Assignment no 03: Chapter 4

Note: You can check the exercises after the book Chapter. In our assignment, we are using the 11th edition of "Digital Fundamentals" By Thomas L. Floyd"

8. **Identify** the Boolean rule(s) on which each of the following equalities is based:

(a) $\overline{\overline{AB} + \overline{CD}} + \overline{EF} = AB + CD + \overline{EF}$

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

(c) $A(BC + BC) + AC = A(BC) + AC$

(d) $AB(C + \overline{C}) + AC = AB + AC$

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

(f) $ABC + \overline{AB} + \overline{AB}CD = ABC + \overline{AB} + D$

10. **Apply** DeMorgan's theorems to each expression:

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

(b) $\overline{AB(CD + \overline{EF})}$

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

(d) $\overline{(\overline{A} + B + C + D)}\,\overline{(\overline{AB}\,\overline{CD})}$

(e) $\overline{A\overline{B}(CD + \overline{EF})(\overline{AB} + \overline{CD})}$

13. **Write** the Boolean expression for each of the logic circuits in Figure 4–57.

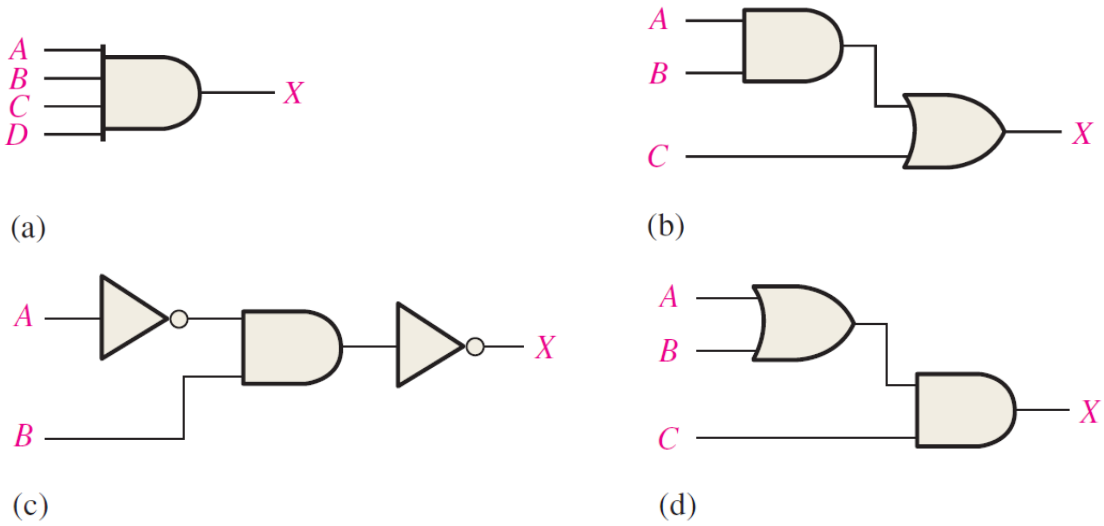


Figure 4–57

14. **Draw** the logic circuit represented by each of the following expressions:

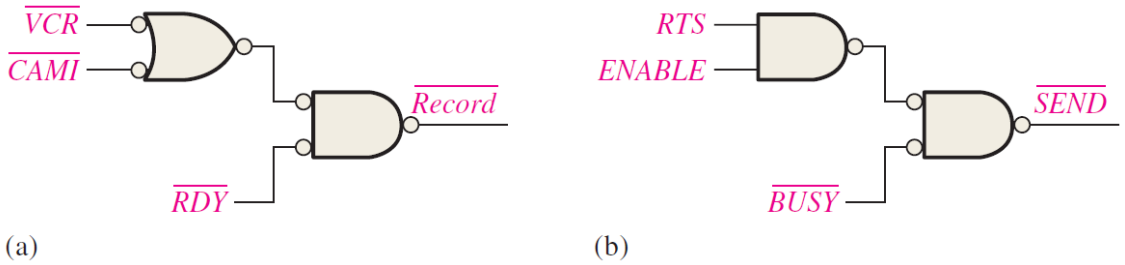
(a) $A + B + C + D$

(b) $ABCD$

(c) $A + BC$

(d) $ABC + D$

17. **Develop** the truth table for each of the circuits in Figure 4–58.



