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Section 2E2 BSCS DLD LAB 06

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Question # 1

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

taking double complement

$$\begin{aligned} \text{out} &= \overline{(A+B+C+\bar{D}) + (A+B+\bar{C}+D) + (A+\bar{B}+C+\bar{D}) + (A+\bar{B}+\bar{C}+D) + (\bar{A}+\bar{B}+\bar{C}+D)} \\ &\quad + \overline{(\bar{A}+B+C+\bar{D}) + (A+\bar{B}+\bar{C}+D)} \\ &= \bar{A}\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}B\bar{C}D + \bar{A}B\bar{C}\bar{D} + A\bar{B}\bar{C}D + A\bar{B}C\bar{D} + A\bar{B}C\bar{D} + A\bar{B}C\bar{D} \\ &= \bar{A}\bar{B}\bar{C}D + A\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D} + \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + A\bar{B}C\bar{D} + A\bar{B}C\bar{D} \\ &= \bar{B}\bar{C}D(\bar{A}+A) + \bar{A}C\bar{D}(\bar{B}+B) + \bar{A}B\bar{C}D + A\bar{C}\bar{D}(\bar{B}+\bar{B}) \\ &= \bar{B}\bar{C}D + \bar{A}C\bar{D} + \bar{A}B\bar{C}D + A\bar{C}\bar{D} \\ &= \bar{B}\bar{C}D + \bar{A}B\bar{C}D + \bar{A}C\bar{D} + A\bar{C}\bar{D} \\ &= \bar{C}D(\bar{B} + \bar{A}B) + \bar{C}\bar{D}(\bar{A} + A) \\ &= \bar{C}D(\bar{B} + B)(\bar{B} + \bar{A}) + \bar{C}\bar{D} \\ &= \bar{C}D\bar{B} + \bar{C}D\bar{A} + \bar{C}\bar{D} \\ &= \overline{C+D+B} \cdot \overline{C+D+A} \cdot \overline{C+D} \\ &= (C+\bar{D}+\bar{B})(C+\bar{D}+\bar{A})(\bar{C}+D) \quad \text{final answer} \end{aligned}$$

Question #2

(a). $Z = A \cdot B$

$$\begin{aligned} &= \overline{\overline{A \cdot B}} \\ &= \overline{\overline{A \cdot B} \cdot \overline{A \cdot B}} = \overline{\overline{A \cdot B}} = A \cdot B \end{aligned}$$

(b). $X = A + B$

$$\begin{aligned} \overline{\overline{X}} &= \overline{\overline{A + B}} \\ &= \overline{\overline{A} \cdot \overline{B}} \end{aligned}$$

(c). $X \text{ NOR}$

$$F = XY + \overline{XY}$$

$$\begin{aligned} \overline{F} &= \overline{\overline{XY} \cdot XY} \\ &= \overline{\overline{XY} \cdot XY} \end{aligned}$$

Question #3

(a). $Z = A \cdot B$

$$\overline{\overline{Z}} = \overline{\overline{A + B}}$$

(b). $X = A + B$

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

(c). $X \text{ OR}$

$$F = X\overline{Y} + \overline{X}Y$$

$$\begin{aligned} \overline{F} &= \overline{X\overline{Y} + \overline{X}Y} = \overline{X\overline{Y}} \cdot \overline{\overline{X}Y} \\ &= (\overline{X} + Y) \cdot (X + \overline{Y}) = (\overline{X} + Y) + (X + \overline{Y}) \end{aligned}$$





