

Electrónica III TP1

August 20, 2018

1 Ejercicio 4

| x_1 | x_2 | x_3 | x_4 | f_1 | f_2 | f_3 | f_4 |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |

Figure 1: Complemento a 2 de los bits de entrada

Si escribimos cada bit de salida en función de los minterminos de los bits de entrada, nos quedan las siguientes ecuaciones:

$$f_1(m_i) = m_1 + m_2 + m_3 + m_4 + m_5 + m_6 + m_7 + m_8$$

$$f_2(m_i) = m_1 + m_2 + m_3 + m_4 + m_9 + m_{10} + m_{11} + m_{12}$$

$$f_3(m_i) = m_1 + m_2 + m_5 + m_6 + m_9 + m_{10} + m_{13} + m_{14}$$

$$f_4(m_i) = m_0 + m_1 + m_3 + m_5 + m_7 + m_9 + m_{11} + m_{13} + m_{15}$$

Remplazando los valores de cada mintermino, quedan las siguientes formulas:

$$f_1(x_1; x_2; x_3; x_4) = \bar{x}_1\bar{x}_2\bar{x}_3x_4 + \bar{x}_1\bar{x}_2x_3\bar{x}_4 + \bar{x}_1\bar{x}_2x_3x_4 + \bar{x}_1x_2\bar{x}_3\bar{x}_4 + \bar{x}_1x_2\bar{x}_3x_4 + \bar{x}_1x_2x_3\bar{x}_4 + \bar{x}_1x_2x_3x_4 + x_1\bar{x}_2\bar{x}_3\bar{x}_4$$

$$f_2(x_1; x_2; x_3; x_4) = \bar{x}_1\bar{x}_2\bar{x}_3x_4 + \bar{x}_1\bar{x}_2x_3\bar{x}_4 + \bar{x}_1\bar{x}_2x_3x_4 + \bar{x}_1x_2\bar{x}_3\bar{x}_4 + x_1\bar{x}_2\bar{x}_3x_4 + x_1\bar{x}_2x_3\bar{x}_4 + x_1\bar{x}_2x_3x_4 + x_1x_2\bar{x}_3\bar{x}_4$$

$$f_3(x_1; x_2; x_3; x_4) = \bar{x}_1\bar{x}_2\bar{x}_3x_4 + \bar{x}_1\bar{x}_2x_3\bar{x}_4 + \bar{x}_1x_2\bar{x}_3x_4 + \bar{x}_1x_2x_3\bar{x}_4 + x_1\bar{x}_2\bar{x}_3x_4 + x_1\bar{x}_2x_3\bar{x}_4 + x_1x_2\bar{x}_3x_4 + x_1x_2x_3\bar{x}_4$$

$$f_4(x_1; x_2; x_3; x_4) = \bar{x}_1\bar{x}_2\bar{x}_3\bar{x}_4 + \bar{x}_1\bar{x}_2\bar{x}_3x_4 + \bar{x}_1\bar{x}_2x_3x_4 + \bar{x}_1x_2\bar{x}_3x_4 + \bar{x}_1x_2x_3x_4 + x_1\bar{x}_2\bar{x}_3x_4 + x_1\bar{x}_2x_3x_4 + x_1x_2\bar{x}_3x_4 + x_1x_2x_3x_4$$

Si simplificamos cada ecuación, se puede llegar a las siguientes expresiones:

$$f_1(x_1; x_2; x_3; x_4) = x_1\bar{x}_2\bar{x}_3\bar{x}_4 + \bar{x}_1(x_2 + x_3 + x_4)$$

$$f_2(x_1; x_2; x_3; x_4) = x_2\bar{x}_3\bar{x}_4 + \bar{x}_2(x_3 + x_4)$$

$$f_3(x_1; x_2; x_3; x_4) = x_3\bar{x}_4 + \bar{x}_3x_4$$

$$f_4(x_1; x_2; x_3; x_4) = x_4 + \bar{x}_1\bar{x}_2\bar{x}_3$$

Al intentar expresar dichas formulas en graficos de compuertas logicas, se consiguieron los siguientes:

