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**Subject : digital logic and design**

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**Qno: 01 :- Convert each of The following:**

Part(a) $45.25_{10} = (?)$

Sol: :

whole part of a number is obtained by dividing ~~of~~ on the basis new.

$$
\begin{array}{r|l}
45 & 2 \\
-44 & 22 \\
1 & \\
\end{array}
\quad
\begin{array}{r|l}
22 & 2 \\
-22 & 11 \\
0 & \\
\end{array}
\quad
\begin{array}{r|l}
11 & 2 \\
-10 & 5 \\
1 & \\
\end{array}
\quad
\begin{array}{r|l}
5 & 2 \\
-4 & 2 \\
1 & \\
\end{array}
\quad
\begin{array}{r|l}
2 & 2 \\
-2 & 1 \\
0 & \\
\end{array}
$$

Happend $45_{10} = 101101$

The functional Part of ~~the~~ number is found by multiplying on the basis new.

$$
\begin{array}{c|c}
0 & .25 \\
 & 2 \\
\hline
0 & 5 \\
 & 2 \\
\hline
1 & 0 \\
\end{array}
$$

Happend : $0.25_{10} = 001_2$

Add up ~~to the~~ Together whole and functional part here so

$101101_2 + 0.01_2 = 101101.01_2$

$\boxed{45.25_{10} = 101101.01_2}$

Ans

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Part (b): $01111111.1010_2 = (?)_{10}$

Sol :- $01111111.1010_2 = 0\cdot2^7 + 1\cdot2^6 + 1\cdot2^5 + 1\cdot2^4 + 1\cdot2^3$
$+ 1\cdot2^2 + 1\cdot2^1 + 1\cdot2^0 + 1\cdot2^{-1} + 0\cdot2^{-2} + 1\cdot2^{-3} + 0\cdot2^{-4}$

$= 127.625_{10}$

Results

$$\boxed{01111111.1010_2 = 127.625_{10}}$$

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Part (c) :- $3A6F_{16} = (?)_2$

Sol :- $3A6F_{16} = 3\cdot16^3 + 10\cdot16^2 + 6\cdot16^1 + 15\cdot16^0$

$= 12288 + 2560 + 96 + 15$

$= 14959_{10}$

Now converting $14959_{10}$ into Binary system.

whole part of number is obtained by dividing.

| | | | |
|---|---|---|---|
| 14959 | 2 | -14958 | 1 |
| 7479 | 2 | -7478 | 1 |
| 3739 | 2 | -3738 | 1 |
| 1869 | 2 | -1868 | 1 |
| 934 | 2 | -934 | 0 |
| 467 | 2 | -466 | 1 |
| 233 | 2 | -232 | 1 |
| 116 | 2 | -116 | 0 |
| 58 | 2 | -58 | 0 |
| 29 | 2 | 28 | 1 |
| 14 | 2 | -14 | 0 |
| 7 | 2 | -6 | 1 |
| 3 | 2 | 2 | 1 |
| 1 | | | |

Happened $14959_{10}$ = ~~1110~~ $11101001101111_2$

$$\boxed{3A6F_{16} = 11101001101111_2}$$

Ans

Part (d):- $10101010_2 = \pm(?)_{10}$

Sol:- $10101010_2 = ?$

$10101010_2 = 1\times2^7 + 0\times2^6 + 1\times2^5 + 0\times2^4 + 1\times2^3 + 0\times2^2$

$+ 1\times2^1 + 0\times2^0$

$\Rightarrow 1\times128 + 0 + 1\times32 + 0 + 1\times8 + 0 + 1\times2 + 0$

$= 128 + 32 + 2 + 8$

$= 170$

$\boxed{10101010_2 = 170_{10}}$

Ans

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Part e, $-1_{10} = ?_2$

Sol: $-1_{10} = ?_2$

$2 \,|\, 1 \,|\, 0 \,|\, 1$

$(-1)_{10} = (-1)_2$ $\boxed{-1_{10} = -1_2}$ Ans

---

Part H;

111000 = (? 101001)

even parity.

Sol:-

111000 = ? even parity

~~111000~~ =

the even parity is equal to

1101001

$\boxed{111000 = 1101001}$

Ans

—— // ——

Part(f) :- $156_{10} = (?)_{BCD}$

Sol:-

$$156_{10} = (\qquad)_{BCD}$$

| 1 | 5 | 6 |
| --- | --- | --- |
| 0001 | 0101 | 0110 |

$$\therefore (156)_{10} = (000101010110)_{BCD}$$

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Part(g) : $1001010_2 = (?)_{gray}$

Sol:- $1001010_2 = ?_{Gray}$.

