Iqra National University

Mid term exam

Subject: Digital Logic Design

Instructor : Sir Khalid Hamid

Name : Nooriya Ilyas

ID : 15770

BS (SE) 3rd Semester

Question. 1. Convert each of the numbers to the required number system.

a). $(1011100.10101)_2 = (\quad)_{10}$

Solution:-

$$1011100.10101_2 = (1\times2^6)+(0\times2^5)+(1\times2^4)+(1\times2^3)+(1\times2^2)+(0\times2^1)+(0\times2^0)+(1\times2^{-1})+(0\times2^{-2})+(1\times2^{-3})+(0\times2^{-4})+(1\times2^{-5}).$$

$$= 64+0+16+8+4+0+0+0.5+0+0.125+0+0.03125$$

$$= 92+0.65625 \Rightarrow 92.65625_{10}$$

$$1011100.10101_2 = 92.65625_{10}$$

b. $(111100.101)_2 = (\ )_{10}$

Solution:-

$111100.101_2 = (1\times2^5)+(1\times2^4)+(1\times2^3)+(1\times2^2)+(0\times2^1)+(0\times2^0)+(1\times2^{-1})+(0\times2^{-2})+(1\times2^{-3})$.

$= 32 + 16 + 8 + 4 + 0 + 0 + 0.5 + 0 + 0.125$

$= 60 + 0.625$

$= 60.625_{10}$.

c). $(ABCD)_{16} = (\ )_2$

Solution:-

writing equivalent binary value for the given hexadecimal value

A	B	C	D
1010	1011	1100	1101

$ABCD_{16} = 1010101111001101_2$.

d. $(10)_{10} = (\ )_{16}$

Solution:-

if the given number is less than 16, the hex equivalent is the same. Since the letter A is used for the value 10, the answer to this question is A_{16}.

$$(10)_{10} = A_{16}$$

e. $(7777)_8 = (\ )_{10}$

Solution:-

$$7777_8 = (7 \times 8^3) + (7 \times 8^2) + (7 \times 8^1) + (7 \times 8^0).$$

$$7777_8 = 3584 + 448 + 56 + 7$$

$$7777_8 = 4095_{10}$$

f. $(7777)_8 = (\ )_2$

Solution:-

7	7	7	7
111	111	111	111

$$7777_8 = 111111111111_2$$

g. $(7777)_8 = (\ )_{16}$

Solution:-

First convert into Binary.

7 7 7 7

111 111 111 111

$7777_8 = 111111111111_2$

Now convert Binary into Hex.

1111 1111 1111

F F F

$111111111111_2 = FFF_{16}$

h. $(10101111)_2 = (\ )_8$

Solution:-

Split the binary no. from left to right each group 3 bits.

010 101 111

2 5 7

$10101111_2 = 257_8$

i. $(101010)_{10} = (\ )_8$

Solution:-

we'll divide the given decimal number by 8 until we get a 0.

remainders

$\frac{101010}{8} = 12626.25 = 0.25 \times 8 = 2$

$\frac{12626}{8} = 1578.25 = 0.25 \times 8 = 2$

$\frac{1578}{8} = 197.25 = 0.25 \times 8 = 2$

$\frac{197}{8} = 24.625 = 0.625 = 5$

$\frac{24}{8} = 3$

$\frac{3}{8} = 0.375 = 0.375 = 3$

$101010_{10} = 305222_8$

j. $(98)_{10} = (\quad)_{BCD}$

Solution:-

$$\begin{array}{cc} 9 & 8 \\ 1001 & 1000 \end{array}$$

$$98_{10} = 10011000_{BCD}.$$

Question. 2. Apply De-morgan's theorums to each expression.

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

Solution:-

let the term $\overline{A\bar{B}} = X$ & $\overline{C+\bar{D}} = Y$

Since $\overline{XY} = \bar{X}+\bar{Y}$

$$\overline{A\bar{B}} + (\overline{C+\bar{D}})$$

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

$$\bar{A}+B+(\bar{C}D) \quad \text{Answer}$$

2. $\overline{(A+\bar{B}+C+\bar{D})} + \overline{ABC\bar{D}}$

Solution:-

$$\bar{A}\bar{\bar{B}}\bar{C}\bar{\bar{D}} + \overline{A} + \overline{B} + \overline{C} + \overline{\bar{D}}$$

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

Question 3. Develop a truth table for the following.

a. $\bar{X}\bar{Y}\bar{Z} + \bar{X}Y\bar{Z} + X\bar{Y}Z + \bar{X}YZ + XY\bar{Z}$

X	Y	Z	output
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

b). $\bar{A}\bar{B}C\bar{D} + AB\bar{C}\bar{D} + \bar{A}\bar{B}CD + \bar{A}\bar{B}\bar{C}\bar{D}$

A	B	C	D	output
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0

Question: 4. Convert into SOP form.

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

$BC + DE \cdot \bar{B}C + DE \cdot EE$

$BC + DE\,\bar{B}C + DE$ $\quad \therefore A \cdot A = A$

B). $BC(\bar{C}\bar{D} + CE)$

$BC \cdot \bar{C}\bar{D} + BC \cdot CE$ $\quad \therefore C \cdot \bar{C} = 0$

[illegible] $\quad 0 + BC \cdot CE$ $\quad \therefore C \cdot C = C$

BCE

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c) $B + C\,[BD + (C+\bar{D})E]$

$B+C\,[BD + EC + E\bar{D}]$

$B + CBD + CEC + CE\bar{D}$ $\qquad C \cdot C = C$

$B + CBD + CE + CE\bar{D}$.

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