(a) (b)

Figure 4–58

18. **Construct** a truth table for each of the following Boolean expressions:

(a) $A + B + C$ **(b)** ABC **(c)** $AB + BC + CA$
(d) $(A + B)(B + C)(C + A)$ **(e)** $A\overline{B} + B\overline{C} + C\overline{A}$

20. Using Boolean algebra, **simplify** the following expressions:

(a) $(\overline{A} + B)(A + C)$ **(b)** $A\overline{B} + A\overline{B}C + A\overline{B}CD + A\overline{B}CDE$
(c) $BC + \overline{BCD} + B$ **(d)** $(B + \overline{B})(BC + BC\overline{D})$
(e) $BC + (\overline{B} + \overline{C})D + BC$

22. **Determine** which of the logic circuits in Figure 4–59 are equivalent.

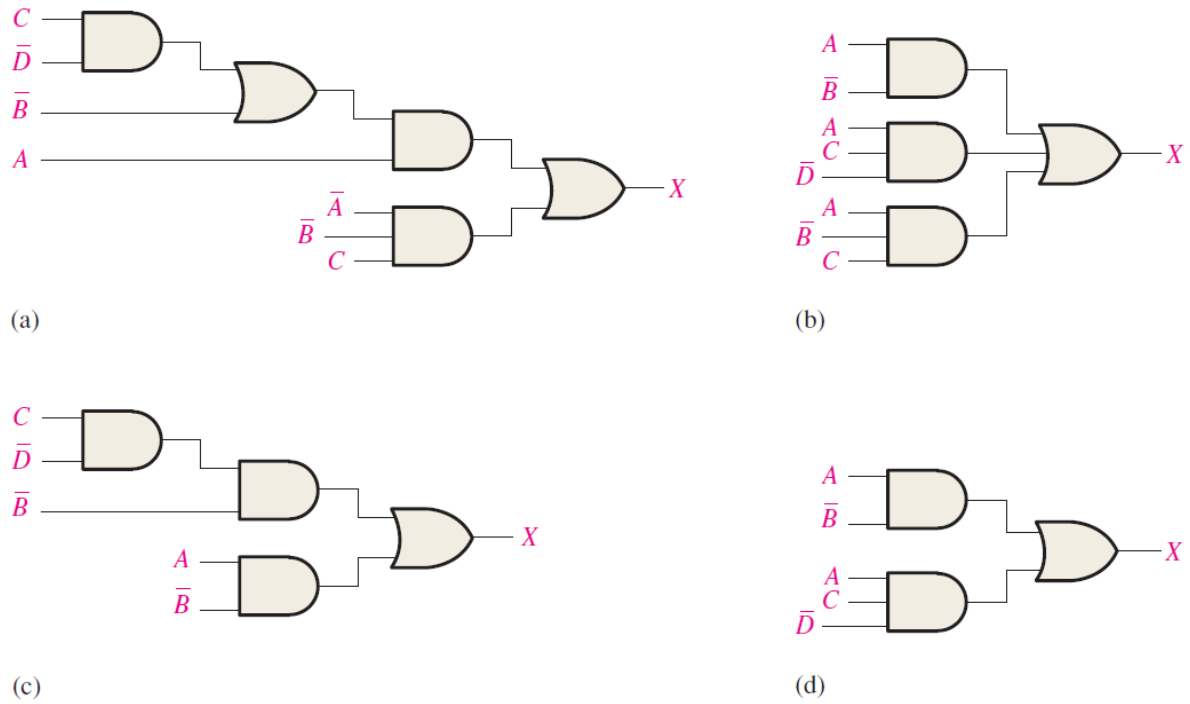


Figure 4–59

24. **Convert** the following expressions to sum-of-product (SOP) forms:

(a) $BC + DE(B\overline{C} + DE)$ **(b)** $BC(\overline{C}\,\overline{D} + CE)$ **(c)** $B + C[BD + (C + \overline{D})E]$

26. **Convert** each SOP expression in Problem 24 to standard SOP form.