Binary code : 1001010

Method-1: (Binary to Gray code)

$$g_6 = b_6 = 1$$

$$g_5 = b_6 \oplus b_5 = 1 \oplus 0 = 1$$

$$g_4 = b_5 \oplus b_4 = 0 \oplus 0 = 0$$

$g_3 = b_4 \oplus b_3 = 0 \oplus 1 = 1$

$g_2 = b_3 \oplus b_2 = 1 \oplus 0 = 1$

$g_1 = b_2 \oplus b_1 = 0 \oplus 1 = 1$

$g_0 = b_1 \oplus b_0 = 1 \oplus 0 = 1$

$\therefore$ Gray code : 1101111

Q.No: 02 :- Calculate each of the following.

Part (a) $9B_{16} + 8A_{16}$

Sol:

$$\begin{array}{r} {}^{1}\,{}^{1}9\,B \\ +\ 8\,A \\ \hline 1\,2\,5 \end{array}$$

step by step solution:

$$\begin{array}{rr} 9 & B \\ +\ 8 & A \\ \hline \end{array}$$

step-1:

$= B_{16} + A_{16}$

$= 11_{10} + 10_{10}$

$= 21_{10}$

$= 16 \times 1 + 5$

$= 15_{16}$

$=$

$\therefore$ Sum = 5 and carry = 1

$$\begin{array}{rcc} & \overset{1}{9} & B \\ + & 8 & A \\ \hline & & 5 \end{array}$$

step-2:

$= 1 + 9_{16} + 18_{16}$

$= 1 + 9_{10} + 8_{10}$

$= 18_{10}$

$= 16 \times 1 + 2$

$= 12_{16}$

$\therefore$ Sum = 2 and carry = 1

$$\begin{array}{rcc} 1 & \overset{1}{9} & B \\ + & 8 & A \\ \hline & 2 & 5 \end{array}$$

$\therefore$ Sum = 5 and carry = 1

$$\begin{array}{rcc} & \overset{1}{9} & B \\ + & 8 & A \\ \hline & & 5 \end{array}$$

step-2:

$= 1 + 9_{16} + 18_{16}$

$= 1 + 9_{10} + 8_{10}$

$= 18_{10}$

$= 16 \times 1 + 2$

$= 12_{16}$

$\therefore$ Sum = 2 and carry = 1

$$\begin{array}{rcc} 1 & \overset{1}{9} & B \\ + & 8 & A \\ \hline & 2 & 5 \end{array}$$

Part (b) :- $F7_{16} - D6_{16}$

Sol :- $F7_{16} - D6_{16}$

$$\begin{array}{r} F\ 7 \\ -\ D\ 6 \\ \hline 2\ 1 \end{array}$$

Step by Step sol: Step1

Here $7 > 6$, so directly subtract it

$= 7 - 6 = 1$

$= 1_{16}$

$$\begin{array}{r} F\ 7 \\ -\ D\ 6 \\ \hline 1 \end{array}$$

Step-2 $F - D$

Here $F = 15 > D = 13$, so directly subtract it

$= 15 - 13$

$= 2$

$= 2_{16}$

$$\begin{array}{r} F\ 7 \\ -\ D\ 6 \\ \hline 2\ 1 \end{array}$$

Part C :- $1100_2 + 1011_2$ [Use modulo-2]

Sol:-

Solution is

$$\begin{array}{r} {}^{1}\phantom{0}1\,1\,0\,0 \\ +\;\;1\,0\,1\,1 \\ \hline 1\;0\,1\,1\,1 \end{array}$$

step by step solution:

$$\begin{array}{r} 1\,1\,0\,0 \\ +\;1\,0\,1\,1 \\ \hline \end{array}$$

step-1:

$= 0_2 + 1_2$

$= 0_{10} + 1_{10}$

$= 1_{10}$

$= 1_2$

$\therefore$ sum $= 1$

$$\begin{array}{r} 1\,1\,0\,1 \\ +\;1\,0\,1\,1 \\ \hline 1 \end{array}$$

step-2:

$= 0_2 + 1_2$

$= 0_{10} + 1_{10}$

$= 1_{10}$

$= 1_2$

$\therefore$ sum $= 1$

$$\begin{array}{r} 1\ 1\ 0\ 0 \\ +\ 1\ 0\ 1\ 1 \\ \hline 1\ 1 \end{array}$$

step-3:

$= 1_2 + 0_2$

$= 1_{10} + 0_{10}$

$= 1_{10}$

$= 1_2$

$\therefore$ sum $= 1$

$$\begin{array}{r} 1\ 1\ 0\ 1 \\ +\ 1\ 0\ 1\ 1 \\ \hline 1\ 1\ 1 \end{array}$$

step-4:

$= 1_2 + 1_2$

$= 1_{10} + 1_{10}$

$= 2_{10}$

$= 2 \times 1 + 0$

$= 10_2$

sum $= 0$ and carry $= 1$

$$\begin{array}{r} 1\ \ \ \ \ \ \ \ \ \ \\ 1\ 1\ 0\ 0 \\ +\ 1\ 0\ 1\ 1 \\ \hline 0\ 1\ 1\ 1 \end{array}$$

Part d,:- $01111111_2 - 00000111_2$

[use 2's complement.]

