ENGR1200U Introduction to Programming for Engineering (Winter 2013)

Assignment 1: Getting Started with C++ (Individual Submission)

Total Marks: 20 points

Due Date: By 6:00pm on Tuesday, Feb 12, 2013

The purpose of this assignment is to get you started with C++ programming. You'll develop simple programs (with input and output) to solve simple mathematical and engineering problems.

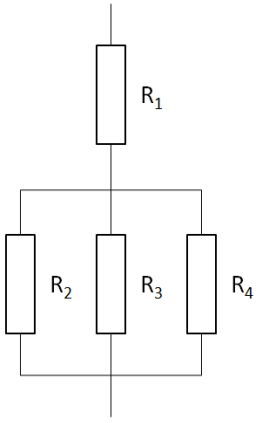
1. Write a program to compute the area A of any ellipse with semiaxes a and b. Prompt the user to enter the lengths a and b. Set the precision of the area to two decimal points. (The area of an ellipse is computed using this formula: Area= π a∗ b.)

   Sample Output:

   ```
   Enter the length of the semiaxes: 12 15

   The area of an ellipse with semiaxes 12 and 15 is 565.49
   ```

2. Consider the following circuit.



   Ohm's Law describes the relationship between voltage (V), current (I) and resistance (R). To calculate total resistance for multiple resistances in series, the following series resistance formula is applied:

$$R_{total} = R_1 + R_2 + \ldots + R_n$$

   where R is each individual resistor. To calculate the total parallel resistance, the following parallel resistance formula is applied:

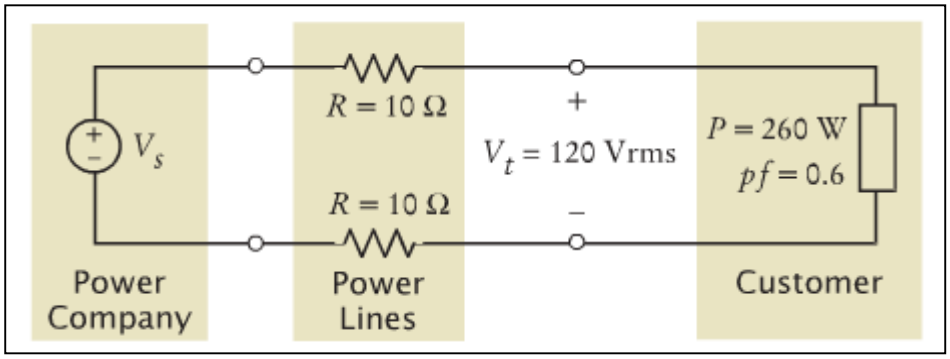
$$R_{total} = \frac{1}{\left(\frac{1}{R_1}\right) + \left(\frac{1}{R_2}\right) + \cdots + \left(\frac{1}{R_n}\right)}$$

where R is each individual resistor. Write a program that reads the resistances of the four resistors and computes the total resistance, using Ohm's law. Set the precision of the final total resistance to two decimal points. *HINT: To measure the total resistance of this circuit, you need to calculate the total parallel resistance of R_2, R_3, and R_4 first. Then, calculate the total series resistance of R_1 and the calculated total parallel resistance.*

Sample Output:

```
Enter the value of R1: 10
Enter the value of R2: 20
Enter the value of R3: 20
Enter the value of R4: 20
The total resistance for this circuit is: 16.67 ohms.
```

3. The circuit shown below illustrates some important aspects of the connection between a power company and one of its customers. The customer is represented by three parameters, V_t, P, and pf. V_t is the voltage accessed by plugging into a wall outlet. Customers depend on having a dependable value of V_t in order for their appliances to work properly. Accordingly, the power company regulates the value of V_t carefully. P describes the amount of power used by the customer and is the primary factor in determining the customer's electric bill. The power factor, pf, is less familiar. (The power factor is calculated as the cosine of an angle so that its value will always be between zero and one.) In this problem you will be asked to write a C++ program to investigate the significance of the power factor.



In the figure, the power lines are represented, somewhat simplistically, as resistances in Ohms. The power company is represented as an AC voltage source. The source voltage, V_s, required to provide the customer with power P at voltage V_t can be determined using the formula

$$V_s = \sqrt{\left(V_t + \frac{2RP}{V_t}\right)^2 + \left(\frac{2RP}{pfV_t}\right)^2 \left(1 - pf^2\right)}$$

(V_s has units of V_{rms}.) This formula indicates that the value of V_s depends on the value of pf. Write a C++ program that prompts the user for a power factor value and then prints a message giving the corresponding value of V_s, using the values for P, R, and V_t shown in the figure above. Set the precision of V_s to two decimal points.

Sample Output:

```
Enter the power factor, pf: 0.75

P = 260 W, R = 10 Ohms, and Vt = 120 Vrms

Vs = 167.75 Vrms
```

Submission Instructions

Please follow the following instructions carefully as the submission process consists of two important steps (pay attention to the marking scheme):

1) By 6:00pm on Tuesday, February 12, 2013, you must submit a stapled hard copy of your code and output results for each problem in addition to a coversheet. Please use the coversheet attached as the first page for your submission and ensure that all required details are provided, including: your name, student ID, section number, and tutorial session number. It is important to include your tutorial session number on the right hand corner of the coversheet.

   Submission Location: On the attached coversheet, locate your tutorial session and determine the drop box number. Drop a hard copy of the assignment by the above due date in the appropriate drop box. Drop boxes are located at the first floor in the Engineering building (ENGR), near the elevators.
2) Attend your tutorial session (Wednesday Feb 13 / Thursday Feb 14) and demo (compile and run) your solutions to the TA.

NO LATE ASSIGNMENTS WILL BE ACCEPTED NO MATTER WHAT IS THE REASON.

You are given more than enough time to finish the assignment well before the due date.

Grading Guidelines Marking Scheme

1) If a student submits the printout for the assignment but doesn't demo his/her solution, then 50% of the marks will be automatically deducted for "no demo". No late demos will be accepted.
2) If a student demos the solution in the tutorial session but haven't submitted the assignment (printout of the code and output), then 70% of the marks will be deducted.
3) Documentation: Document your program code Your program code must have proper documentation

Program 1: 3 marks

Program 2: 5 marks

Program 3: 8 marks

Documentation & submission organization: **4 marks** [documented code, coversheet]

Total marks: 20

References:

- D. Etter, J. Ingber, Engineering Problem Solving with C++, Third Edition, 2011, Pearson.
- C. Horstmann, C++ for Everyone, Second Edition, 2010, John Wiley.

Write your Tutorial # here

ENGR 1200U: Introduction to Programming for Engineers

Assignment 1

Name	
Student ID	
Section Number	

Submission Drop Box Number	Tutorial #	Location	Day	Time
13	1	UA2220	Wednesdays	7:10 pm – 9:00 pm
15	2	UA2230	Wednesdays	7:10 pm – 9:00 pm
13	3	UA2220	Thursdays	7:10 pm – 9:00 pm
14	4	UA2230	Thursdays	7:10 pm – 9:00 pm
14	5	UA2140	Thursdays	8:10 am – 10:00 am
13	6	UA2130	Thursdays	8:10 am – 10:00 am
16	7	UA2220	Thursdays	9:10 am – 11:00 am
15	8	UA2120	Thursdays	9:10 am – 11:00 am
15	9	UA2240	Thursdays	8:10 am – 10:00 am
16	10	UA2230	Thursdays	8:10 am – 10:00 am
16	11	UA2220	Wednesdays	1:10 pm – 3:00 pm
14	12	UA2230	Wednesdays	1:10 pm – 3:00 pm