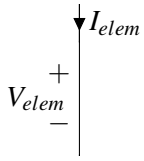
EECS 16A Designing Information Devices and Systems I
Spring 2022 Discussion 3A

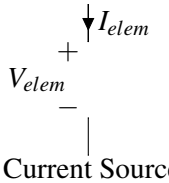
1. Circuit Components and Ohm's Law

(a) We will look at the $I-V$ characteristics of different circuit components. For each of the components listed below plot the $I_{elem}-V_{elem}$ characteristic curves.

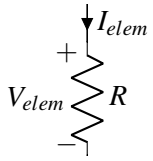
i. Wire



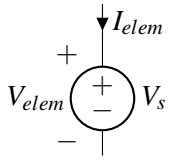
ii. Open Circuit



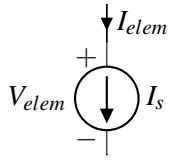
iii. Resistor



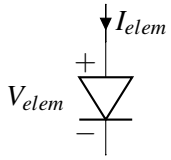
iv. Voltage Source



v. Current Source

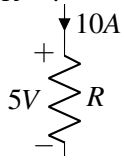


vi. Diode

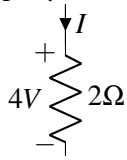


(b) Use Ohm's Law to find the missing component values in the circuits below.

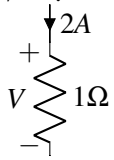
i. $R=?$



ii. $I=?$

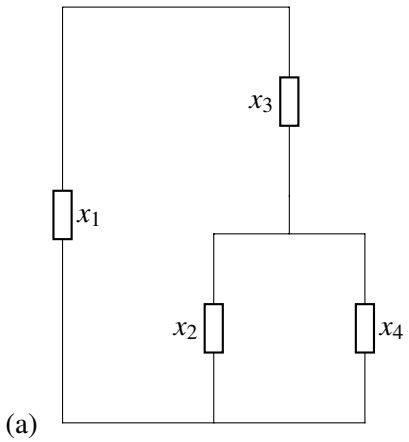


iii. $V=?$

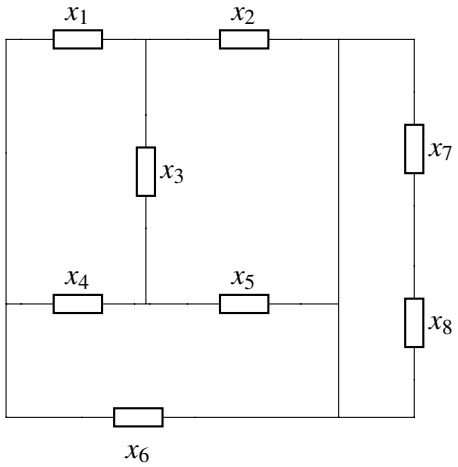


2. Label the nodes

In the circuits shown below, label all the nodes.



(a)



(b)

3. Quest Review

This problem will review concepts of linearity, systems of equations, Gaussian elimination and matrix multiplication.

(a) Determine whether the following functions are linear or nonlinear.

i.
$$f(x_1, x_2) = 3x_1 + 4x_2$$

ii.
$$f(x_1, x_2) = e^{x_2} + x_1^2$$

(b) For each system of equations given as an augmented matrix, use Gaussian elimination to determine whether the system has a unique solution, infinite solutions or no solution.

i.
$$\left[\begin{array}{ccc|c} 2 & 6 & 4 & 10 \\ 1 & -3 & 3 & 13 \\ 0 & 0 & 3 & 12 \end{array}\right] \tag{1}$$

ii.
$$\left[\begin{array}{ccc|c} 3 & -1 & 2 & 1 \\ 0 & 0 & 2 & 1 \end{array}\right] \tag{2}$$

(c) Consider the following matrices:

$$\mathbf{A} = \begin{bmatrix} 1 & 9 & 5 & 7 \\ 4 & 3 & 2 & 2 \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 5 & 5 & 8 \\ 6 & 1 & 2 \\ 4 & 1 & 7 \\ 3 & 2 & 2 \end{bmatrix} \quad \mathbf{C} = \begin{bmatrix} 8 & 1 & 6 \\ 3 & 5 & 7 \\ 4 & 9 & 2 \end{bmatrix} \quad \mathbf{D} = \begin{bmatrix} 5 & 3 & 4 \\ 1 & 8 & 2 \\ 2 & 3 & 5 \end{bmatrix}$$

For each matrix multiplication problem note whether the product exists, and *if the product exists*, find the dimensions of the resulting matrix.

i. **A B**
ii. **A C**
iii. **B D**