Digital System Assignment 2

He Tianyang

March 26, 2024

Problem 1

Use algebraic method to simplify the logic function

$$Y = (\overline{A\overline{B} + \overline{A}B} \cdot C + A\overline{B}C)(AD + BC) \tag{1}$$

Solves:

$$\begin{aligned}
Y =& (\overline{A\overline{B} + \overline{A}B} \cdot C + A\overline{B}C)(AD + BC) \\
=& ((AB + \overline{A} \cdot \overline{B}) \cdot C + A\overline{B}C)(AD + BC) \\
=& (ABC + \overline{A} \cdot \overline{B}C)(AD + BC) \\
=& ABCD + \overline{B}CD + ABC + \overline{A}C \\
=& C(ABD + \overline{B}D + AB + \overline{A}) \\
=& C(AB + \overline{A} + \overline{B}D) \\
=& \boxed{AC(B + D)}
\end{aligned}$$

Problem 2

Simplify the logic function

$$Y(A, B, C, D) = \sum m(3, 4, 5, 7, 8, 9, 10, 11) \tag{2}$$

Constraint:

$$m_0 + m_1 + m_2 + m_{13} + m_{14} + m_{15} = 0 \tag{3}$$

Solves: Solving this by drawing the Karnaugh map, we get:

AB \ CD	00	01	11	10
00	×	×	1	×
01	1	1	1	
11		×	×	×
10	1	1	1	1

So we get:

$$Y = A\overline{B} + \overline{A}\,\overline{C} + \overline{A}CD \tag{4}$$

Problem 3

Solve the function Y

$$Y = (A\overline{C} + A\overline{B}C + \overline{A}BC) \oplus (AB\overline{C} + A\overline{B}C + \overline{ABC}) \tag{5}$$

Solves: drawing the Karnaugh map, we get:

A \ BC	00	01	11	10
0	1			
1		1		

So we get:

$$\boxed{Y = A\overline{B}C + \overline{A}BC}$$