QUIZ 1 SOLUTIONS

1.) a.) $(1001,1001)_2$

$2^3\ 2^0\ 2^{-1}\ 2^{-4}$

$1+8,\ \frac{1}{2}+\frac{1}{16} = (9,5625)_{10}$

b.) $(72,6)_8 = (58,75)_{10}$

$8^1\ 8^0\ 8^{-1}$

$58/2 = 29 + 0$
$29/2 = 14 + 1$
$14/2 = 7 + 0$
$7/2 = 3 + 1$
$3/2 = 1 + 1$
$1/2 = 0 + 1$

111010

$0,75 \times 2 = 1,5$
$0,5 \times 2 = 1,0$

$\Rightarrow (111010,11)_2$

2.) Applying De Morgan Law

a) $f_1 = (x_1 + \bar{x}_2 + \bar{x}_3)(\bar{x}_1 + \bar{x}_4)$

$= x_1\bar{x}_1 + x_1\bar{x}_4 + \bar{x}_2\bar{x}_1 + \bar{x}_2\bar{x}_4 + \bar{x}_3\bar{x}_1 + \bar{x}_3\bar{x}_4$

$0 + x_1\bar{x}_4 + \bar{x}_1\bar{x}_2 + (x_1+\bar{x}_1)\bar{x}_2\bar{x}_4 + \bar{x}_1\bar{x}_3 + \bar{x}_3\bar{x}_4$

$= x_1\bar{x}_4 + \bar{x}_1\bar{x}_2 + x_1\bar{x}_2\bar{x}_4 + \bar{x}_1\bar{x}_2\bar{x}_4 + \bar{x}_1\bar{x}_3 + \bar{x}_3\bar{x}_4$

$= x_1\bar{x}_4 + \bar{x}_1\bar{x}_2 + \bar{x}_1\bar{x}_3 + \bar{x}_3\bar{x}_4$

$= \bar{x}_1\bar{x}_2 + x_1\bar{x}_4 + \bar{x}_1\bar{x}_3 + \bar{x}_3\bar{x}_4$ similarly

$= \bar{x}_1\bar{x}_2 + x_1\bar{x}_4 + \bar{x}_1\bar{x}_3$ literal count = 6

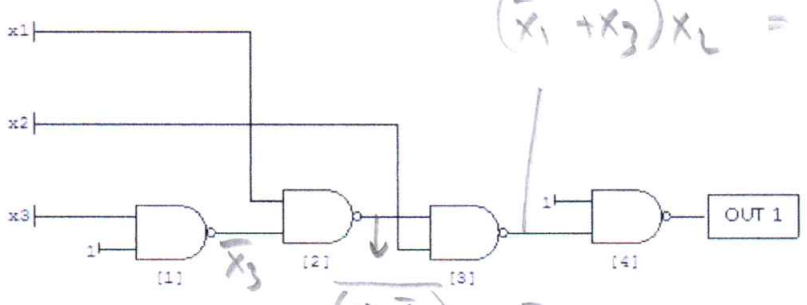
b) $f_2 = (\bar{x}_1 + \bar{x}_2 + x_3)(\bar{x}_1 + x_2 + \bar{x}_3)(x_1 + \bar{x}_2 + \bar{x}_3)(x_1 + x_2 + x_3)$

$= x_1x_2x_3 + x_1\bar{x}_2\bar{x}_3 + \bar{x}_1x_2\bar{x}_3 + \bar{x}_1\bar{x}_2x_3$

literal count = 12

3.)

