University of Pittsburgh
Department of Electrical and Computer Engineering
ECE 0301

In-Class Assignment #1

Programming concepts:

- Floating-point variables and arithmetic
- Printing text to standard output.

ECE concepts:

- DC circuits, Ohm's Law, calculating current
- Power and energy calculations

Background: Surf to URL http://www.falstad.com/circuit/ and run the Java circuit simulation applet. There are many examples to play with under the Circuits menu. Choose `Circuits` → `Basics` → `Ohm's Law` for this assignment.

This circuit contains two resistors, 100 Ω and 1 kΩ, connected between a +5V source and ground. The simulator computes the current in each resistor, and when the user hovers the mouse pointer over either resistor, the current, voltage, resistance and power dissipated are all displayed. You can change the value of the voltage source by moving the slider in the right panel, and you can edit the resistances and the range of voltages produced by the source, by double-clicking on the component.

We will name the left resistor R_1, the right resistor R_2, and the voltage source V_s.

Instructions: Develop software according to the following specifications and submit whatever portion you have completed to the class repository before midnight tonight. **For all in-class assignments, you must include line-by-line comments to explain what your code does and why! You must also choose meaningful names for all variables so that it will be easy for a reader to understand your code.**

1. Write a computer program that will display the following introductory message to standard output:

```
ECE 0301 DC Resistive Circuit Simulation
Modeled after www.falstad.com/circuit/
Circuits -> Basics -> Ohm's Law
```

Don't forget to include comments! Type them in your code as you complete each item.

2. Declare double-precision floating-point variables to represent the voltage V_s, and the resistances R_1 and R_2. Initialize the voltage to V_s = 5 V, and the resistances to R_1 = 100 Ω and R_2. = 1 kΩ.

   Print a line of text to standard output that displays the value of V_s. Your message must be in the form of a complete sentence that includes the string "`Vs = `", followed by the numerical value for V_s, followed by "` Volts`".

   Print another line of text to standard output that displays the values of R_1 and R_2. Your message must be in the form of a complete sentence that includes the string "`R1 = `", followed by the numerical value for R_1, followed by "` Ohms`", followed by "`R2 = `", followed by the numerical value for R_2, followed by "` Ohms`".

3. Use Ohm's Law to compute the current flowing through each resistor, and the power dissipated in each resistor, and store them in appropriately-named variables.

   Print two lines of text that display the current and power for R_1 to standard output. Each line must be in the form of a complete sentence. The first line must include the string "`I1 = `", followed by the numerical value for the current, followed by "`Amperes`", and the second line must include the text "`P1 = `" , followed by the numerical value for the power, followed by "`Watts`".

   Print two more lines of text that display the current and power for R_2 to standard output, following the same format.

4. Compute the total energy supplied by the voltage source in one second, one hour, one day and one year, with units of Joules. Store each quantity in an appropriately named variable.

   Print a line of text to standard output to report the energy used in 1 second. Your message must be a complete sentence and must include the strings "`energy`", "`one second`", and "`Joules`".

   Print three more lines of text to report the other energy values, following the same format.

5. Compute the cost required to provide each of the four energy amounts from Part 4, assuming a fixed electricity cost of $0.10/kWh. Store each quantity in an appropriately-named variable.

   Print a line of text to standard output that reports the cost of electricity that is in the form of a complete sentence, and includes the string "`$0.10/kWh`".

   Print a line of text to standard output that is in the form of a complete sentence, to report the cost for 1 second. Your message should include a dollar sign before the cost, and must include the strong "`one second`", but there is no need to provide any particular numeric formatting, the default formatting for floating-point values is acceptable.

Print three more lines of text to standard output to report the other costs, following the same format.

Test your program fully. Ensure that all output is as specified. When you are certain your program is correct, save it in a file named:

`ece0301_ICA01_step05.cpp`

Submit this file to the class repository.

6. Change the source voltage to 120 V, and the resistances to 10 Ω and 15 Ω. These numbers are roughly correct for a typical American home in 2016. Use your program with these values and examine the results. Use the falstad.com simulator to confirm that your currents and powers are correct. Using this model, how much would the annual electric bill be for a typical home?

   Save your modified program in a file named:

   `ece0301_ICA01_step06.cpp`

   Submit this file to the class repository.

7. Change the source voltage to 7.2 kV, and the resistances to 8 Ω and 10 Ω. These numbers are roughly correct for a moderately-sized electric utility substation. Use your program with these values and examine the results. Use the falstad.com simulator to confirm that your currents and powers are correct.

   Save your modified program in a file named:

   `ece0301_ICA01_step07.cpp`

   Submit this file to the class repository.

Don't forget to include comments! You will lose credit if you leave them out, even if your code functions as directed!