



Program: BC (CS)
Subject: Digital Logic Design
Assignment Number: 03
Course Code: CSC-201
EDP Code: 102002077
Spring Semester 2020

- Q.1** Using Boolean notation, write an expression that is a 0 only when all of its variables (A , B , C , and D) are 0s.
- Q.2** Write an expression that is a 1 when one or more of its variables (A , B , C , D , and E) are 0s.
- Q.3** Write an expression that is a 0 when one or more of its variables (A , B , and C) are 0s.
- Q.4** Evaluate the following operations:
(a) $0 + 0 + 0 + 1$ **(b)** $1 \cdot 0 \cdot 1 \cdot 0$ **(c)** $1 \cdot 0 + 1 \cdot 0 + 0 \cdot 1 + 0 \cdot 1$
- Q.5** Find the values of the variables that make each product term 1 and each sum term 0.
(a) $\bar{A}\bar{B}C$ **(b)** $\bar{A} + \bar{B} + C$
- Q.6** Apply DeMorgan's theorems to the following:
(a) $\overline{\overline{ABC}(EFG) + \overline{\overline{HIJ}(KLM)}}$ **(b)** $\overline{\overline{\overline{A+B}(C+D)(E+F)(G+H)}}$

Q.7 Write the Boolean expression for each of the logic circuits in Figure 01.

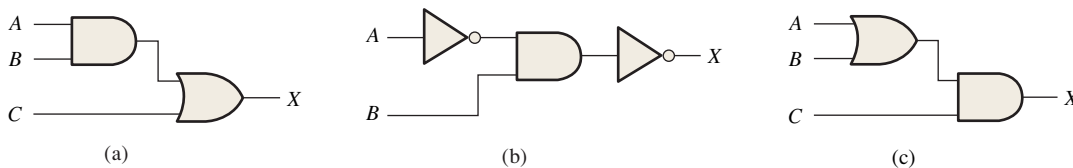


FIGURE 01

- Q.8** Draw the logic circuit represented by the following expression: $AB + \bar{A}\bar{B}$
- Q.9** **(a)** Draw a logic circuit for the case where the output, ENABLE, is HIGH only if the inputs, ASSERT and READY, are both LOW.
(b) Draw a logic circuit for the case where the output, HOLD, is HIGH only if the input, LOAD, is LOW and the input, READY, is HIGH.
- Q.10** Develop the truth table for each of the circuits in Figure 02.

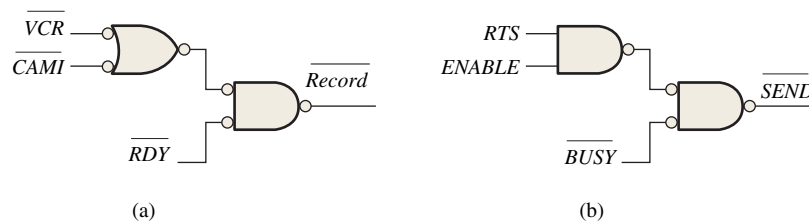


FIGURE 02

Q.11 Construct a truth table for each of the following Boolean expressions:

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

Q.12 Using Boolean algebra techniques, simplify the following expressions as much as possible:

(a) $A(A + B)$ (b) $A(A + \bar{A}B)$ (c) $BC + \bar{B}\bar{C}$
 (d) $A(A + \bar{A}B)$ (e) $\bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C}$ (f) $BC + (\bar{B} + C)D + BC$
 (g) $BCD[BC + \bar{D}(CD + BD)]$ (h) $\bar{A}\bar{B} + \bar{A}\bar{B}C + \bar{A}\bar{B}CD + \bar{A}\bar{B}CDE$

Q.13 Determine which of the logic circuits in Figure 03 are equivalent.