Question # 4

$$F(A, B, C, D) = \sum m(2, 4, 12, 14)$$

(a). Truth table

				min term Boolean Expression		F
A	B	C	D	Index	$\bar{A}\bar{B}\bar{C}\bar{D}$ $\bar{A}\bar{B}\bar{C}\bar{D}$	
0	0	0	0	0	$\bar{A}\bar{B}\bar{C}\bar{D}$	0
0	0	0	1	1	$\bar{A}\bar{B}\bar{C}D$	0
0	0	1	0	2	$\bar{A}\bar{B}C\bar{D}$	1
0	0	1	1	3	$\bar{A}\bar{B}CD$	0
0	1	0	0	4	$\bar{A}B\bar{C}\bar{D}$	1
0	1	0	1	5	$\bar{A}B\bar{C}D$	0
0	1	1	0	6	$\bar{A}BC\bar{D}$	0
0	1	1	1	7	$\bar{A}BCD$	0
1	0	0	0	8	$A\bar{B}\bar{C}\bar{D}$	0
1	0	0	1	9	$A\bar{B}\bar{C}D$	0
1	0	1	0	10	$A\bar{B}C\bar{D}$	0
1	0	1	1	11	$A\bar{B}CD$	0
1	1	0	0	12	$AB\bar{C}\bar{D}$	1
1	1	0	1	13	$AB\bar{C}D$	0
1	1	1	0	14	$ABC\bar{D}$	1
1	1	1	1	15	$ABCD$	0

②.

	$\bar{C}\bar{D}$	$\bar{C}D$	CD	$C\bar{D}$
$\bar{A}\bar{B}$	m_0	m_1	m_3	m_2 
$\bar{A}B$	m_4 	m_5	m_7	m_6
AB	m_{12} 	m_{13}	m_{15}	m_{14} 
AB	m_8	m_9	m_{11}	m_{10}

$$= \cancel{AB\bar{D}} + \cancel{\bar{A}B\bar{C}\bar{D}} +$$

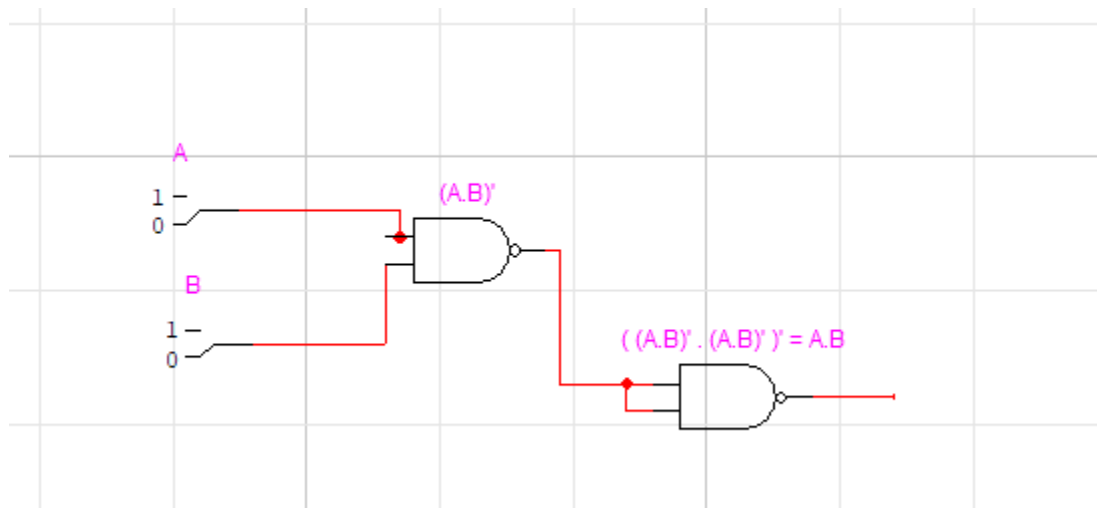
$$F_1 = AB\bar{D} + B\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D}$$

③. using only NAND gates! (final Answer).

