DLD Paper Page# 01

Name: M Abbas ID: 13063 Dep# CS(SE) 22-8-2020.

Q1 a) Convert the following

(a) $45.25_{10} = (?)_2$

Sol:- $45.25_{10} = (?)_2$

Dividing by 2

45 | 2
-44 | 22 | 2
1 | -22 | 11 | 2
0 | -10 | 5 | 2
1 | -4 | 2 | 2
1 | -2 | 1
0

Fractional Part

0 | .25
. | 2
0 | 5
0 | 2
1 | 0

Happened $0.25_{10} = 0.01_2$

Now adding both

$101101_2 + 0.01_2 = 101101.01_2$

$\boxed{\text{Result} = 4.25_{10} = 101101.01_2}$

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Q1

B $01111111.1010_2 = (?)_{10}$

Sol:- $01111111.1010_2 = (?)_{10}$

Converting Binary into Decimal.

$01111111.1010_2 = 0.2^7 + 1.2^6 + 1.2^5 + 1.2^4 + 1.2^3 + 1.2^2 + 1.2^1 + 1.2^0 + 1.2^{-1} + 0.2^{-2} + 1.2^{-3} + 0.2^{-4} =$

$0 + 64 + 32 + 16 + 8 + 4 + 2 + 1 + 0.5 + 0 + 0.125 + 0 = 127.625_{10}$

So

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

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Q1

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

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

Translating into decimal first

$3A6F_{16} = 3 \cdot 16^3 + 10 \cdot 16^2 + 6 \cdot 16^1 + 15 \cdot 16^0 = 12288 + 2560 + \boxed{96 + 15 = 14959_{10}}$

Now converting 14959_{10} in Binary.

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

Result

$14959_{10} = 11101001101111_2$

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Q1

(D) $10101010_2 = \pm(?)_{10}$

Sol

$10101010_2 = \pm(?)_{10}$

10101010

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

$= 1\times128 + 0\times64 + 1\times32 + 0\times16 + 1\times8 \times 0\times4 + 1\times2 + 0\times1 = 170$

So

$\therefore (10101010)_2 = (170)_{10}$

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Q1

(E) $-1_{10} = (?)_2$

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

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

$$\begin{array}{c|c|c} 2 & 1 & \\ \hline & 0 & 1 \uparrow \end{array}$$

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

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Q1

(F) $156_{10} = (?)_{BCD}$

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

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

$\underset{0001}{1}\ \underset{0101}{5}\ \underset{0110}{6}$

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

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Q1 (G) $1001010_2 = (?)$ Gray

Sol $1001010_2 = (?)$ Gray

Binary To Gray code

$g_6 = b_6 = 1$

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

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

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

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

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

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

so the gray code is $\boxed{1101111}$

(H) 111000 = (?101001)$_{Even\ Parity}$.

Sol 111000 = (?101001)$_{Even\ Parity}$

101001 is odd sinc its not
divisible by 2
As remainder is equal to 1
when divided by (2)

Q2 (b) calculate the following.

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

Sol

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

solution step by step

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

step (1)

$= B_{16} + A_{16}$
$= 11_{10} + 10_{10}$
$= 21_{10}$
$= 16 \times 1 + 5$
$= 15_{16}$
$\therefore$ sum $= 5$ and carry $= 1$

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

step (2)

$= 1 + 9_{16} + 8_{16}$
$= 1 + 9_{10} + 8_{10}$
$= 18_{16}$
$= 16 \times 1 + 2$
$= 12_{16}$
$\therefore$ sum $= 2$ and carry $= 1$

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

Q2 (B) $F7_{16} - D6_{16}$

Sol:-

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

step by step solution

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

(step 1) $7 - 6$

Here $7 > 6$ so subtract it

$= 7 - 6$

$= 1$

$= 1_{16}$

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

(step 2) $F - D$

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

$= 15 - 13$

$= 2$

$= 2_{16}$

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

Q2 (C) $1100_2 + 1011_2$

Sol

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

step by step solution

(step 1)

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

$= 0_2 + 1_2$

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

$= 1_{10}$

$= 1_2$

$\therefore$ sum $= 1$

(step 2)

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

$= 0_2 + 1_2$

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

$= 1_{10}$

$= 1_2$

$\therefore$ Sum $= 1$

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

Continue on next Page.

