In the circuit shown, there are five resistors and a battery $V=10$ volts.

1. Calculate $R_{eq}$ for this circuit. (6 points)
2. Calculate the total current $I$. (2 points)
3. Calculate the voltage across $R_1$. (2 points)

Solution:

1. To obtain $R_{eq}$, we combine the resistances starting from the end and going to the front (towards the battery)

   First, $R_5$ and $R_4$ can be combined in series

   
   \[
   R_4 + R_5 = 1\Omega + 1\Omega = 2\Omega
   \]

   The combination can then be combined with $R_3$ in parallel

   \[
   \frac{R_3 + 2\Omega}{2\Omega \times R_3} = \frac{2\Omega + 2\Omega}{2\Omega \times 2\Omega} = 1\Omega
   \]

   This result can be combined in series with $R_2$

   \[
   R_2 + 1\Omega = 2\Omega + 1\Omega = 3\Omega
   \]

   Finally, $R_{eq}$ is the parallel combination of the $3\Omega$ resistance with $R_1$

   \[
   R_{eq} = \frac{R_1 + 3\Omega}{3\Omega \times R_1} = \frac{1\Omega + 3\Omega}{3\Omega \times 1\Omega} = 0.75\Omega
   \]

2. The total current $I$ can be calculated using Ohm's Law

   \[
   I = \frac{V}{R_{eq}} = \frac{10 \text{ volts}}{0.75\Omega} = 13.33mA
   \]

3. Using KVL

   \[
   V - V_{R_1} = 0
   \]

   \[
   V_{R_1} = V = 10V
   \]