Question No 1 (a)

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

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TRUTH TABLE

A	B	C	$\bar{A}$	$\bar{B}$	$\bar{C}$	$\bar{A}B\bar{C}$	$\bar{A}\bar{B}\bar{C}$	$A\bar{B}\bar{C}$	$\bar{A}B\bar{C}+\bar{A}\bar{B}\bar{C}+\bar{A}BC+A\bar{B}\bar{C}$
0	0	0	1	1	1	0	1	0	1
0	0	1	1	1	0	0	0	0	0
0	10	0	1	0	1	1	0	0	1
0	1	1	1	0	0	0	0	0	0
1	0	0	0	1	1	0	0	1	1
1	0	1	0	1	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0
1	1	1	0	0	0	0	0	0	0
									0

Simplifying the Equation

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

$\because A+\bar{A}=1$

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

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

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

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

Truth Table

A	B	C	$\bar{A}$	$\bar{B}$	$\bar{C}$	$\bar{A}+\bar{B}$	$\bar{C}(\bar{A}+\bar{B})$
0	0	0	1	1	1	1	1
0	0	1	1	1	0	1	0
0	1	0	1	0	1	1	1
0	1	1	1	0	0	1	0
1	0	0	0	1	1	1	1
1	0	1	0	1	0	1 0	0
1	1	0	0	0	1	0	0
1	1	1	0	0	0	0	0

Hence Proved

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

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Question # 1 (b)

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

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Solution

Drawing the Truth Table

A	B	C	D	$\bar{A}$	$\bar{B}$	$\bar{C}$	$\bar{D}$	$A\bar{B}C$	$\bar{A}B\bar{C}\bar{D}$	$\bar{A}C$	$\bar{A}BD$	$\overline{\bar{A}BD}$	$\bar{A}C \cdot \overline{\bar{A}BD}$	$A\bar{B}C + \bar{A}B\bar{C}\bar{D} + \bar{A}C \ldots$
0	0	0	0	1	1	1	1	0	0	0	0	1	0	0
0	0	0	1	1	1	1	0	0	0	0	0	1	0	0
0	0	1	0	1	1	0	1	0	0	1	0	1	1	1
0	0	1	1	1	1	0	0	0	0	1	0	1	1	1
0	1	0	0	1	0	1	1	0	1	0	0	1	0	1
0	1	0	1	1	0	1	0	0	0	0	1	0	0	0
0	1	1	0	1	0	0	1	0	0	1	0	1	1	1
0	1	1	1	1	0	0	0	0	0	1	1	0	0	0
1	0	0	0	0	1	1	1	0	0	0	0	1	0	0
1	0	0	1	0	1	1	0	0	0	0	0	1	0	0
1	0	1	0	0	1	0	1	1	0	0	0	1	0	1
1	0	1	1	0	1	0	0	1	0	0	0	1	0	1
1	1	0	0	0	0	1	1	0	0	0	0	1	0	0
1	1	0	1	0	0	1	0	0	0	0	0	1	0	0
1	1	1	0	0	0	0	1	0	0	0	0	1	0	0
1	1	1	1	0	0	0	0	0	0	0	0	1	0	0

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Simplifying the Boolean Expression

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$$X = A\overline{B}C + \overline{A}B\overline{C}\overline{D} + \overline{A}C(\overline{\overline{A}BD})$$

Sol: Let $Y = \overline{A}$, $Z = BD$

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

$$= A\overline{B}C + \overline{A}B\overline{C}\overline{D} + \overline{A}C(\overline{Y} + \overline{Z})$$

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

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

$$= A\overline{B}C + \overline{A}B\overline{C}\overline{D} + \overline{A}C \cdot A + \overline{A}C(\overline{B} + \overline{D})$$ $\boxed{\because \overline{A}A = 0}$

$$= A\overline{B}C + \overline{A}B\overline{C}\overline{D} + 0 + \overline{A}C\overline{B} + \overline{A}C\overline{D}$$

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

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

$$= \overline{B}C(A + \overline{A}) + \overline{A}\overline{D}(B\overline{C} + C)$$ $\boxed{\because A + \overline{A} = 1}$

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

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

$$\boxed{X = \overline{B}C + \overline{A}\overline{D}(B\overline{C} + C)}$$

Now Truth Table to check Equation.

