2.2: $(x + y) \cdot (x + \overline{y})$

$= x + (y \cdot \overline{y})$

$= x + 0$

$= x$

2.10: $\sum m(1,2,3,4,5,6,7)$

$= \overline{x_1 x_2} x_3 + \overline{x_1} x_2 \overline{x_3} + \overline{x_1} x_2 x_3 + x_1 \overline{x_2 x_3} + x_1 \overline{x_2} x_3 + x_1 x_2 \overline{x_3} + x_1 x_2 x_3$

$= x_2 x_3 (\overline{x_1} + x_1) + x_1 \overline{x_3} (\overline{x_2} + x_2) + \overline{x_2} x_3 (\overline{x_1} + x_1) + \overline{x_1} x_2 \overline{x_3}$

$= x_2 x_3 + x_1 \overline{x_3} + \overline{x_2} x_3 + \overline{x_1} x_2 \overline{x_3}$

$= x_2 (x_3 + \overline{x_1 x_3}) + x_1 \overline{x_3} + \overline{x_2} x_3$

$= x_2 (x_3 + \overline{x_1}) + x_1 \overline{x_3} + \overline{x_2} x_3$

$= x_2 x_3 + \overline{x_1} x_2 + x_1 \overline{x_3} + \overline{x_2} x_3$

$= x_3 (x_2 + \overline{x_2}) + \overline{x_1} x_2 + x_1 \overline{x_3}$

$= x_3 + \overline{x_1} x_2 + x_1 \overline{x_3}$ (use $x + \overline{x} y = x$)

$= x_3 + x_2 + x_1 = x_1 + x_2 + x_3$

2.12: $x_1 x_3 + x_1 \overline{x_2} + \overline{x_1} x_2 x_3 + \overline{x_1 x_2 x_3}$

$= x_3 (x_1 + \overline{x_1} x_2) + \overline{x_2} (x_1 + \overline{x_1 x_3})$

$= x_3 (x_1 + x_2) + \overline{x_2} (x_1 + \overline{x_3})$

$= x_1 x_3 + x_2 x_3 + x_1 \overline{x_2} + \overline{x_2 x_3}$ (use Consensus)

$= x_1 x_3 + x_2 x_3 + \overline{x_2 x_3}$

2.13: $x_1 \overline{x_2 x_3} + x_1 x_2 x_4 + x_1 \overline{x_2} x_3 \overline{x_4}$

$= x_1 \overline{x_2} (\overline{x_3} + x_3 \overline{x_4}) + x_1 x_2 x_4$

$= x_1 \overline{x_2} (\overline{x_3} + \overline{x_4}) + x_1 x_2 x_4$

$= x_1 \overline{x_2 x_3} + x_1 \overline{x_2 x_4} + x_1 x_2 x_4$

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2.21: $\sum m(1,3,4,6,7)$

$= \overline{x_1 x_2} x_3 + \overline{x_1} x_2 x_3 + x_1 \overline{x_2 x_3} + x_1 x_2 \overline{x_3} + x_1 x_2 x_3$

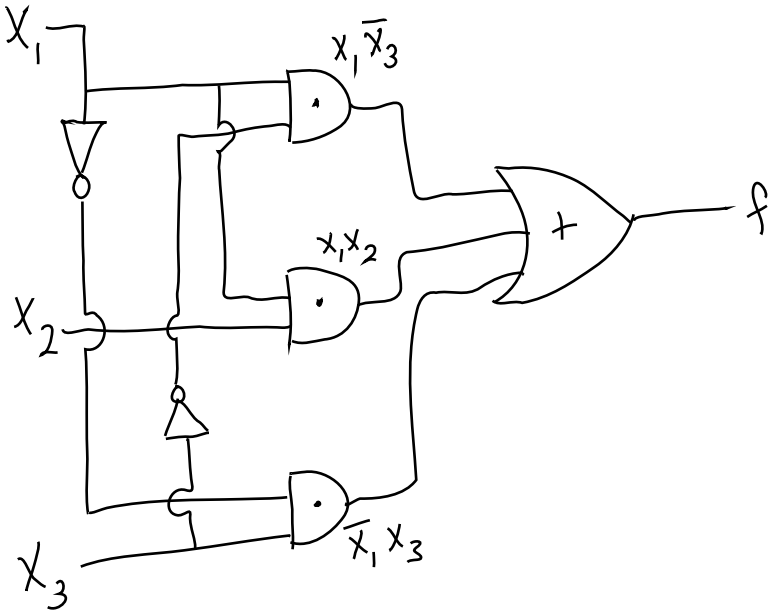
$= \overline{x_1} x_3 (\overline{x_2} + x_2) + x_1 \overline{x_3} (\overline{x_2} + x_2) + x_1 x_2 x_3$