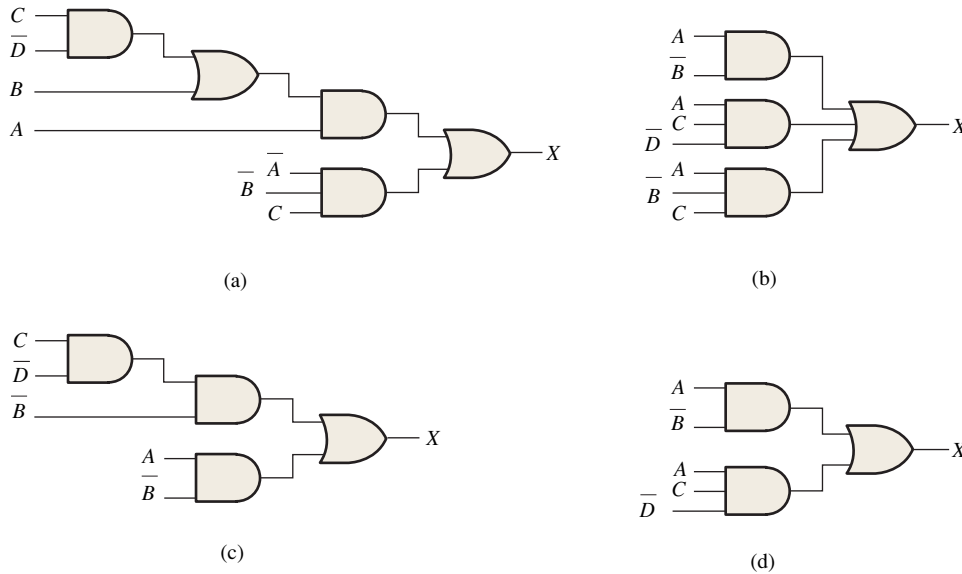


FIGURE 03

Q.14 Convert the following expressions to sum-of-product (SOP) forms:

(a) $(C + D)(A + \bar{D})$ (b) $(A + C)(CD + AC)$ (c) $B + C[BD + (C + \bar{D})E]$
 (d) $A(\bar{A}\bar{D} + C)$ (e) $BC + DE(\bar{B}\bar{C} + DE)$ (f) $BC(\bar{C}\bar{D} + CE)$

Q.15 Convert each SOP expression obtained in Q.14 to standard SOP form.

Q.16 Convert each standard SOP expression obtained in Q.15 to standard POS form.

Q.17 Develop a truth table for each standard SOP expression obtained in Q.15.

Q.18 Develop a truth table for each standard POS expression obtained in Q.16.

Q.19 Derive a standard SOP and a standard POS expression form truth table in Table 01.

Q.20 Use a Karnaugh map to find the minimum SOP form for each expression:

(a) $\bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}BC$ (b) $AC(\bar{B} + C)$
 (c) $\bar{A}(BC + B\bar{C}) + A(BC + B\bar{C})$ (d) $\bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}C + \bar{A}B\bar{C} + A\bar{B}\bar{C}$
 (e) $A + B\bar{C} + CD$ (f) $\bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + ABCD + ABC\bar{D}$
 (g) $\bar{A}\bar{B} + \bar{A}\bar{B} + \bar{C}\bar{D} + \bar{C}\bar{D}$ (h) $\bar{A}B(\bar{C}\bar{D} + \bar{C}D) + AB(\bar{C}\bar{D} + \bar{C}D) + \bar{A}\bar{B}\bar{C}\bar{D}$

- Q.21** Reduce the function specified in truth Table 02 to its minimum SOP form by using a Karnaugh map.
- Q.22** Use the Karnaugh map method to implement the minimum SOP expression for the logic function specified in truth Table 03.

Inputs				Output
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

Table 01

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

Table 02

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

Table 03

- Q.23** Use a Karnaugh map to find the minimum POS for each expression:

- (a) $(A + B + C)(\bar{A} + \bar{B} + \bar{C})(A + \bar{B} + C)$
 (b) $(X + \bar{Y})(\bar{X} + Z)(X + \bar{Y} + \bar{Z})(\bar{X} + \bar{Y} + Z)$
 (c) $A(B + \bar{C})(\bar{A} + C)(A + \bar{B} + C)(\bar{A} + B + \bar{C})$

- Q.24** For the function specified in Table 02, determine the minimum POS expression using a Karnaugh map.

- Q.25** Determine the minimum POS expression for the function in Table 03.

- Q.26** Convert each of the following POS expressions to minimum SOP expressions using a Karnaugh map:

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