Sol:-

$$\begin{array}{r} 01111111 \\ -\ 00000111 \\ \hline 1111000 \end{array}$$

Step by Step Solution:-

Step 1: 1-1

Here 1=1 ~~so it~~

= 1-1

$= 0_2$

$\boxed{1111000}$

Ans

Step 2:- 1-1

= 1=1

= 1-1

$= 0_2$

Step3 = 1=1 = 1-1

$= 0_2$

Step 4 : 1-0

Here 1>0 So directly

= 1-0

$= 1_2$

# Q.No: 03

Determine the output ~~@~~ waveforms for XOR and XNOR gates. given the input waveform A and B.

**Ans:-**

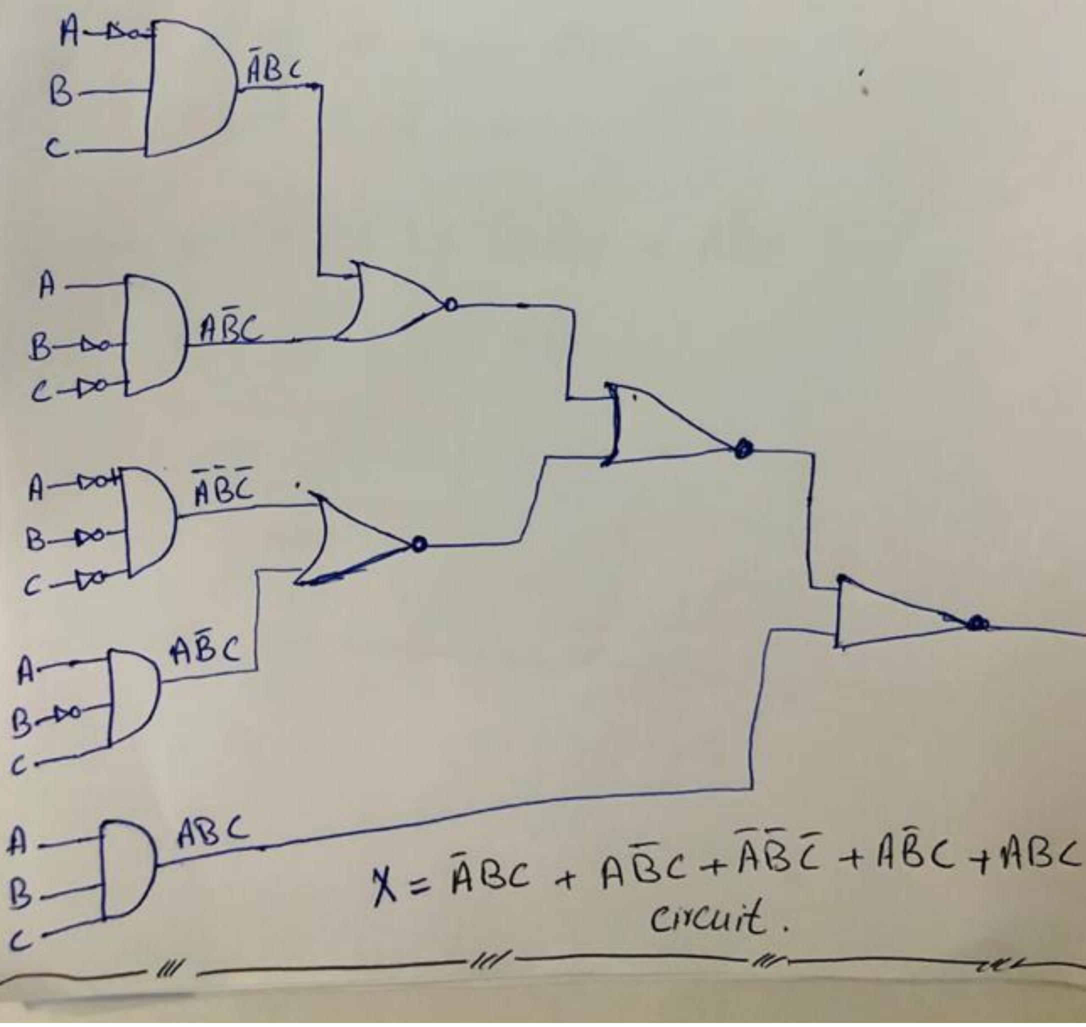
**Sol:-** The output ~~waveform~~ waveforms are shown in the Figure 01. Notices that the XOR output is High only when both inputs are at opposite levels. Notice that the XNOR output is High only when both inputs are the same.