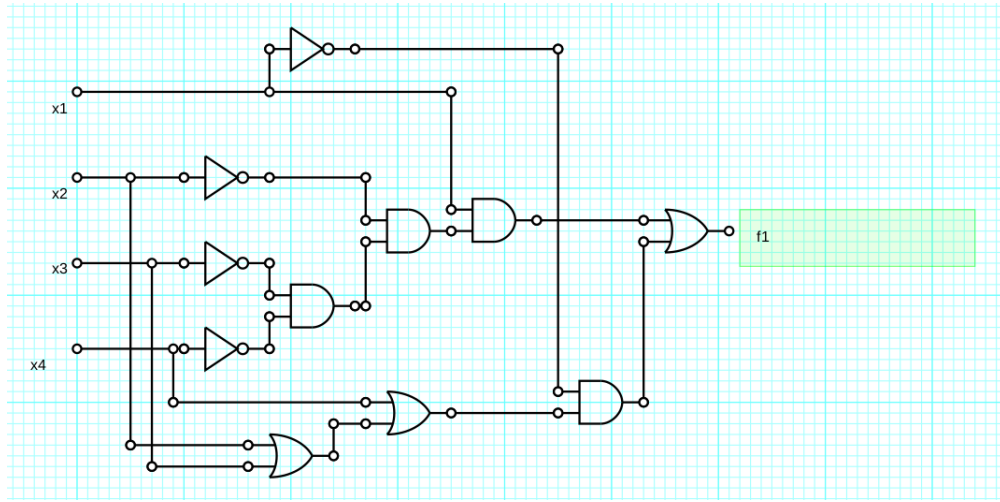


Figure 2: Grafico de compuertas logicas Bit 1

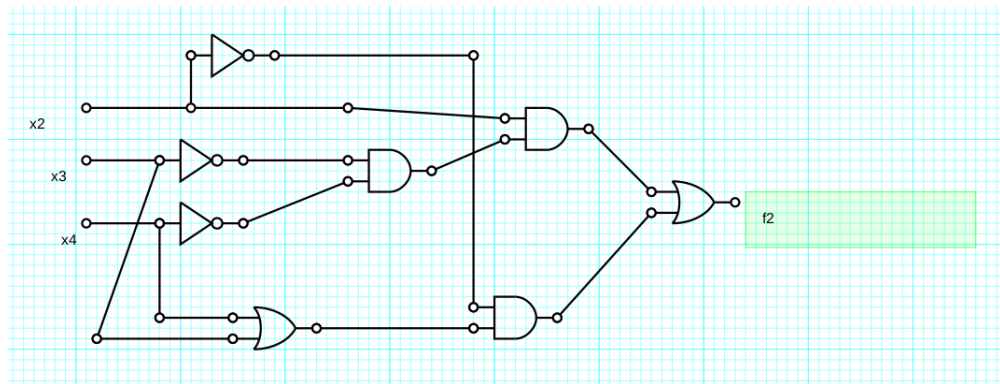


Figure 3: Grafico de compuertas logicas Bit 2

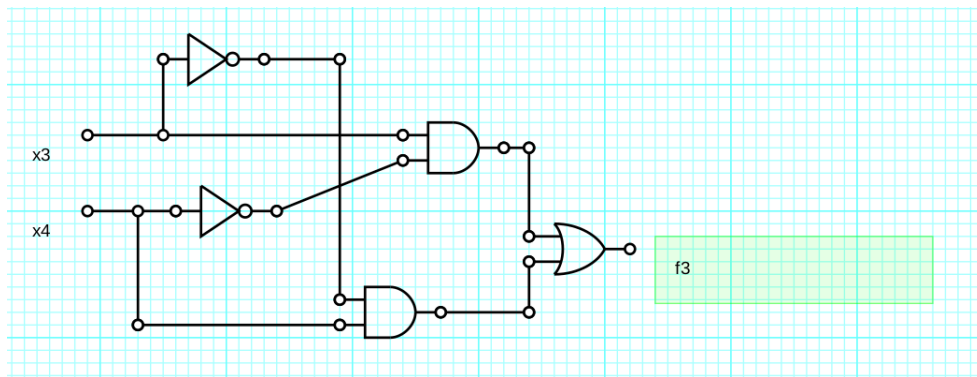


Figure 4: Grafico de compuertas logicas Bit 3

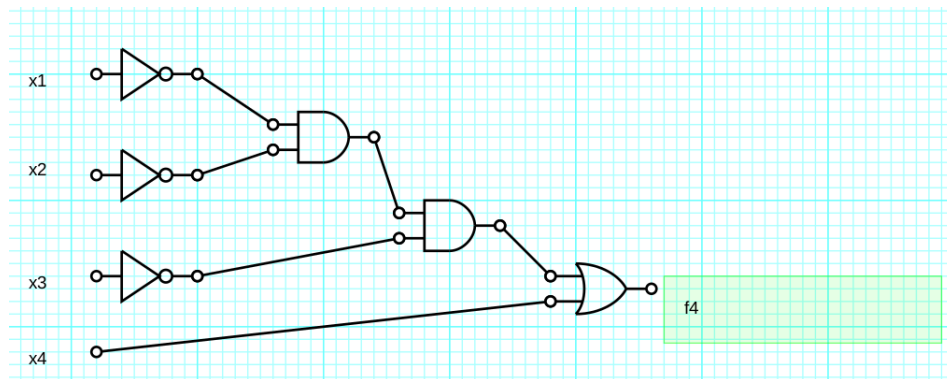


Figure 5: Grafico de compuertas logicas Bit 4