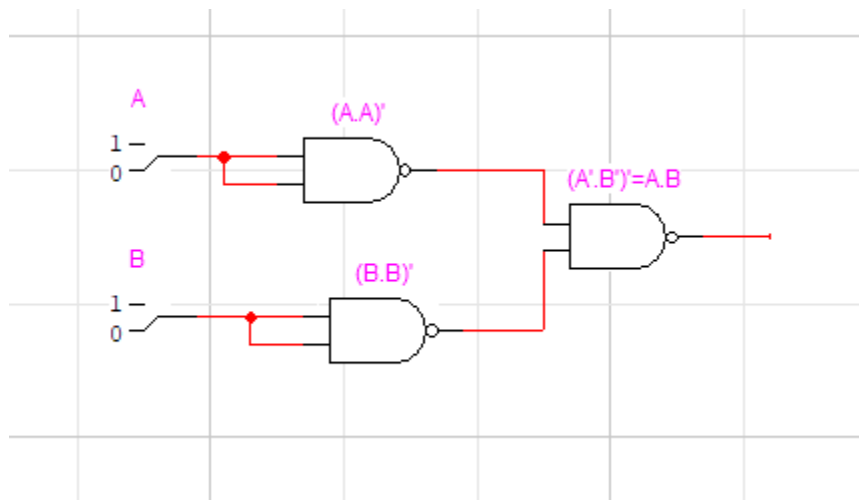
$$\begin{aligned} \bar{F}_1 &= \overline{AB\bar{D} + B\bar{C}\bar{D} + \bar{A}\bar{B}C\bar{D}} \\ &= \overline{AB\bar{D} \cdot B\bar{C}\bar{D} \cdot \bar{A}\bar{B}C\bar{D}} \end{aligned}$$

④

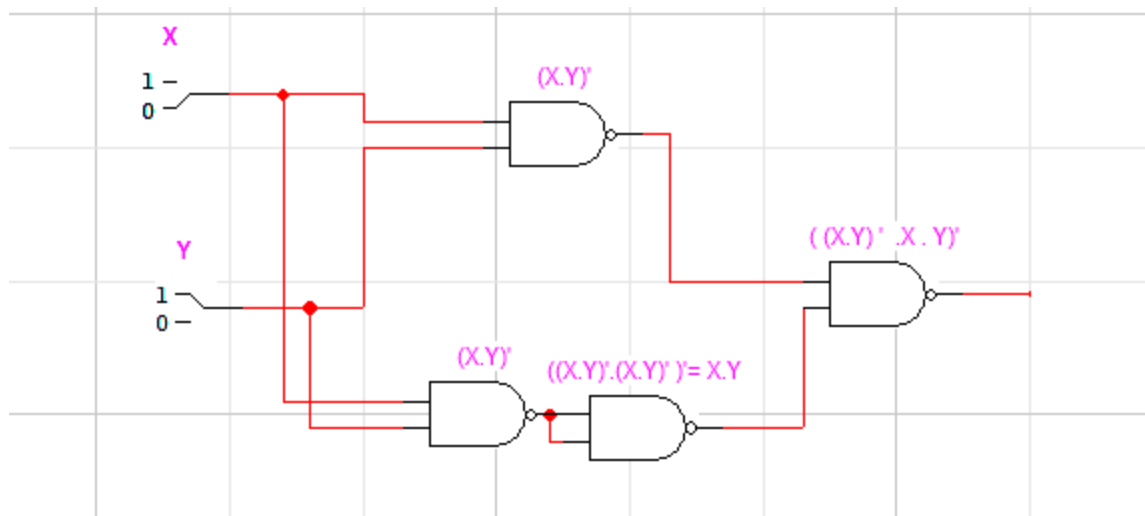
Q2 (a).



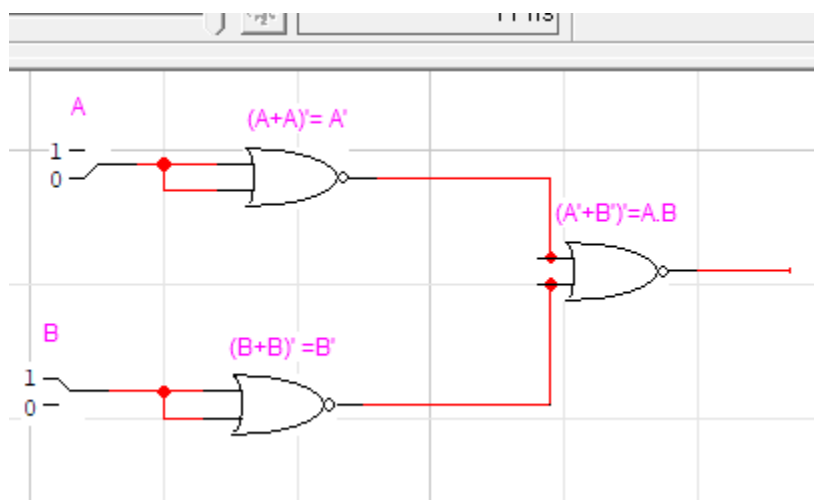
Q2(b).