$= \overline{x_1} x_3 + x_1 \overline{x_3} + x_1 x_2 x_3$

$= \overline{x_1} x_3 + x_1 (\overline{x_3} + x_2 x_3)$

$= \overline{x_1} x_3 + x_1 (\overline{x_3} + x_2)$

$= \overline{x_1} x_3 + x_1 \overline{x_3} + x_1 x_2$



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2.29:

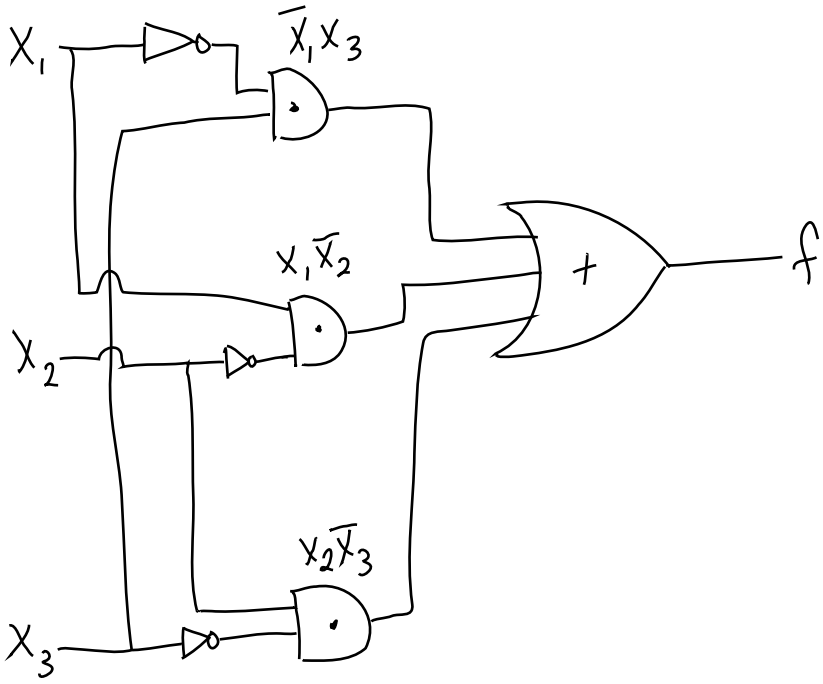
x_1	x_2	x_3	f
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

$$f(x_1, x_2, x_3) = \sum m(1,2,3,4,5,6) = m_1 + m_2 + m_3 + m_4 + m_5 + m_6$$

$$= \overline{x_1}\overline{x_2}x_3 + \overline{x_1}x_2\overline{x_3} + \overline{x_1}x_2x_3 + x_1\overline{x_2}\overline{x_3} + x_1\overline{x_2}x_3 + x_1x_2\overline{x_3}$$

$$= \overline{x_1}x_3(\overline{x_2} + x_2) + x_2\overline{x_3}(\overline{x_1} + x_1) + x_1\overline{x_2}(\overline{x_3} + x_3)$$

$$= \overline{x_1}x_3 + x_2\overline{x_3} + x_1\overline{x_2}$$



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2.31:

x_1	x_2	x_3	f
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

$$f(x_1, x_2, x_3) = \sum m(0,3,5,6) = m_0 + m_3 + m_5 + m_6$$

$$= \overline{x_1}\overline{x_2}\overline{x_3} + \overline{x_1}x_2x_3 + x_1\overline{x_2}x_3 + x_1x_2\overline{x_3}$$

2.36a:

x_0	x_1	y_0	y_1	f
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
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	1
1	1	1	1	1

2.36b: $f(x_0, x_1, y_0, y_1) = \sum m(0,4,5,6,8,10,12,13,14,15)$

$$= m_0 + m_4 + m_5 + m_6 + m_8 + m_{10} + m_{12} + m_{13} + m_{14} + m_{15}$$

$$= \overline{x_0}x_1y_0y_1 + \overline{x_0}x_1\overline{y_0}y_1 + \overline{x_0}x_1\overline{y_0}y_1 + \overline{x_0}x_1y_0\overline{y_1} + x_0\overline{x_1}y_0\overline{y_1} + x_0\overline{x_1}y_0\overline{y_1} + x_0x_1\overline{y_0}y_1 + x_0x_1\overline{y_0}y_1 + x_0x_1y_0\overline{y_1} + x_0x_1y_0y_1$$

