3.1 (20points)

f = $x_1' x_2' x_3 + x_1' x_2 x_3' + x_1 x_2' x_3' + x_1 x_2 x_3$

Truth table:

x_1	x_2	x_3	f
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**

Number of transistors:

Gate	**NOT**	**3-input AND**	**4-input OR**
Number of Gates	3	4	1
Number of Transistors per Gate	2	8	10

So, the total number of transistors is given as follows:

$2 \times 3 + 8 \times 4 + 10 \times 1 = 48$

Supplementary problem (20 points):

f = $x_1 x_4 + x_1 (x_2 x_3)' (x_2 x_3' x_4)' + x_1' x_2' x_3 + x_1' x_2' x_3' x_4'$

Truth table:

x_1	x_2	x_3	x_4	f
0	**0**	**0**	**0**	**1**
0	**0**	**0**	**1**	**0**
0	**0**	**1**	**0**	**1**
0	**0**	**1**	**1**	**1**
0	**1**	**0**	**0**	**0**
0	**1**	**0**	**1**	**0**
0	**1**	**1**	**0**	**0**
0	**1**	**1**	**1**	**0**
1	**0**	**0**	**0**	**1**
1	**0**	**0**	**1**	**1**
1	**0**	**1**	**0**	**1**
1	**0**	**1**	**1**	**1**
1	**1**	**0**	**0**	**1**
1	**1**	**0**	**1**	**1**
1	**1**	**1**	**0**	**0**
1	**1**	**1**	**1**	**1**

Number of transistors:

Gate	**NOT**	**2-input AND**	**2-input NAND**	**3-input NAND**	**3-input AND**	**4-input AND**	**4-input OR**
Number of Gates	4	1	1	1	2	1	1
Number of Transistors per Gate	2	6	4	6	8	10	10

So, the total number of transistors is given as follows:

$2\times4 + 6\times1 + 4\times1 + 6\times1 + 8\times2 + 10\times1 + 10\times1 = 60$