Sheet 2 Solution
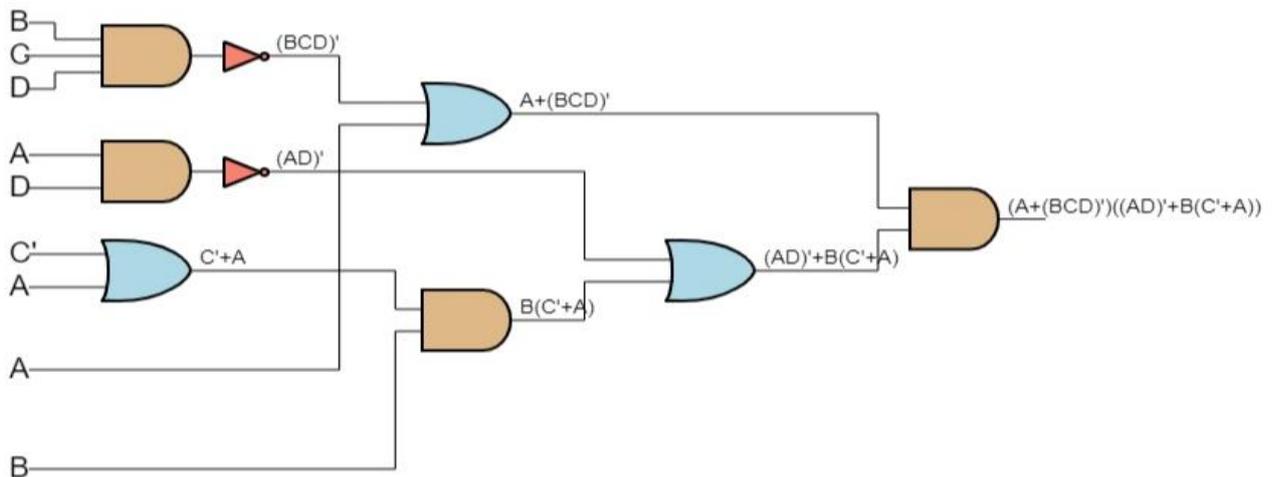
Q1. **Draw the Logic Circuit diagram for the following Boolean expression**
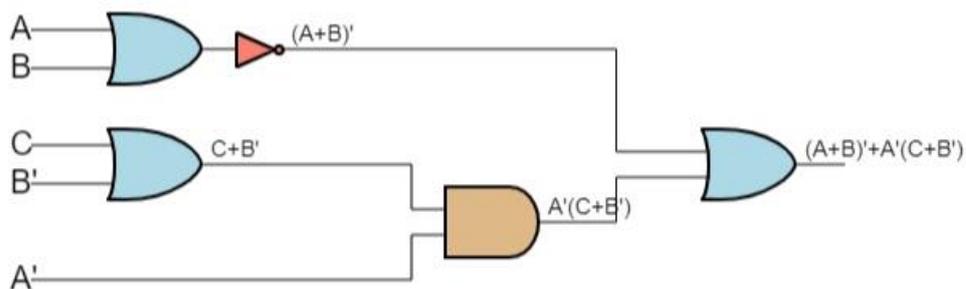
a) $F = \overline{AB} + \overline{C}(E + \overline{D})$
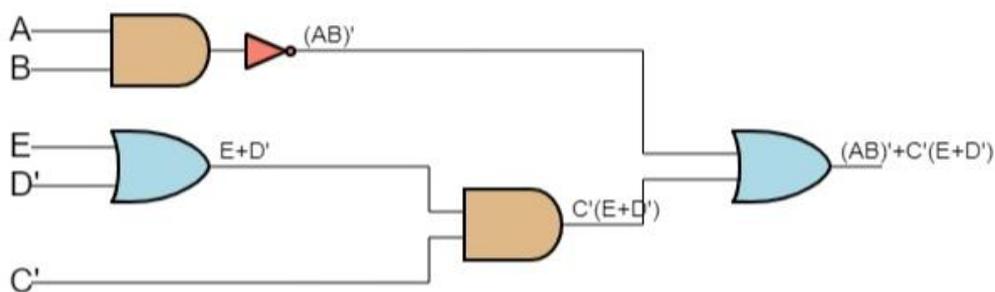
b) $F = [A + \overline{BCD}\,][\overline{AD} + B(\overline{C} + A)]$

