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Q1. Convert each of the following

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

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

2	45.25	
2	22 -	1
2	11 -	0
2	5 -	1
2	2 -	1
	1 -	0

$0.25 \times 2 = 0.50$

$0.50 \times 2 = 1.00$

$(1\,0\,1\,1\,0\,1 \cdot 0\,1)_2$

$(45.25)_{10} = (101101.01)_2$

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

Sol:-

$0 \times 2 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-3}$

$64 + 32 + 16 + 8 + 4 + 2 + 1 + 0.5 + .125$

$125 + 0.5 + 0.125$

$(125.625)_{10}$

So $(01111111.1010)_2 = (125.625)_{10}$

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

Sol:

3	A	6	F
0011	1010	0110	1111

Now combine these

$$(3A6F)_{16} = (0011\ 1010\ 0110\ 1111)_2 \text{ Ans}$$

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

Sol:

$$1\times2^7 + \cancel{0\times2^6} + 1\times2^5 + \cancel{0\times2^4} + 1\times2^3 + \cancel{0\times2^2} + 1\times2^1 + \cancel{0\times2^0}$$

$$128 + 32 + 8 + 2$$

So $\pm(170)_{10}$

$$(10101010)_2 = \pm(170)_{10} \text{ Ans}$$

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

~~d~~ −1
−0001

$$-(0001)_2 =$$

So

$$-(1)_{10} = -(0001)_2$$

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

Sol:

1	5	6
0001	0101	0110

combines

$(0001\ 0101\ 0110)_{BCD}$

So:

$(156)_{10} = (0001\ 0101\ 0110)_{BCD}$

(g) $1001010_2 = (?)\ gray$.

Sol:

1001010_2

$$\text{MSB}\ 1 \xrightarrow{+} 0 \xrightarrow{+} 0 \xrightarrow{+} 1 \xrightarrow{+} 0 \xrightarrow{+} 1 \xrightarrow{+} 0$$

$\downarrow$

1 1 0 1 1 1 1

So

$(1001010)_2 = (1101111)_{gray}$

Q2:- Calculate each of the following.

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

$$\begin{array}{r} {}^{1}\,{}^{1}\phantom{B_{16}} \\ 9\ B_{16} \\ +\ 8\ A_{16} \\ \hline (12\ 5)_{16} \end{array}$$ Ans

Rough

B = 11
A = 10

$$\begin{array}{r|l} 16 & 21 \\ \hline & 1 - 5 \end{array}$$

$(15)_{16}$

$$\begin{array}{r|l} 16 & 18 \\ \hline & 1 - 2 \end{array}$$

$(12)_{16}$

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

$$\begin{array}{r} F\ 7_{16} \\ -\ D\ 6_{16} \\ \hline 2\ 1_{16} \end{array}$$ Ans.

F = 15
D = 13

2

(c) $1100_2 + 1011_2$ (use modulo-21)

Sol:

$$\begin{array}{r} 1100_2 \\ +\ 1011 \\ \hline 0111_2 \end{array}$$ Ans. (use modulo-21)