Step 3

$= 1_2 + 0_2$
$= 1_{10} + 0_{10}$
$= 1_{10}$
$= 1_2$
$\therefore$ Sum $= \underline{1}$

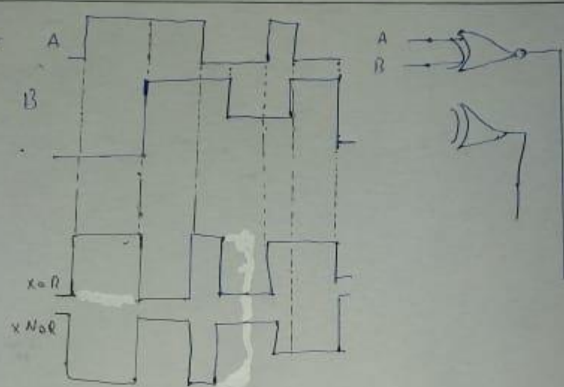
$$\begin{array}{r} 1100 \\ +\,1011 \\ \hline 111 \end{array}$$

Step 4

$= 1_2 + 1_2$
$= 1_{10} + 1_{10}$
$= 2_{10}$
$= 2\times1+0$
$= 10_2$
$\therefore$ Sum $= 0$ and Carry $= \underline{1}$

$$\begin{array}{r} \underline{1} \\ 1100 \\ +\,1011 \\ \hline 0111 \end{array}$$

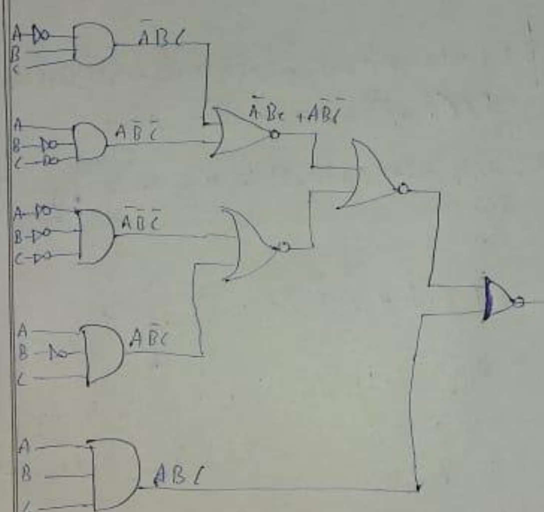
Q3 Sol:-



Solution:-

The output waveforms are shown. Notice 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.

Q4 (c) $X = \bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C} + A\bar{B}C + ABC$



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

Q4 (B) simplify the expression

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

Sol:-

step 1: Factor BC out of the first and last terms

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

Step 2: Apply rule 6 $(\bar{A}+A=1)$ to the term in Parenthese, and factor $A\bar{B}$ from the second last term

$BC.1 + A\bar{B}(\bar{C}+C) + \bar{A}\bar{B}\bar{C}$

step 3: Apply rule 4 (drop 1) to the first term and rule 6 $(\bar{C}+C=1)$ to the term in parenthesis

$BC + A\bar{B}\cdot 1 + \bar{A}\bar{B}\bar{C}$

step 4: Apply rule 4 (drop 1) to 2nd term

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

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Q4 (B) step 5: Factor $\bar{B}$ from the second and 3rd term

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

step 6: Apply rule III ($A + \bar{A}\bar{C} = A + \bar{C}$) to the term in pharenthesis

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

step 7: use the destributive and commutative laws to get the following expression

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

Q5 (A)

$$A = \overline{x+y} + z$$

Sol

$$A = \bar{x} + \bar{y} + z$$

$$A = \bar{x} + \bar{x} + \bar{z}$$

$$A = x \cdot y \cdot \bar{z}$$

Q5 Part (b)

$$A = xy\bar{z}$$

These are the total 8 combinations the SOP contains 1 of these, so the POS must contains the other 7 which are

000, 010, 011, 100, 101, 110, 111

$$(x+y+z)(x+\bar{y}+z)(x+\bar{x}+z)(x+y+z)$$

$$(\bar{x}+y+\bar{z})(\bar{x}+\bar{y}+z)(\bar{x}+\bar{y}+\bar{z})$$

Q5 c

x	y	z	Expressions
0	0	0	$(x+y+z)$
0	0	1	$(x+y+\bar{z})$
0	1	0	$(x+\bar{y}+z)$
0	1	1	$(x+\bar{y}+\bar{z})$
1	0	0	$(\bar{x}+\bar{y}+z)$
1	0	1	$(\bar{x}+y+\bar{z})$
1	1	0	$(\bar{x}+\bar{y}+z)$
1	1	1	$(\bar{x}+\bar{y}+\bar{z})$

Q6 (A)

Karnaugh Map

Sol

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

$AB \backslash C$	0	1
00		
01		
11		
10		

(a)

$AB \backslash C$	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	$A\bar{B}\bar{C}$	$A\bar{B}C$

(b)

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

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

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

$AB\bar{C} = 110$

$ABC = 111$

$A\bar{B}C = 101$

6 B

Minimum POS form

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

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

(POS)

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