c) $F = \overline{A + B} + \overline{A}.(C + \overline{B})$

Q2. **Find the Boolean expression output and the complement for the following circuits.**

$$X = \overline{A}B + A\overline{C} + ABC$$
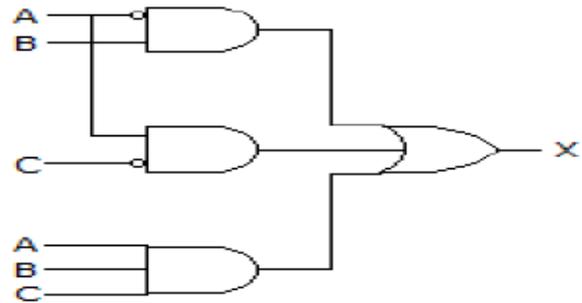
Fig. 1

$$X = A\overline{B}$$
$$Y = \overline{A \oplus B}$$
$$Z = \overline{A}B$$
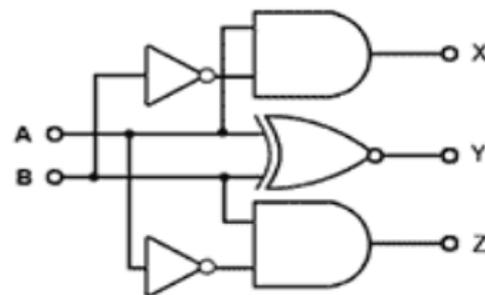
Fig. 2

$$D = \overline{(\overline{A}B + \overline{C})}(A + C)$$
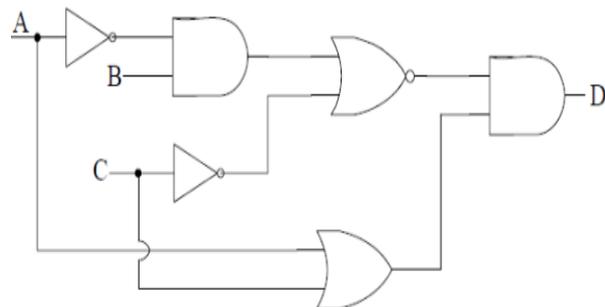
Fig. 3

$$Q = \overline{\left(A\overline{B} + \overline{(A + BC)}\right)}$$

Fig. 4

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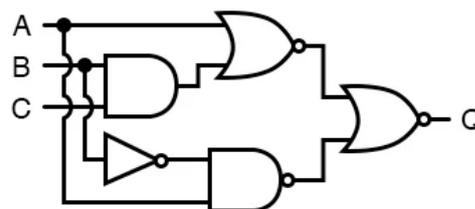
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TAs: Eng Rania helal, Eng. Asmaa Sherif , Eng.Abdullah

COURSE : Digital Engineering
Semester : Fall 2024-2025

Q3. Apply DeMorgan's Law to the following expressions:

a) $F = \overline{\overline{AB} + \overline{C}(E + \overline{D})}$

$$F = \overline{\overline{(AB)}} . \overline{\overline{C}(E + \overline{D})} = AB . \left(\overline{\overline{C}} + \overline{E + \overline{D}}\right)$$
$$= AB\left(C + \overline{E}\,\overline{\overline{D}}\right) = AB(C + \overline{E}\,D)$$

b) $F = \overline{(\overline{A + B})(A + \overline{A}\overline{B})}$

$$F = \overline{\overline{(A + B)}} + \overline{(A + \overline{A}\,\overline{B})} = (A + B) + \left(\overline{A} . \overline{(\overline{A}\,\overline{B})}\right)$$
$$= (A + B) + \left(\overline{A} . (\overline{\overline{A}} + \overline{\overline{B}})\right) = (A + B) + \overline{A}(A + B)$$

c) $F = \overline{\overline{A(B + C)} + \overline{C}E\overline{D}}$

$$F = \overline{\overline{A(B + C)}} . \overline{(\overline{C}\,E\overline{D})} = A(B + C) . \left(\overline{\overline{C}} + \overline{E} + \overline{\overline{D}}\right)$$
$$= A(B + C)(C + \overline{E} + D)$$

d) $F = \overline{\overline{(ABCE)}\,\overline{C}(E + \overline{D})}$

$$F = \overline{\overline{(ABCE)}} + \overline{\overline{C}} + \overline{(E + \overline{D})} = ABCE + C + \left(\overline{E} . \overline{\overline{D}}\right)$$
$$= ABCE + C + \overline{E} . D$$