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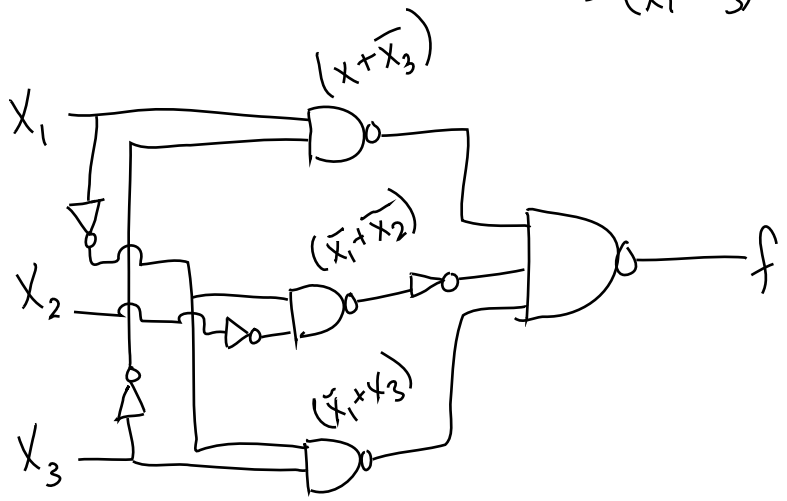
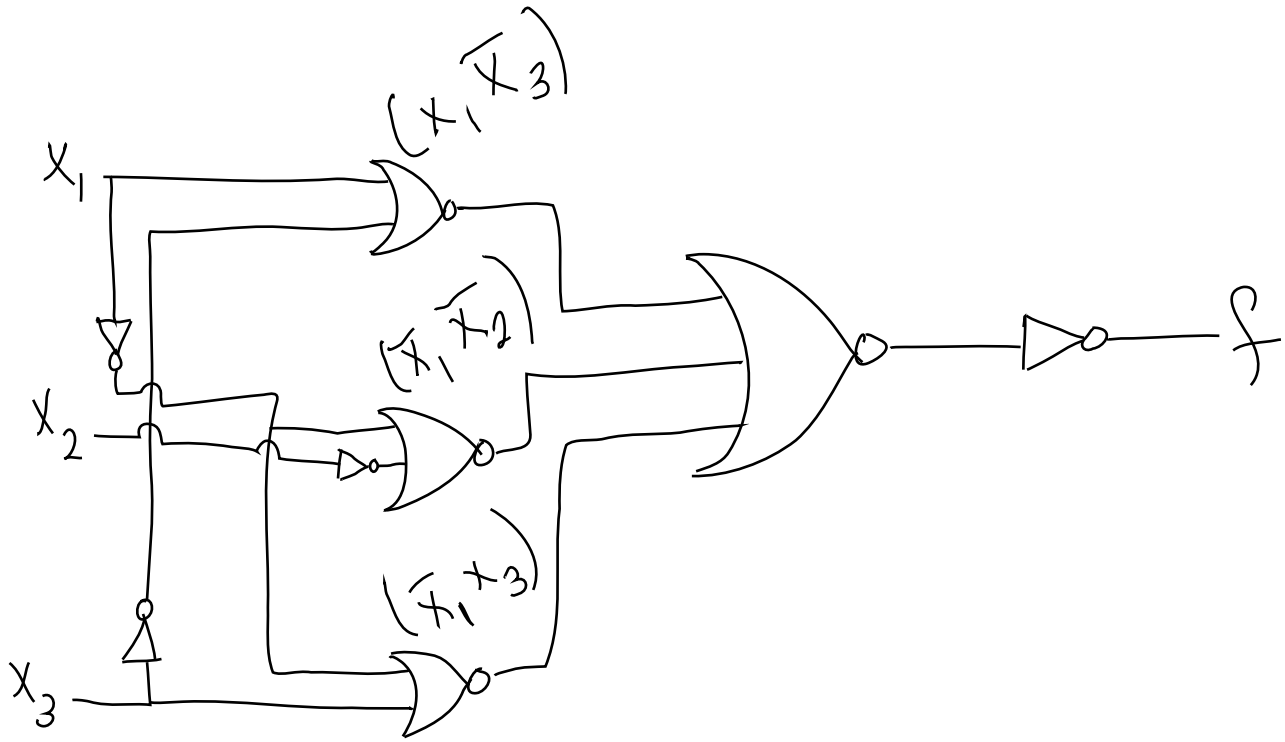
From exercise 2.21

2.41: $f = \sum m(1,3,4,6,7) = \bar{x}_1 x_3 + x_1 \bar{x}_3 + x_1 x_2$

for NAND Gates $\overline{(\bar{x}_1 x_3)} + \overline{(x_1 \bar{x}_3)} + \overline{(x_1 x_2)}$

$= (x_1 + \bar{x}_3) + (\bar{x}_1 + x_3) + (\bar{x}_1 + \bar{x}_2)$



2.43: $f = \sum m(1,3,4,6,7) = \bar{x}_1 x_3 + x_1 \bar{x}_3 + x_1 x_2$