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Section:
BS(CS)-2D.

Question #2

a)

Boolean expression:

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

Simplified expression:

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

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

As we know that

$$A+1 = 1 \text{, so.}$$

$$AB(1) + A\bar{C}(1)$$

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

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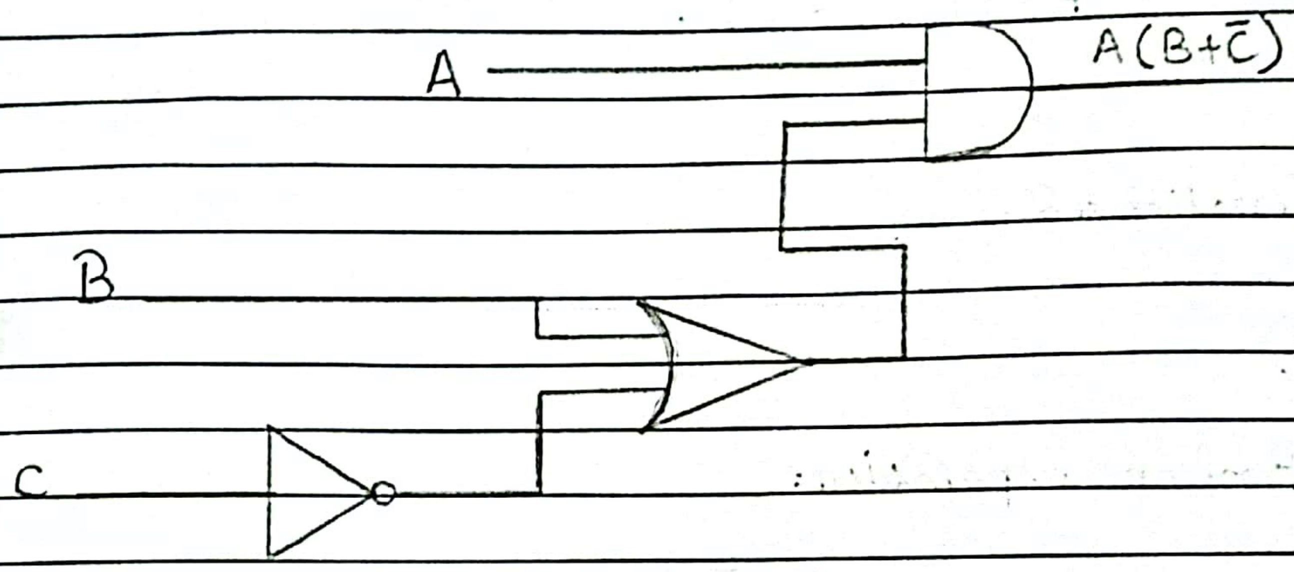
$AB + A\bar{C}$

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

Logic circuit:



b)

Boolean expression:

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

Simplified expression:

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

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

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

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

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

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

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

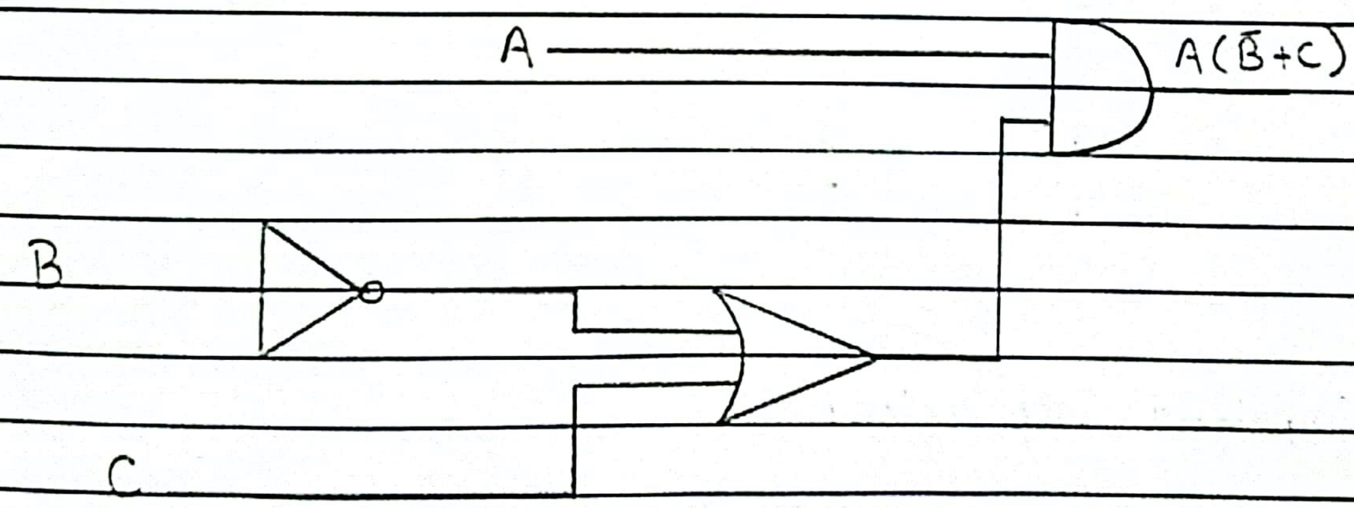
$AC(B + \bar{B}) + A\bar{B}$

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

$AC + A\bar{B}$

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

Logic circuit:



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

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

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

$A\bar{B}\bar{C} = 100$

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

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

Simplified expression:

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

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

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

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

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

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

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

$\bar{C}(\overline{AB})$

$\overline{[C+(AB)]}$

A	B	C	A·B	C+(A·B)	$\overline{[C+(A\cdot B)]}$
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	0	1
0	1	1	0	1	0
1	0	0	0	0	1
1	0	1	0	1	0
1	1	0	1	1	0
1	1	1	1	1	0

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

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

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

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

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

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

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

$A\bar{B}C + \bar{A}B\bar{C}\bar{D} + (0)C + \bar{A}\bar{B}C + \bar{A}C\bar{D}$ $(\because \bar{A}\cdot A = 0)$.

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

Now we see that eq (1) is in SOP form but not in standard SOP and to write the truth table we have to convert it into Std. SOP form, so

Domain = $\{A, B, C, D\}$

$A\bar{B}C$:

$A\bar{B}C \times 1$

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

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

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

$\bar{A}\bar{B}C \times 1$

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

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

$\bar{A}C\bar{D}$:

$$\bar{A}C\bar{D} \times 1$$

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

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

Now putting the values in eq ①, we get:

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

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

Simplified expression:

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

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

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

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

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

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

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

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

Truth table is on next page!

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