Homework 2

Andrei Tumbar

Question 1

$$f = (\overline{x_1}\overline{x_2}x_3) + (\overline{x_1}x_2\overline{x_3}) + (x_1\overline{x_2}\overline{x_3}) + (x_1x_2x_3) \tag{1}$$

Table 1: Truth table for equation 1

x_1	x_2	x_3	Value
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

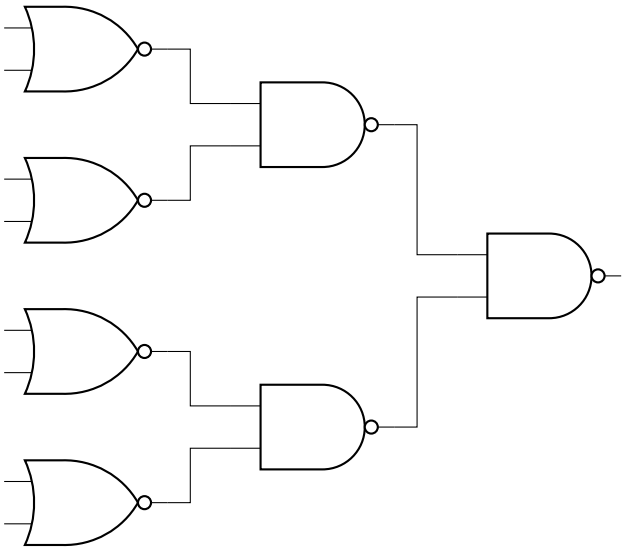
If this circuit was implemented as a CMOS gate, it would take 46 transistors. Each triple AND/OR gates take 8 transistors. Each invertor takes 2 transistors. $8 * 5 + 2 * 3 = 46$

Question 3

$$f = x_1 \oplus x_2 \oplus x_3 \tag{2}$$

This is logically equivalent to the truth table in question 1. The output f is true when an odd number of inputs are HIGH. This is the same as a 3-input XOR gate.

Question 5



Each 2 input NOR/NAND gate takes 4 transistors. There are 4 NOR gates and 3 NAND gates meaning there are $4 * 7$ or 28 transistors total.