Question 1: (Use the **Last page for rough work**, perform all **calculations, and write a neat and clean** answer in the provided space. Tick in the **table according** to the option **available** for every question**)** **[10*3=30] (CLO-1)**

A. The sum of $(123)_4 + (456)_8$ will be equal to

a. $(320)_{10}$
b. $(1235)_3$
c. $(101001101)_2$
d. $(149)_{16}$
e. b and c both

B. What will be the $(4A)_{16} - (321)_4$

a. $(11000)_2$
b. $(10100)_2$
c. $(10010)_2$
d. $(10001)_2$
e. $(11100)_2$

C. Write the ASCII characters for the following binary sequence 110000011101101011000010 considering odd parity

a. ABC
b. ABZ
c. BAZ
d. AZB
e. BZA

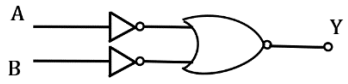
D. What will be the gray code for the binary sequence obtained after BCD addition of $(791)_{10} + (658)_{10}$

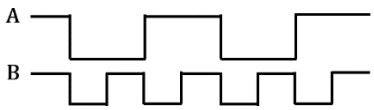
a. 0011111001101101
b. 0001111001101111
c. 0011110011011011
d. 0001111001101101
e. 0001111011101101

E. For the signed numbers A=16, B=-29 and C=19 what will be D if D=A-B-C

a. 0011001
b. 0011010
c. 1011110
d. 0011010
e. 1001100

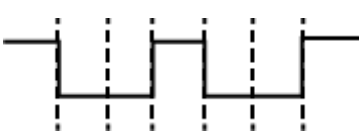
F. For the following circuit having inputs A and B, what will be the output waveform of Y for the given inputs waveform A and B.



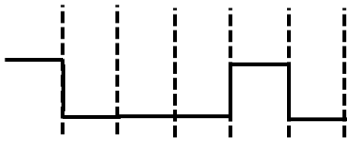


a.

b.



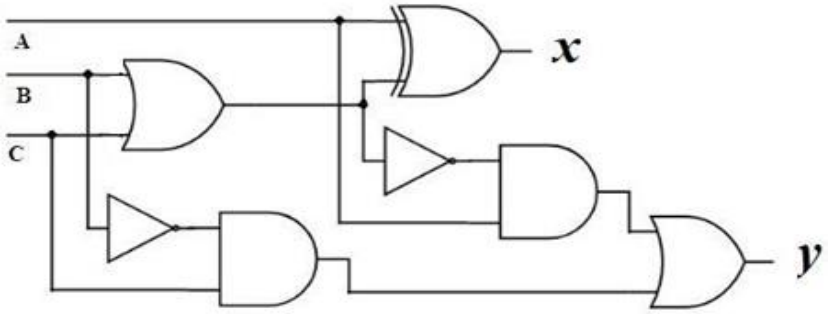
c.



G. Simplify the Boolean expression F= (x'+y'+z)(x'+y+z)(x+y) and Identify its complement

a. (x+z)(x+y')
b. (x+z')(x+y')
c. (x+z')(x'+y)
d. (x+z)(x+y')
e. (x+z)(x+y')(y'+z)

H. The Boolean function y will be



a. Y=(B+C)A'+B'+C
b. Y=(B+C)A+B'C
c. Y=(B+C)'A+B'C
d. Y=(B+C)'A+B'+C

I. The simplified Boolean expression of (A+B+C)(AB+C) to a minimum number of literals will be

a. AC+B
b. AB+BC
c. AB+C
d. A+BC
e. AB+A

J. Digital Logic Families used for high-speed operations

a. CMOS
b. MOS
c. ECL
d. TTL

Question Sr. No	Option: a	Option: b	Option: c	Option: d	Option: e
A				✓	
B				✓	
C				✓	
D				✓	
E				✓	

F			✓		
G			✓		
H			✓		
I			✓		
J			✓		

Question 2: (A neat and clean Circuit diagram is important. Cutting and overwriting can directly affect your marks.) **[30] (CLO-1)**

A. Explain the difference between Minterm and Maxterm **[2*2.5 =5]**

Minterm: The AND of N variables such that they equals to 1 is called minterm or standard product. There are 2^N possible minterms with N variables. Minterms are denoted by lower case m. Minterm is obtained from an AND term of the n variables, with each variable being primed if the corresponding bit of the binary number is a 0 and unprimed if a 1.

Maxterm: The OR of N variables such that the result is equal to 0 is called maxterm or standard sum. There are 2^N possible minterms with N variables. Maxterms are denoted by upper case M **.**Maxterm is obtained from an OR term of the n variables, with each variable being unprimed if the corresponding bit is a 0 and primed if a 1.

The complement of a minterm is equal to its corresponding maxterm

B. The truth table of the function X is shown below. Note: A term is MSB and C term is LSB. (Please ensure that you mention the name of every logic law you apply at each step. Failure to do so will result in a deduction of marks for the question). **[1*10=10]**

ABC	X
000	**1**
001	**1**
010	**1**
011	**1**
100	**1**
101	**0**
110	**0**
111	**0**

Using Boolean **Algebra's laws**, show that the function **X** based on the truth table that it can be expressed as: $X = \overline{A}+\overline{B+C}$.

