NAME: Muhammad Hamza. ID: 13136.

Q1 Convert the following.

a). 101109.

b). 127.

c). 1110100110111.

d). $(170)_{10}$

e). 1111111111111111.

f). 000101010110.

g). 110111.

h).

Q2 Calculate each of the following.

a). 125

b). 21.

c). 0111.

d). 01111000_2.

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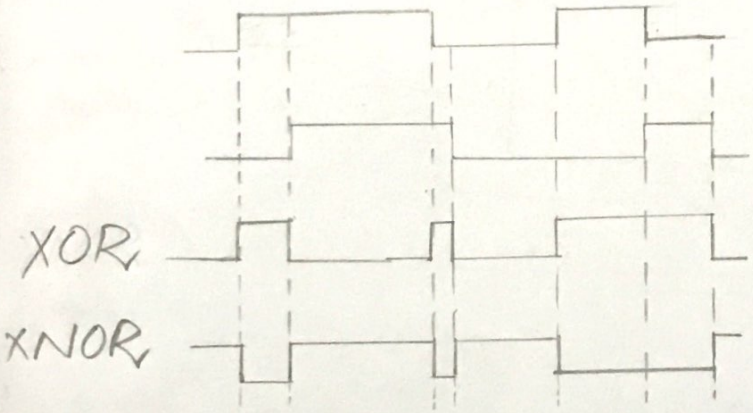
Q3 Determine the output waveforms for the XOR & XNOR gates given the input waveforms, A & B, in fig 01.



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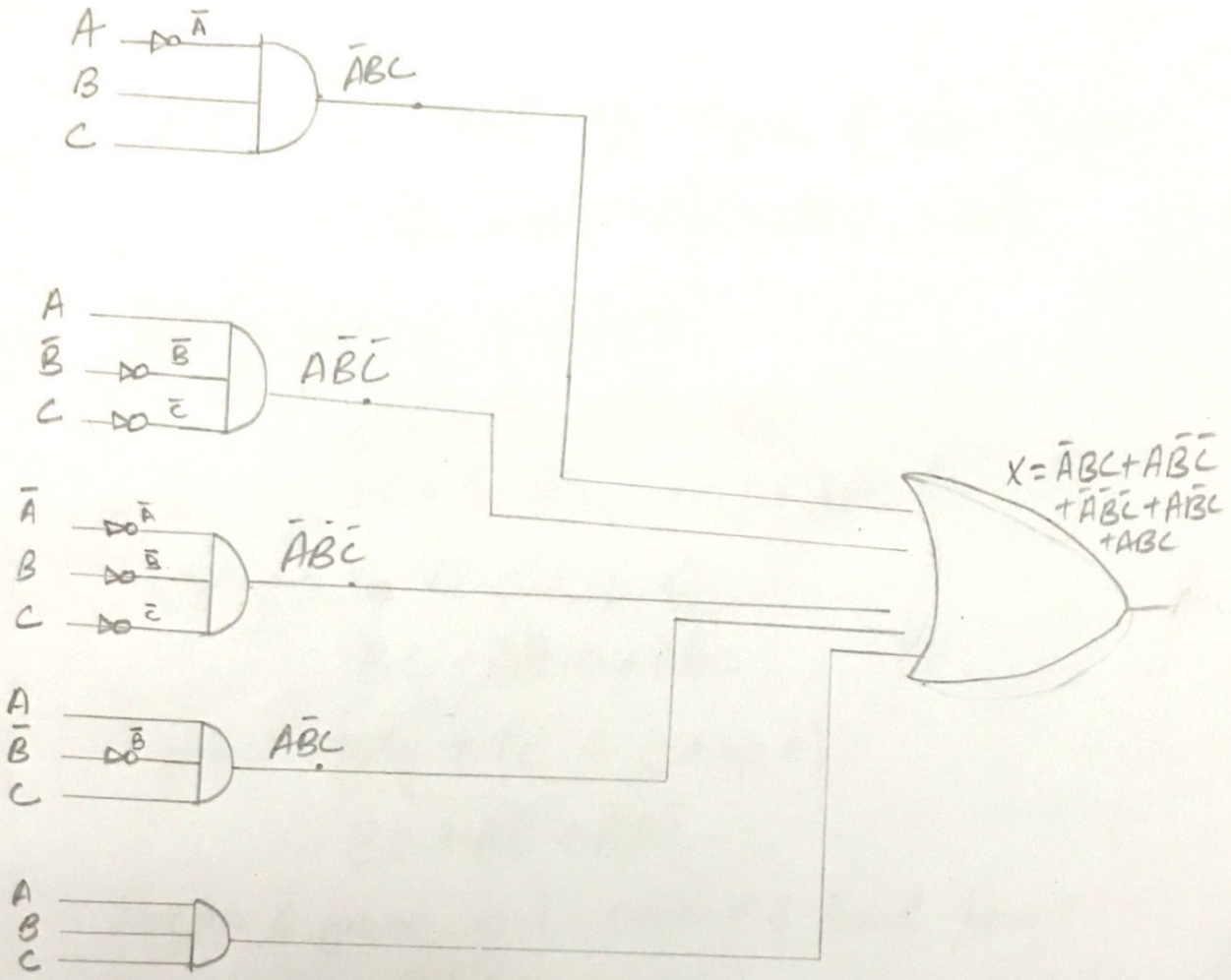
Q4 (a) Draw the logic circuit for the following

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



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(b) Using Boolean algebra, simplify the expression in given part a.

