HW Set 1

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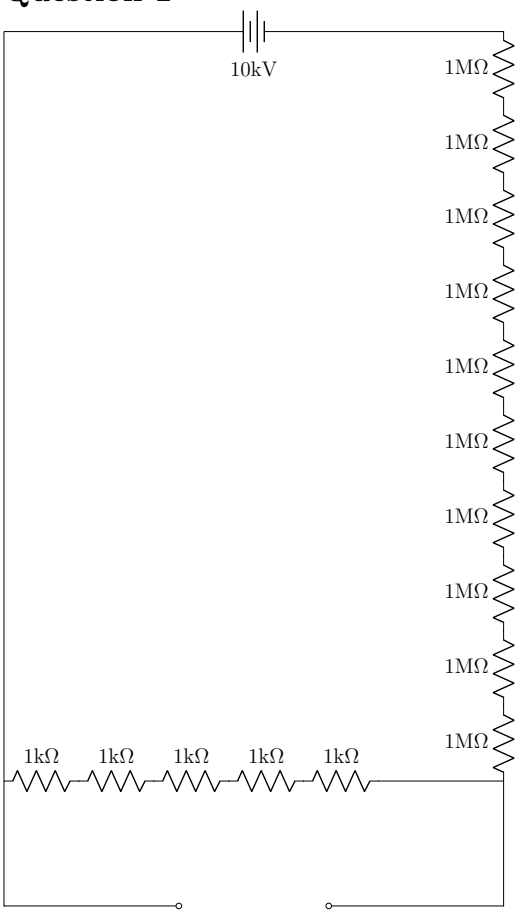
Question 1



Assuming the data monitoring system can be modeled as a short, the total current across the circuit is $I = \frac{10\text{ kV}}{10\text{ M}\Omega + 5\text{ k}\Omega} \approx 10^{-5}$ A. Thus the maximum power dissipated by any single resistor cannot be more than $P = I^2R =$

$(10^{-5})^2$ A $\times$ 1 M$\Omega \approx$ 1 W

Question 2

$-16 = -2I_1 - 2(I_1 + I_2) - I_1 + I_3$

$-9 = -2(I_2 + I_3) - 2(I_2 + I_1) - I_2$

$0 = -4I_3 - I_3 + I_1 - 2(I_3 + I_2)$

$$\begin{bmatrix} -5 & -2 & 1 \\ -2 & -5 & -2 \\ 1 & -2 & -7 \end{bmatrix}^{-1} \begin{bmatrix} -16 \\ -9 \\ 0 \end{bmatrix} \approx \begin{bmatrix} 3.1 \\ 0.4 \\ 0.3 \end{bmatrix}$$

Question 3

$-16 = -r_1 I_1 - r_3(I_1 + I_2) - L_4(\frac{\delta I_1}{\delta t} + \frac{\delta I_3}{\delta t})$

$-9 = -r_5(I_2 + I_3) - r_3(I_2 + I_1) - L_2\frac{\delta I_2}{\delta t}$

$0 = -r_6 I_3 - r_4(I_3 - I_1) - r_5(I_3 + I_2)$