X = A`+(B+C)`

X= A`+(B`.C`) **DEMORGAN's LAW**

Completing terms

X= A`(B+B`)(C+C`)+B`C`(A+A`) **Because we know that (A+A`=1) Identity Law**

X= (A`B+A`B`)(C+C`)+B`C`A+B`C`A` **Distributive Law**

X= A`BC+ A`BC`+ A`B`C + A`B`C` + B`C`A+B`C`A` ` **Distributive Law**

X= A`BC+ A`BC`+ A`B`C + A`B`C` + AB`C`+A`B`C` **Commutative Law**

We know that in minterm if A = 1 and A` = 0 so,

Extra Detail (X= 011+010+001+000+100+000)

X= $m_3+m_2+m_1+m_0+m_4+m_0$

X= $m_3+m_2+m_1+m_0+m_4$ **Theorem 1**

X= $m_0+m_1+m_2+m_3+m_4$ **Logical Equivalence**

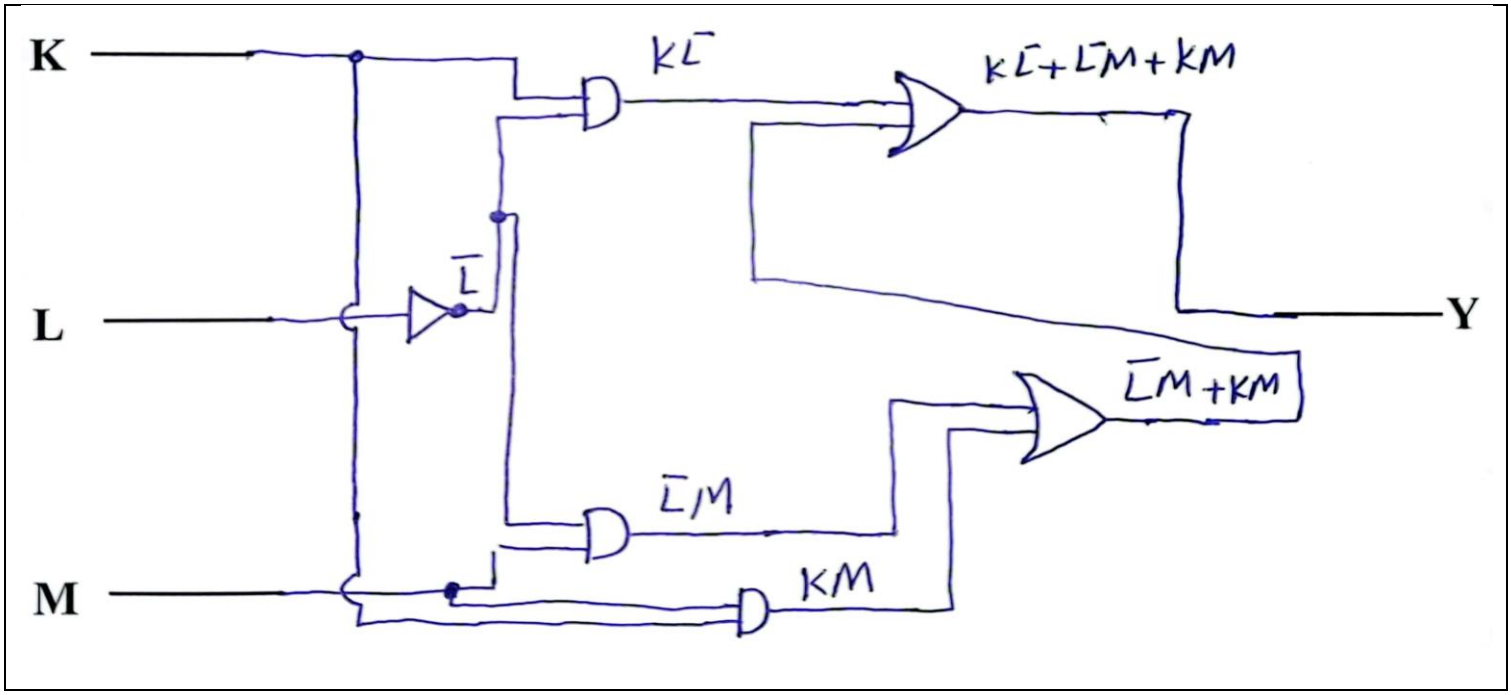
X= Σm(0,1,2,3,4)

So,

X = A`+(B+C)` = A`B`C` + A`B`C + A`BC` + A`BC + AB`C`

C. Based on the following logic equation: $Y = K\bar{L}+\bar{L}M+KM$

a) Draw the corresponding logic circuit by using the combination AND, OR, and INVERTER gates only [1*5 =5]



b) Complete the following Truth Table based on Question 2C. Note: K term is MSB and L term is LSB. [1*10 =10]

K	L	M	Y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Y = K$\bar{L}$+$\bar{L}$M+KM

Y = KL`(M+M`)+L`M(K+K`)+KM (L+L`)** **Because we now that (A+A`=1) Identity Law

Y= KL`M+KL`M`+ L`MK+L`MK`+KML+KML` **Distributive Law**

Y= KML`+KM`L`+KML`+K`ML`+KML+KML` **Commutative Law according to question K is MSB and L is LSB**

Now

Y= (110+100+110+010+111+110)

So,

Y= Σm(2,4,6,7)

Question 3: (A neat and clean Circuit diagram is important. Cutting and overwriting can directly affect your marks.) **[1*10=10] (CLO-1)**

Draw the circuit diagram of given Boolean expression:

$$Z = \overline{\bar{B}A \oplus A\bar{C}} + \bar{B}C$$