(d) 0 1 1 1 1 1 1 1 → 1

\- 0 0 0 0 0 1 1 1 → 2

Sol: Now take invert on 2

0 0 0 0 0 1 1 1

1 1 1 1 1 0 0 0

+1

1 1 1 1 1 0 0 1 → 3

Now add 3 & 1

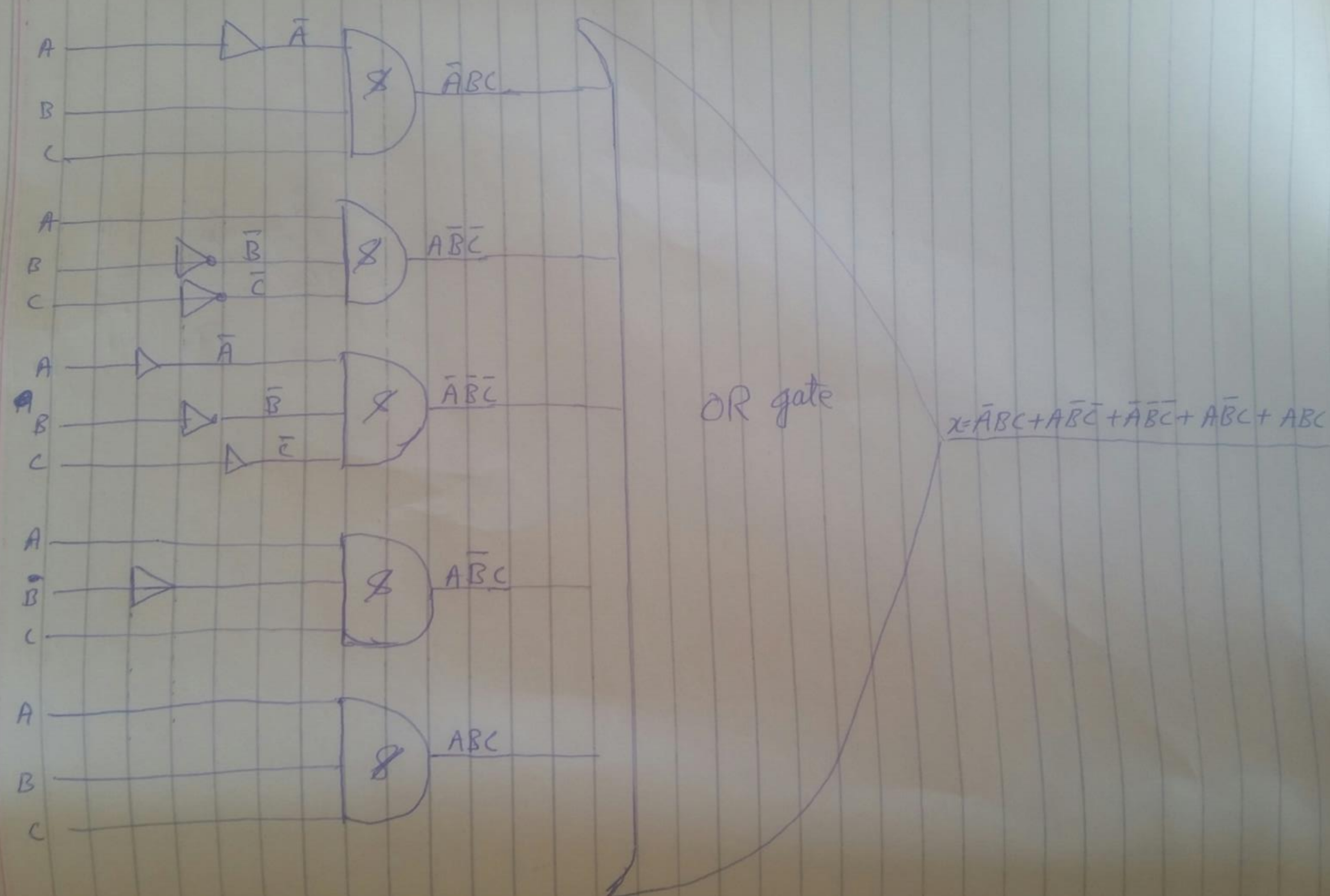
$$
\begin{array}{r}
\ 0\ 1\ 1\ 1\ 1\ 1\ 1\ 1 \\
+\ 1\ 1\ 1\ 1\ 1\ 0\ 0\ 1 \\
\hline
\text{drop } 1\ 0\ 1\ 1\ 1\ 1\ 0\ 0\ 0
\end{array}
$$

So

$(01111000)_2$ Ans

Q4

(a)


A
B
C
$\bar{A}$
&
$\bar{A}BC$
$\bar{B}$
$\bar{C}$
$A\bar{B}\bar{C}$
$\bar{A}\bar{B}\bar{C}$
$A\bar{B}C$
ABC
OR gate
$x=\bar{A}BC+A\bar{B}\bar{C}+\bar{A}\bar{B}\bar{C}+A\bar{B}C+ABC$

Q6:-

a) $X = \bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}B\bar{C} + ABC + A\bar{B}C.$

A	B	C	X
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

SOP form $\begin{cases} 0 \rightarrow \bar{A} \\ 1 \rightarrow A \end{cases}$

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

$$X = \bar{B}\bar{C}(\bar{A}+A) + \bar{A}B\bar{C}(1+1) + AC(B+\bar{B})$$

$$X = \bar{B}\bar{C}(1) + \bar{A}B\bar{C}(1) + AC(1)$$

$$X = \bar{B}\bar{C} + \bar{A}B\bar{C} + AC$$

So this is the minimum SOP form for the following expression

Q5:

x	y	z	A
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

OR

$A = (x, y, z) = \Sigma m\,(0,2,3,6,7)$

1, 4, 5

$Y(x, y, z) = \Pi M\,(1,4,5)$

SOP For

$0 \rightarrow \bar{x}$

$1 \rightarrow x$

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

$A = \bar{x} \cdot \bar{y} \cdot \bar{z} + \bar{x} \cdot y\,(\bar{z} + z) + xy\,(\bar{z} + z)$

$A = \bar{x} \cdot \bar{y} \cdot \bar{z} + \bar{x}y\,(1) + (xy)\,(1)$

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

$A = \bar{x}\bar{y}z + y\,(\bar{x} + x)$

$A = \bar{x}\bar{y}\bar{z} + y\,\underset{(1)}{(\bar{x} + x)}$

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

$A = x\,y + y$

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

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

let $x = \bar{x}\bar{z}$