3.1 (20 points)

\[ f = x_1' x_2' x_3 + x_1' x_2 x_3' + x_1 x_2' x_3' + x_1 x_2 x_3 \]

Truth table:

<table>
<thead>
<tr>
<th>( x_1 )</th>
<th>( x_2 )</th>
<th>( x_3 )</th>
<th>( f )</th>
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<tbody>
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Number of transistors:

<table>
<thead>
<tr>
<th>Gate</th>
<th>NOT</th>
<th>3-input AND</th>
<th>4-input OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Gates</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Number of Transistors per Gate</td>
<td>2</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

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:

<table>
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<tr>
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<th>( x_3 )</th>
<th>( x_4 )</th>
<th>( f )</th>
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</table>

Number of transistors:

<table>
<thead>
<tr>
<th>Gate</th>
<th>NOT</th>
<th>2-input AND</th>
<th>2-input NAND</th>
<th>3-input NAND</th>
<th>3-input AND</th>
<th>4-input AND</th>
<th>4-input OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Gates</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of Transistors per Gate</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

So, the total number of transistors is given as follows:
\[ 2 \times 4 + 6 \times 1 + 4 \times 1 + 6 \times 1 + 8 \times 2 + 10 \times 1 + 10 \times 1 = 60 \]