Q No: 4

Part a. Draw the logic circuit for the following.

$$X = \bar{A}BC + A\bar{B}\bar{C} + A\bar{B}C + ABC$$

Circuit.




$X = \bar{A}BC + A\bar{B}C + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$ circuit.

13062. 

QNo: 4

Part B, Using Boolean algerbra.

$$\bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$$

Sol:

$$\bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$$

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

As we know that

$$A + \bar{A} = 0$$

So

$$= BC(0) + (0)\bar{B}\bar{C} + A\bar{B}C$$

$$= 0 + 0 + A\bar{B}C$$

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

Ans

# Q.No: 05

Part (a) Convert the following expression to standard SOP form: $A = \overline{\overline{X+Y}+Z}$

Sol: :-

$$A = \overline{\overline{X+Y}+Z}$$

$$A = \overline{\overline{X}'+Y+Z}$$

$$A = X+Y+\overline{Z}$$

$$A = X(Y+Y') + Y(X+X') + \overline{Z}(X+X')$$

$$= (XY+XY') + (yx+yx') + (\overline{z}x+\overline{z}x')$$

$$= (xy+xy')(z+\overline{z}) + (xy+x'y)(z+z') + (x\overline{z}+x'\overline{z}')$$

$$= (xyz+xyz'+xy'z+xy'z') + (xyz+xyz'+x'yz+x'yz') + (xz'+x'z')$$

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

Now after removing duplicates.

$= XYZ + XYZ' + XY'Z' + X'YZ + X'YZ' + X'YZ' + X'Y'Z'$

$= m_7 + m_6 + m_5 + m_3 + m_4 + m_2 + m_0$

$= m_0 + m_2 + m_3 + m_4 + m_5 + m_6 + m_7$

Sum ( 0. 2, 3, 4, 5, 6, 7 )

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Q5 Part b,

Convert the standerd SOP expression obtained in Part a, to standerd POS form.

Ans:. As we know that the POS is exactly the opposite to the Sum of Product (SOP) so the ~~vott~~ values are also opposite

$$POS = (M_0 + M_1 + M_3 + M_4 + M_5 + M_7)$$

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## Q No: 05

Part (c):

Truth table:

| X | Y | Z | SOP ($m_i$) Min terms | POS ($M_i$) Max terms |
|---|---|---|---|---|
| 0 | 0 | 0 | $\rightarrow X'Y'Z' = m_0$ | $\rightarrow X'+Y'+Z' = m_7$ |
| 0 | 1 | 0 | $\rightarrow X'YZ' = m_2$ | $\rightarrow X'+Y+Z' = m_5$ |
| ~~0~~ | ~~1~~ | ~~1~~ | $\cancel{\rightarrow XY'Z' = m_4}$ | $\cancel{\rightarrow X+Y'+Z' = m_3}$ |
| 0 | 1 | 1 | $\rightarrow X'YZ = m_3$ | $\rightarrow X'+Y+Z = m_4$ |
| 1 | 0 | 0 | $\rightarrow XY'Z' = m_4$ | $\rightarrow X+Y'+Z' = m_3$ |
| 1 | 0 | 1 | $\rightarrow XY'Z = m_5$ | $\rightarrow X+Y'+Z = m_2$ |
| 1 | 1 | 0 | $\rightarrow XYZ' = m_6$ | $\rightarrow X+Y+Z' = m_1$ |
| 1 | 1 | 1 | $\rightarrow XYZ = m_7$ | $\rightarrow X+Y+Z = m_0$ |

# QNo: 06

Part a. use the Karnaugh map to find the minium SoP form for the following expression.

$$X = \bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}B\bar{C} + AB\bar{C} + ABC + A\bar{B}C$$

Sol:

$$\bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}B\bar{C} + AB\bar{C} + ABC + A\bar{B}C$$

| AB \ C | 0 | 1 |
|---|---|---|
| 00 | | |
| 01 | | |
| 11 | | |
| 10 | | |

(a)

| AB \ C | 0 | 1 |
|---|---|---|
| 00 | $\bar{A}\bar{B}\bar{C}$ | $\bar{A}\bar{B}C$ |
| 01 | $\bar{A}B\bar{C}$ | $\bar{A}BC$ |
| 11 | $AB\bar{C}$ | $ABC$ |
| 10 | $A\bar{B}\bar{C}$ | $A\bar{B}C$ |

Solution

$\bar{A}\bar{B}\bar{C} = 000$

$A\bar{B}\bar{C} = 001$

$\bar{A}B\bar{C} = 010$

$AB\bar{C} = 110$

$ABC = 111$

$A\bar{B}C = 101$

Q.No: 6

Part (B)

determine minium POS Form

Sol:-

| AB \ C | 0 | 1 |
|---|---|---|
| 00 | | 1 |
| 01 | 1 | |
| 11 | 1 | 1 |
| 10 | | 1 |

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