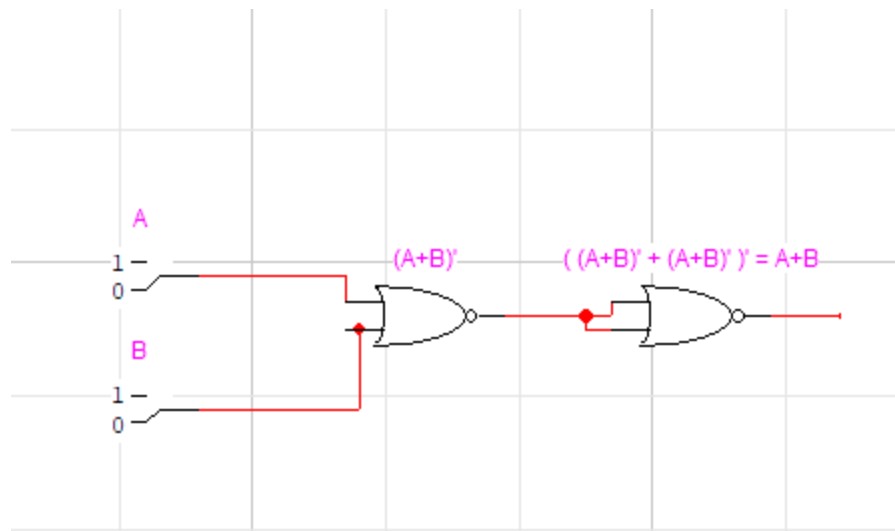
Q2(c).



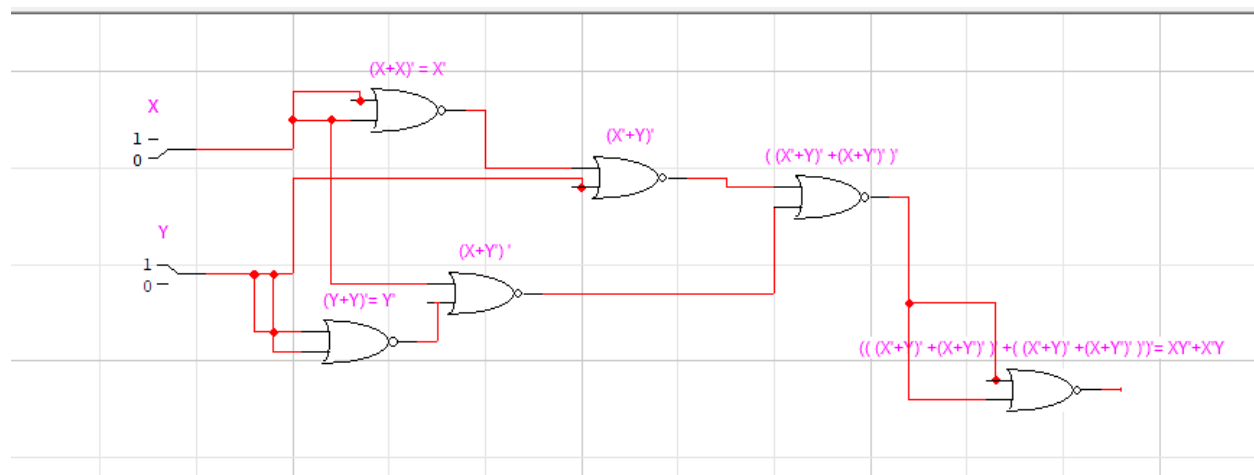
Q3(a).



Q3 (b).



Q3 (C).



Q4.

