111001
positive?
Answer in 2's complement is 10111001

15

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

354_8

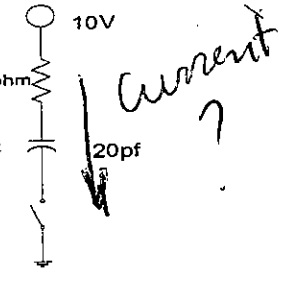
a) to Binary
$354_8 = 011\ 101\ 100_2 = 011101100_2$

b) to Hex
$354_8 = 011101100_2 = 0000\ 1110\ 1100_2 = \text{OEA}_{16}$ ~~OEA~~ OEC_{16}

c) to Decimal
$354_8 = 011101100_2 = (0\times2^8)+(1\times2^7)+(1\times2^6)+(1\times2^5)+(0\times2^4)+(1\times2^3)+(1\times2^2)+(0\times2^1)+(0\times2^0)$
$= 128+64+32+8+4 = 236_{10}$
Answer: 236_{10}

5

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.



$RC = 300\Omega\,(20\times10^{-12}\,F)$
$= 6000\times10^{-12}\,sec$
$RC = 6\times10^{-9}\,sec$

$t = 2RC$

$V_c = V_{cc}(1 - e^{-t/RC})$

$= 10\left(1 - e^{-2/6\times10^{-9}}\right)$

$= 10\left(1 - e^{-\frac{2\times10^9}{6}}\right)$

$= \left(10 + e^{-109/3}\right)\ V$

V_{cc} $C = 9/2V$

Figure 1.

4. Design the given equation:

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

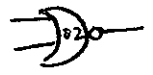
20 **F = X*Y + Z*(X + Y)** **X MSB AND Z LSB.**

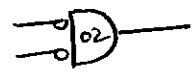
Z is negative assigned
XY and F are positive assigned)

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

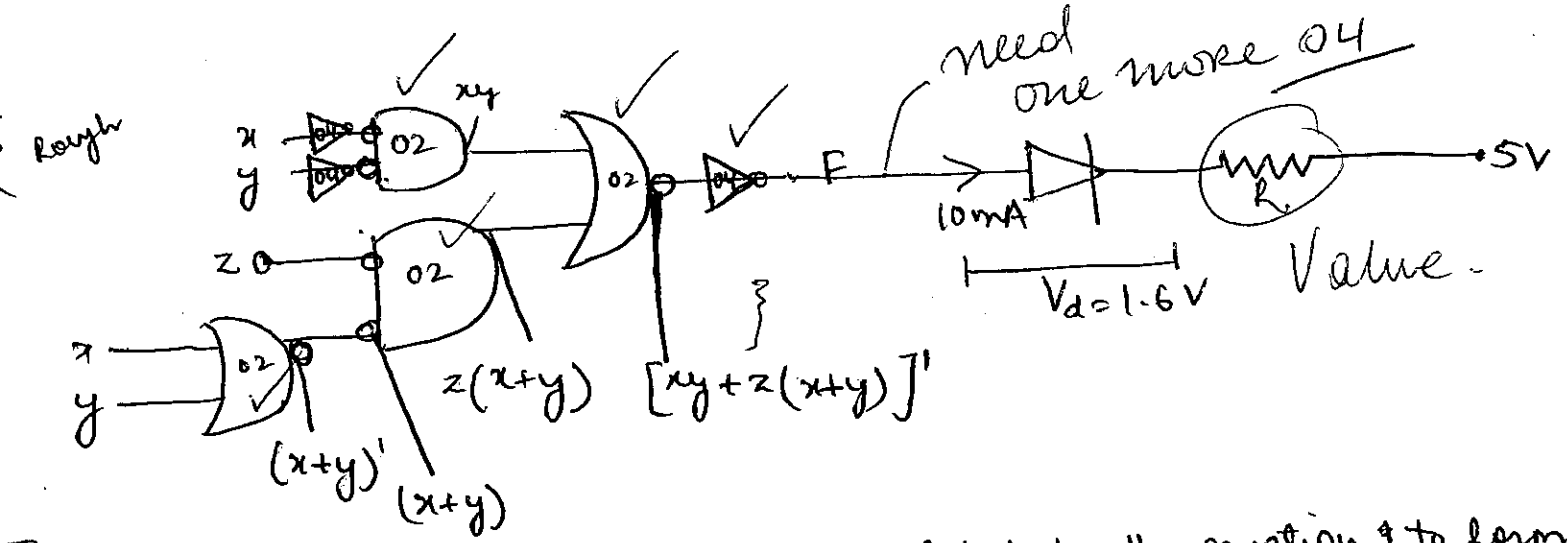
LED Id = 10mA, Vd =1.6 V

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

7402 

Dual. 

$F = xy + z(x+y)$



Truth Table:

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	1
1	1	0	1
1	1	1	1

Simplying the equation F to form Truth Table

$F = xy + z(x+y)$

$= xy + xz + yz$

$= xy(z+z') + x(y+y')z + (x+x')yz$

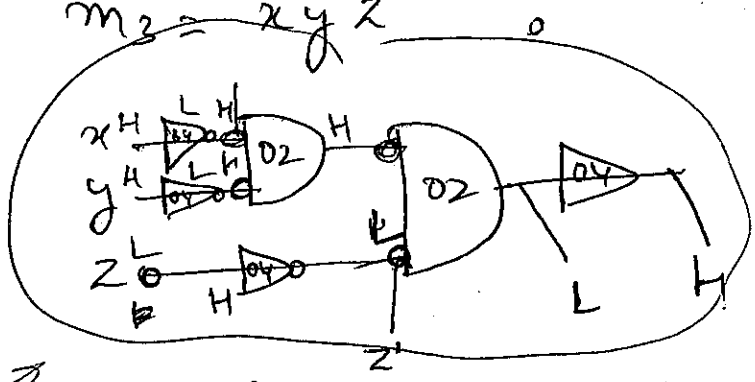
$= xyz + xyz' + xyz + xy'z + xyz + x'yz$

$F = xyz + xyz' + xy'z + x'yz$ (Using axiom $x+x=x$)

Voltage Table

x	y	z	f	
L	L	H	L	
L	L	L	L	
L	H	H	L	
L	H	L	H	
H	L	H	L	✓
H	L	L	H	
H	H	H	H	$= m_3$
H	H	L	H	

$m_3 = x y z'$



Use Box Concept.

(c) Testing the circuit

-5