Scanned with CamScanner

Q.

A	B	C	D	$\bar{A}$	$\bar{B}$	$\bar{C}$	$\bar{D}$	$\bar{B}C$	$\bar{A}\bar{D}$	$B\bar{C}$	$B\bar{C}+C$	$\bar{A}\bar{D}(B\bar{C}+C)$	$\bar{B}C+\bar{A}\bar{D}(B\bar{C}+C)$
0	0	0	0	1	1	1	1	0	1	0	0	0	0
0	0	0	1	1	1	1	0	0	0	0	0	0	0
0	0	1	0	1	1	0	1	1	1	0	1	1	1
0	0	1	1	1	1	0	0	1	0	0	1	0	1
0	1	0	0	1	0	1	1	0	1	1	1	1	1
0	1	0	1	1	0	1	0	0	0	1	1	0	0
0	1	1	0	1	0	0	1	0	1	0	1	1	1
0	1	1	1	1	0	0	0	0	0	0	1	0	0
1	0	0	0	0	1	1	1	0	0	0	0	0	0
1	0	0	1	0	1	1	0	0	0	0	0	0	0
1	0	1	0	0	1	0	1	1	0	0	1	0	1
1	0	1	1	0	1	0	0	1	0	0	1	0	1
1	1	0	0	0	0	1	1	0	0	1	1	0	0
1	1	0	1	0	0	1	0	0	0	1	1	0	0
1	1	1	0	0	0	0	1	0	0	0	1	0	0
1	1	1	1	0	0	0	0	0	0	0	1	0	0

Hence Proved

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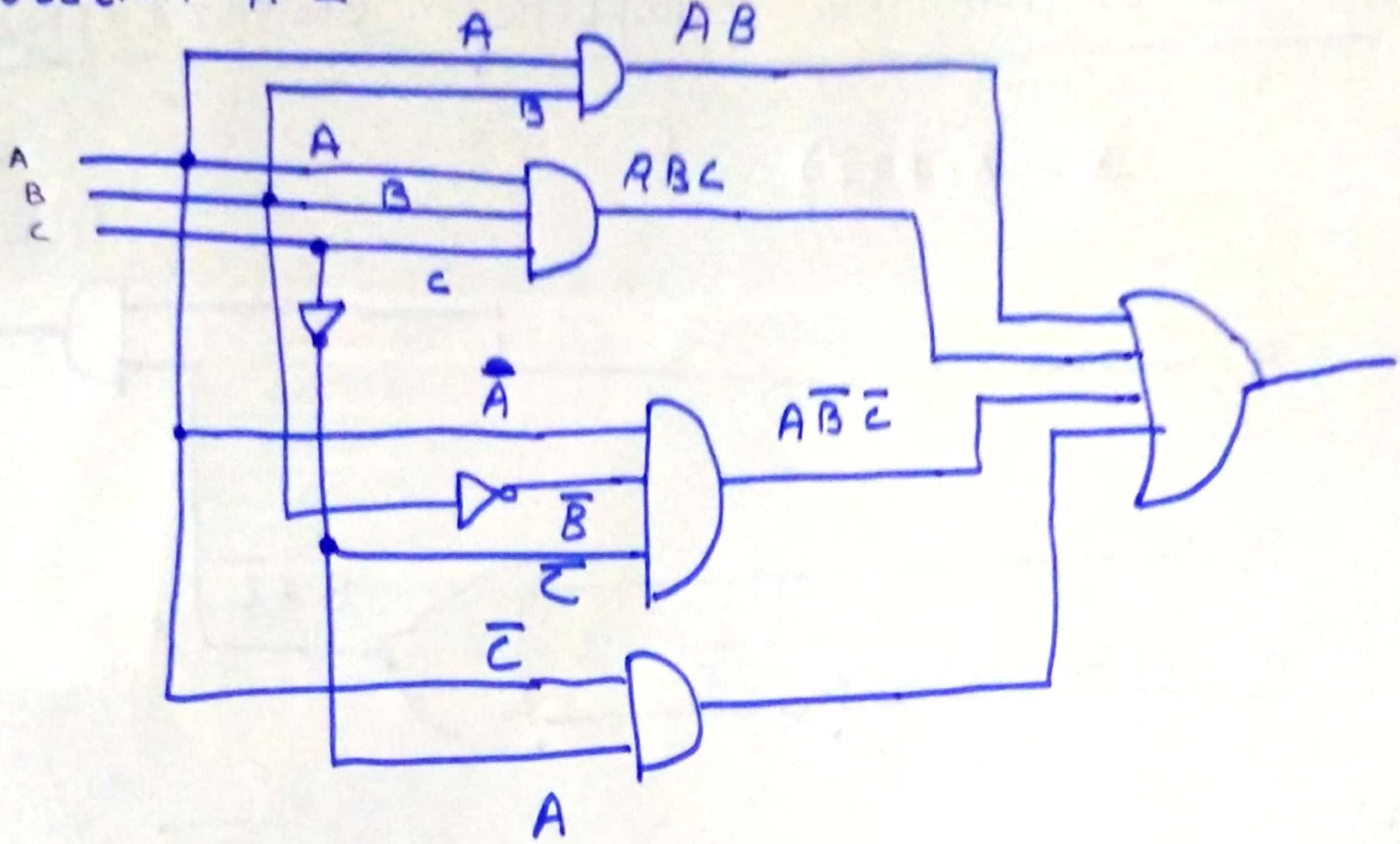
Question #2



