Homework 4
Due: Thursday, November 19
The RC circuit

Overview

For this homework, you will be writing a C++ program to calculate the current as a function of time for an RC circuit (a circuit with a resistor and a capacitor in series) and writing these values to a file.

For an RC circuit, the current as a function of time looks like:

$$I(t) = \frac{\varepsilon}{R} e^{-\frac{t}{RC}} \tag{1}$$

Where ε is the emf of the power supply, and R and C are respectively the resistance and capacitance of the circuit elements.

You will read the necessary parameters (ε, R, and t) from a file.

Details

You will need to declare variables for R, ε, and C. The time range will be specified by three numbers: t_{start}, t_{stop}, and Δt (i.e: you will calculate $I(t)$ for each of t_{start}, $t_{\text{start}} + \Delta t$, $t_{\text{start}} + 2\Delta t$, $t_{\text{start}} + 3\Delta t$ . . . t_{stop}.

Configuration File

These numbers will be read from a configuration file with the following form:

```
* EMF 3.0
* RESISTANCE 100
* CAPACITANCE 1E-4
* TIMERANGE 0 10 0.01
```

Some things to note about the file format:

- EMF, resistance and capacitance are specified by the keyword RESISTANCE and CAPACITANCE. They are followed by a space and then a number.

- All three values for the time range are specified by the TIMERANGE keyword, with the format
  TIMERANGE t_{start} t_{stop} Δt, separated by spaces.

- Only lines beginning with a "*" should be parsed. There may be other lines in the file, but if they do not start with "*", they should be treated as comments and skipped.

An example config file is on google drive here Using these values, you will calculate $I(t)$ and write each value to a file as comma separated values (CSV format):

```
TIME CURRENT
0.00, 4.00
0.01, 3.89
0.02, 3.64
...
```

Specifications

To start off the program, you will prompt the user to enter the name of the configuration file. If the file exists and you are able to open it, then read the values, perform the calculation, and write the data to a new file. If you cannot open or read the configuration file, print a message to the user and don't do anything else.

You should write a function to handle the reading of the configuration file. This function will receive as input the name of the file, and will read the file and assign the appropriate values to your variables for R, C, t_{start}, t_{stop}, and Δt. Write another function to perform the current calculation.