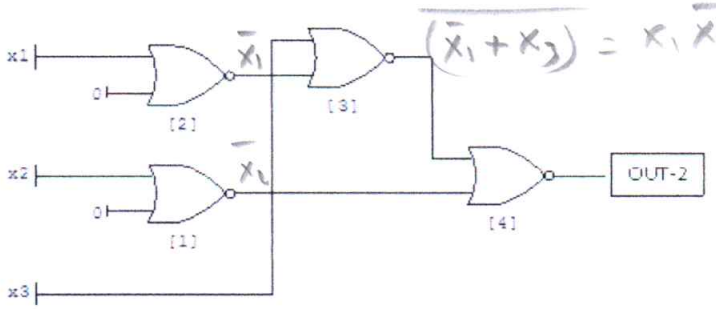
a)



$\overline{(\bar{x}_1 + x_3)x_2} =$

$= x_2(\bar{x}_1 + x_3)$

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



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

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

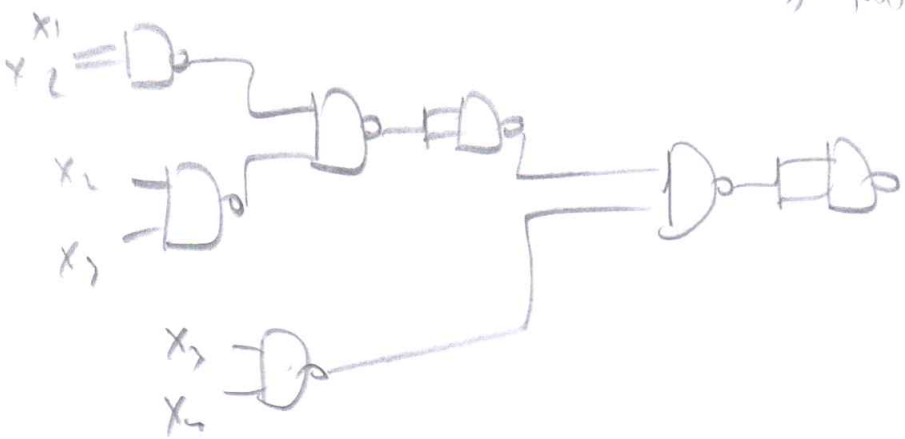
b.) OUT1 = OUT2 $\Rightarrow$ OUT1 $\oplus$ OUT2 = 0

4)

a) $f_1 = (\overline{x_1 x_2}) \cdot (\overline{x_2 x_3}) \cdot (\overline{x_3 x_4})$

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

7 NAND gates

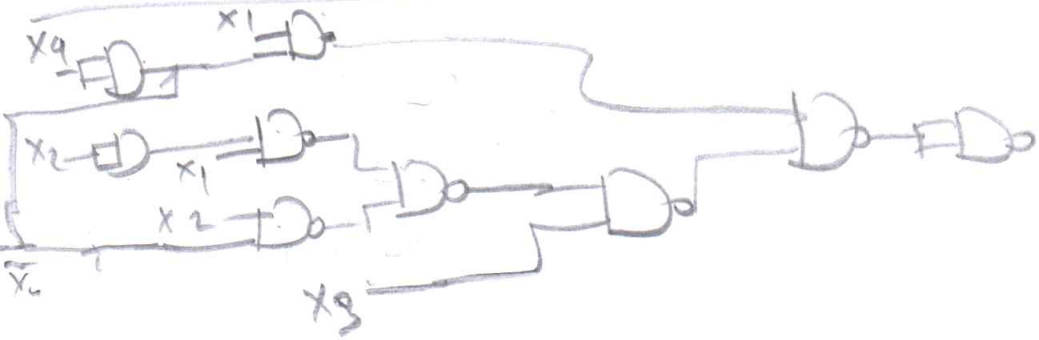


b) $f_2 = x_1 \bar{x}_4 + x_3 (x_1 \bar{x}_2 + x_2 \bar{x}_4)$

$= \overline{x_1 \bar{x}_4} \cdot \overline{x_3 (x_1 \bar{x}_2 + x_2 \bar{x}_4)}$

$= (\overline{x_1 \bar{x}_4}) \cdot (\overline{x_3 (x_1 \bar{x}_2 + x_2 \bar{x}_4)})$

$= \overline{x_1 \bar{x}_4} \cdot x_3 \; \overline{x_1 \bar{x}_2} \cdot \overline{x_2 \bar{x}_4}$



9 NAND gates