Boolean Expression for the Circuit

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

$$= AB(1+C) + A\overline{C}(\overline{B}+1)$$

$$= AB(1) + A\overline{C}(1)$$

$$= AB + A\overline{C}$$

$$\boxed{X = A(B+\overline{C})}$$

$1 + C = 1$

$\overline{B} + 1 = 1$

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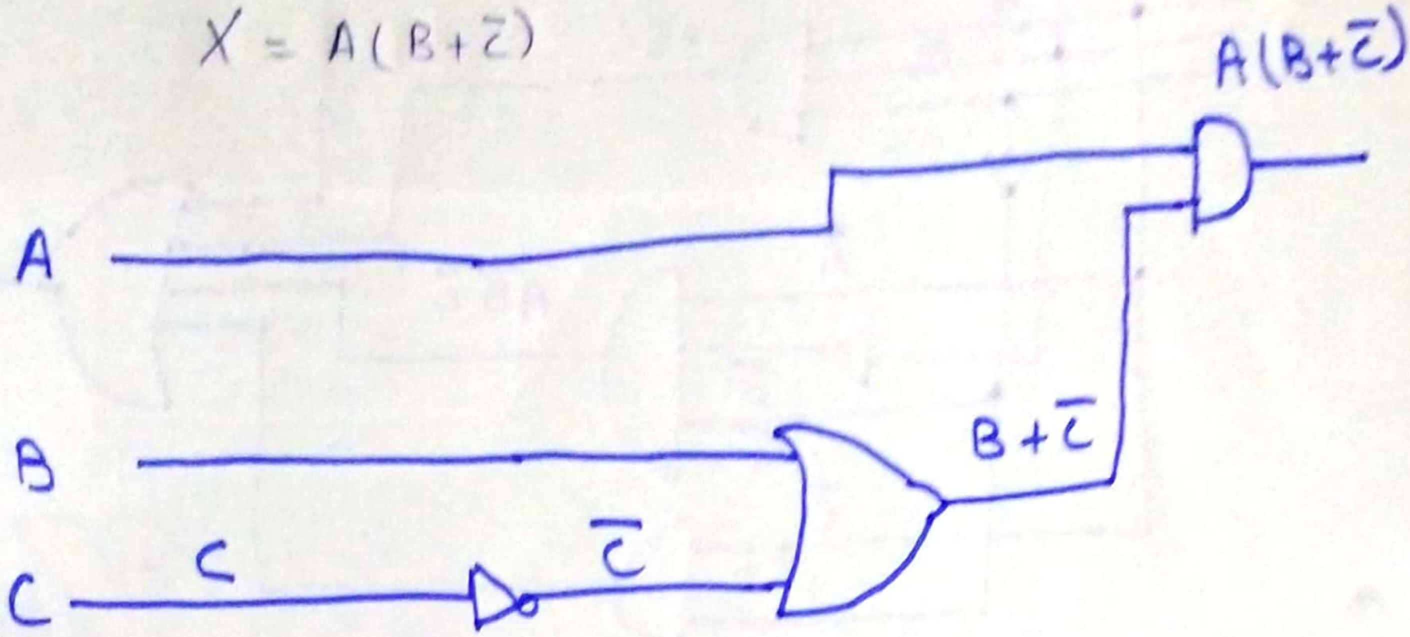
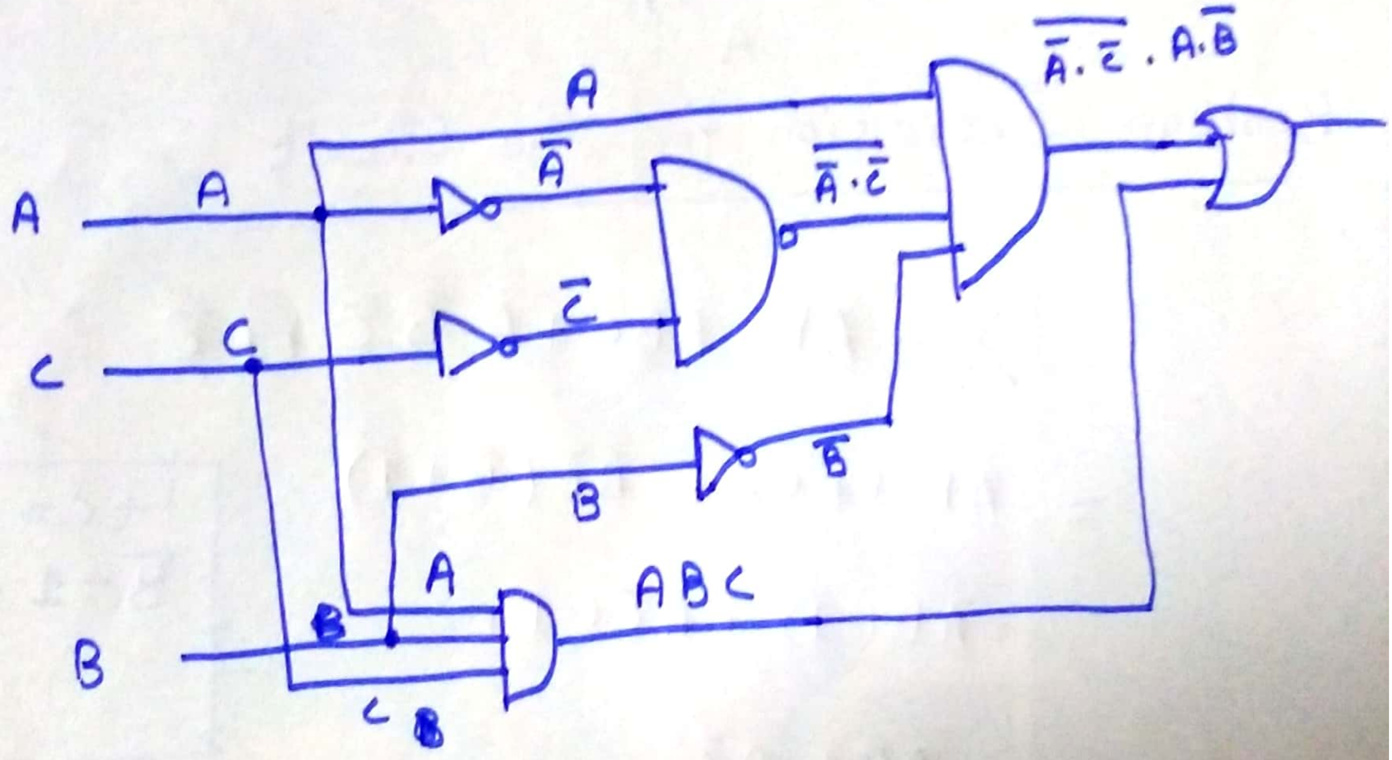
Circuit Diagram For Simplified Boolean Expression