Q4. Find the duals of the logic expressions in Q3.

a) $F = \overline{\overline{AB} + \overline{C}(E + \overline{D})}$

$$F^d = \overline{(\overline{A + B})\overline{C} + E\overline{D}}$$

b) $F = \overline{(\overline{A + B})(A + \overline{A}\overline{B})}$

$$F^d = \overline{\overline{AB} + A . (\overline{A} + \overline{B})}$$

c) $F = \overline{\overline{A(B + C)} + \overline{C}E\overline{D}}$

$$F^d = \overline{\overline{(A + BC)}(\overline{C} + E + \overline{D})}$$

d) $F = \overline{\overline{(ABCE)}\,\overline{C}(E + \overline{D})}$

$$F^d = \overline{\overline{A + B + C + E} + \overline{C} + E\overline{D}}$$

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Q5. Write down the truth table for a logic expressions in Q1 (c) and Q3 (b).

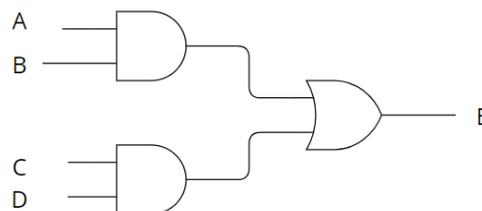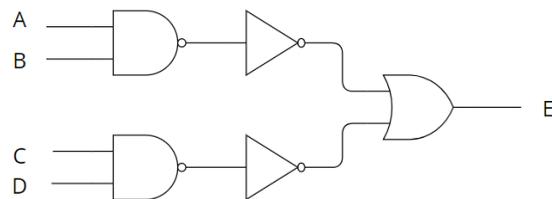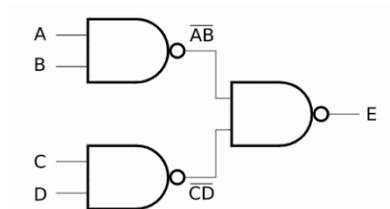a) $F = \overline{A + B} + \overline{A}.(C + \overline{B})$

A	B	C	F
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

b) $F = \overline{(A + B)(A + \overline{A}\overline{B})}$

A	B	F
0	0	0
0	1	1
1	0	1
1	1	1

Q6. Apply Graphical DeMorgan's Theorem to the following logic circuits:

a)

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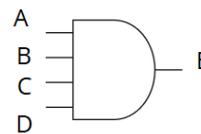**2nd Year**

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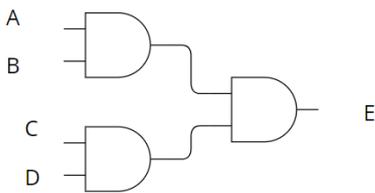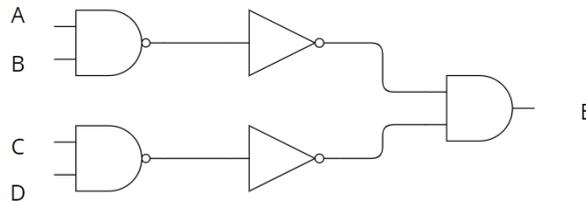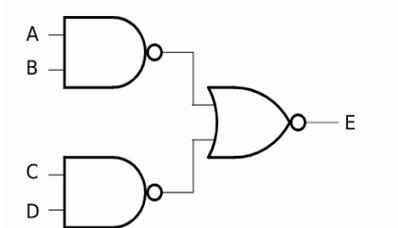جامعة برج العرب التكنولوجية

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b)

c)

d)