28. **Determine** the binary value of each term in the standard SOP expressions from Problem 26.

30. **Convert** each standard SOP expression in Problem 26 to standard POS form.

32. **Develop** a truth table for each of the following standard SOP expressions:

(a) $A\overline{B}C\overline{D} + AB\overline{C}\,\overline{D} + \overline{A}\,\overline{B}CD + \overline{A}\,\overline{B}\,\overline{C}\,\overline{D}$

(b) $WXYZ + \overline{W}X\overline{Y}Z + W\overline{X}Y\overline{Z} + \overline{W}\,\overline{X}YZ + WX\overline{Y}\,\overline{Z}$

34. **Develop** a truth table for each of the standard POS expressions:

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

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

36. For each truth table in Table 4–15, **derive** a standard SOP and a standard POS expression.

TABLE 4–15

(a)

A B C	*X*
0 0 0	0
0 0 1	1
0 1 0	0
0 1 1	0
1 0 0	1
1 0 1	1
1 1 0	0
1 1 1	1

(b)

A B C	*X*
0 0 0	0
0 0 1	0
0 1 0	0
0 1 1	0
1 0 0	0
1 0 1	1
1 1 0	1
1 1 1	1

(c)

A B C D	*X*
0 0 0 0	1
0 0 0 1	1
0 0 1 0	0
0 0 1 1	1
0 1 0 0	0
0 1 0 1	1
0 1 1 0	1
0 1 1 1	0
1 0 0 0	0
1 0 0 1	1
1 0 1 0	0
1 0 1 1	0
1 1 0 0	1
1 1 0 1	0
1 1 1 0	0
1 1 1 1	0

(d)

A B C D	*X*
0 0 0 0	0
0 0 0 1	0
0 0 1 0	1
0 0 1 1	0
0 1 0 0	1
0 1 0 1	1
0 1 1 0	0
0 1 1 1	1
1 0 0 0	0
1 0 0 1	0
1 0 1 0	0
1 0 1 1	1
1 1 0 0	1
1 1 0 1	0
1 1 1 0	0
1 1 1 1	1

40. Use a Karnaugh map to **find** the minimum SOP form for each expression:

(a) $\overline{A}\,\overline{B}\,\overline{C} + \overline{A}\,\overline{B}C + A\overline{B}C$ **(b)** $AC(\overline{B} + C)$

(c) $\overline{A}(BC + B\overline{C}) + A(BC + B\overline{C})$ **(d)** $\overline{A}\,\overline{B}\,\overline{C} + A\overline{B}\,\overline{C} + \overline{A}B\overline{C} + AB\overline{C}$

44. Use a Karnaugh map to **reduce** each expression to a minimum SOP form:

(a) $A + B\overline{C} + CD$

(b) $\overline{A}\,\overline{B}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}\,\overline{C}D + ABCD + ABC\overline{D}$

(c) $\overline{A}B(\overline{C}\,\overline{D} + \overline{C}D) + AB(\overline{C}\,\overline{D} + \overline{C}D) + A\overline{B}\,\overline{C}D$

(d) $(\overline{A}\,\overline{B} + A\overline{B})(CD + C\overline{D})$

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

46. Use the Karnaugh map method to **implement** the minimum SOP expression for the logic function specified in truth Table 4–17.

TABLE 4–17

Inputs				Output
A	*B*	*C*	*D*	*X*
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

48. Use a Karnaugh map to **find** the minimum POS for each expression:

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

(b) $(X + \overline{Y})(\overline{X} + Z)(X + \overline{Y} + \overline{Z})(\overline{X} + \overline{Y} + Z)$

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

52. **Convert** each of the following POS expressions to minimum SOP expressions using a Karnaugh map:

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

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

54. **List** the minterms in the expression

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