

1 Exercise 2

Having the function in maxterms

$$f_1(A, B, C, D) = \prod (M_0, M_1, M_5, M_7, M_8, M_{10}, M_{14}, M_{15})$$

equivalent to

$$f_2(A, B, C, D) = \sum (m_2, m_3, m_4, m_6, m_9, m_{11}, m_{12}, m_{13})$$

using minterms, can be simplify by different ways and represented using logic gates.

1.1 Boolean Algebra

Using the Boolean algebra propertie

$$(A + B).(A + \overline{B}) = A \quad (1)$$

or

$$(AB) + (A\overline{B}) = A \quad (2)$$

the function could be simplify using (1):

$$\begin{aligned} f_1(A, B, C, D) &= (A + B + C + D).(A + B + C + \overline{D}).(A + \overline{B} + C + \overline{D}).(A + \overline{B} + \overline{C} + \overline{D}). \\ &\quad (\overline{A} + B + C + D).(\overline{A} + B + \overline{C} + D).(\overline{A} + \overline{B} + \overline{C} + D).(\overline{A} + \overline{B} + \overline{C} + \overline{D}) \\ &= (A + B + C).(A + \overline{B} + \overline{D}).(\overline{A} + B + D).(\overline{A} + \overline{B} + \overline{C}) \end{aligned}$$

Which in minterms would be, using (2):

$$\begin{aligned} f_2(A, B, C, D) &= (\overline{A}\overline{B}\overline{C}\overline{D}) + (\overline{A}\overline{B}CD) + (\overline{A}B\overline{C}\overline{D}) + (\overline{A}BC\overline{D}) + \\ &\quad (A\overline{B}\overline{C}D) + (A\overline{B}CD) + (AB\overline{C}\overline{D}) + (ABC\overline{D}) \\ &= (A\overline{B}D) + (\overline{A}B\overline{D}) + (\overline{A}\overline{B}C) + (ABC\overline{C}) \end{aligned}$$

1.2 Karnaugh Map

Karnaugh map is a easier way to simplify logic expresion when the functions are too complex or too large to handle, cause Karnaugh map gives a more representative view for a faster analisis for it to simplify.

		AB			
		00	01	11	10
CD	00	0	1	1	0
	01	0	0	1	1
	11	1	0	0	1
	10	1	1	0	0

Now grouping the colour groups we get that the function in minterms would be:

$$\begin{aligned}
 f_2(A, B, C, D) = & (A\overline{B}D) \text{ (Red)} \\
 & + (\overline{A}B\overline{D}) \text{ (Blue)} \\
 & + (\overline{A}BC) \text{ (Orange)} \\
 & + (AB\overline{C}) \text{ (Green)}
 \end{aligned}$$