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

Factor BC out of first & last terms.

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

Apply rule 6 $(\bar{A}+A=1)$

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

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

Apply rule 4 (drop 1).

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

Again apply rule 4 (drop 1).

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

Factor $\bar{B}$ from the second & third terms.

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

Apply rule 11 $(A + \bar{A}\bar{C} = A + \bar{C})$.

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

Use the distributive & commutative law to get the following.

$$Bc + A\bar{B} + \bar{B}\bar{C}.$$

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Q5 (a) Convert the following expression to Standard SOP form $A = \overline{\overline{X+Y+Z}}$.

Solution:

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

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

$$= \overline{\bar{X}\bar{Y}}\cdot\bar{Z} \qquad (\because \overline{A+B} = \bar{A}\cdot\bar{B}).$$

$$= (\bar{\bar{X}}+\bar{\bar{Y}})\cdot\bar{Z}$$

$$= (X+Y)\bar{Z}$$

$$= X\bar{Z}+Y\bar{Z}.$$

$$= X(Y+\bar{Y})\bar{Z}+(X+\bar{X})Y\bar{Z} \qquad (\because A+\bar{A} = 1).$$

$$= XY\bar{Z}+X\bar{Y}\bar{Z}+XY\bar{Z}+\bar{X}Y\bar{Z}.$$

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Q5 (b) Convert the standard SOP expression obtain in part(a) to standard POS form.

Ans Solution.

Demorgan's

$(x+y)' = x'y'$.

$(xy)' = x'+y'$.

Apply demorgan's Law.

$\rightarrow (A') = (xz' + yz')'$

$A' = (xz')'(yz')'$

$A' = (x'+z)(y'+z)$.

$= x'y' + y'z + x'z + z \cdot z$

$A' = x'y' + y'z + x'z$.

again apply demorgan's Law

$(A')' = (x'y' + y'z + xz)'$.

$A = (x'y')'(y'z)(x'z)'$.

$A = (x+y)(y+z')(x+z')$.

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Q5 (c) Develope a single truth table for the standard SOP & standard POS expression obtain in part (a) & part (B).

Ans

X	Y	Z	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

1 shows SOP terms.

$$\Sigma = (2,4,6)$$

0 shows POS terms.

$$\Pi (0,1,3,5,7).$$

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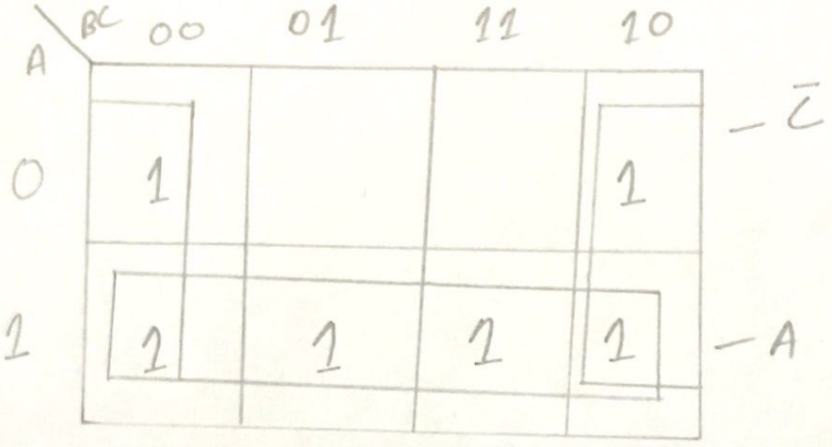
Q6 Use a karanaugh map to find minimum SOP form the following.

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

Solution

$X = \bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}B\bar{C} + AB\bar{C} + ABC + A\bar{B}C$.
$000 \quad 100 \quad 010 \quad 110 \quad 111 \quad 101$.



SOP form = $X = A + \bar{C}$.

Q6 (b) Determine minimum Pos from the karanaugh map used in part (a).

Ans $\bar{A}\bar{B}\bar{C} + A\bar{B}\bar{C} + \bar{A}B\bar{C} + AB\bar{C} + ABC + A\bar{B}C$.
$111 + 011 + 101 + 001 + 000 + 010$.