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



(b)



Boolean Expression

$$\boxed{X = \overline{\bar{A}\,\bar{C}} \cdot A\bar{B} + ABC}$$

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Simplifying the Boolean Expression

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

Let $Y = \bar{A}$, $Z = \bar{C}$

Apply De-Morgras Law

$$= \overline{YZ} \cdot A\bar{B} + ABC$$

$$= (\bar{Y} + \bar{Z})\, A\bar{B} + ABC \qquad (\bar{\bar{A}} = A)$$

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

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

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

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

$$\cancel{= A\bar{B}(1 + C) + ABC}$$

$$\cancel{= A\bar{B} + ABC}$$

$$\cancel{\boxed{X = A(\bar{B} + BC)}}$$

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

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

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

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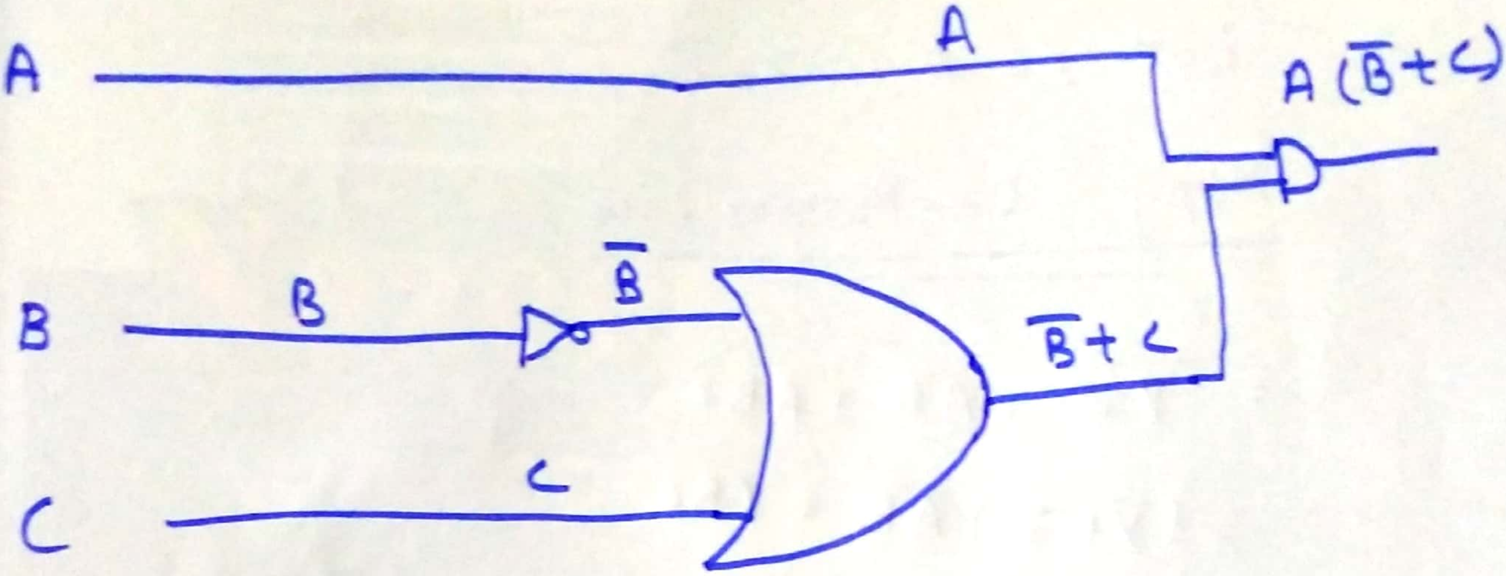
Circuit Diagram

$$\cancel{\boxed{X = A(\overline{B} + BC)}}$$

$$\boxed{X = A(\overline{B} + C)}$$



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