Introduction to C - Programming Assignment #1: Fuel Efficiency

Due date: *September 8, 2010 – 11:59pm*

Notes
1. **In this assignment, you are required to write three programs.**

Objectives
1. To give students practice at typing in, compiling and running simple programs.
2. To learn how to read in input from the user.
3. To learn how to use assignment statements and arithmetic expressions.

References
CKnights: Sections 2, 3   GuhaDraft: Chapter 2

Problem A: Calculating Fuel Economy
With the recently increasing gas prices, car manufacturers have been touting their vehicles' fuel economy. Cars, such as the Toyota Prius tell their drivers what their fuel efficiency for five minute time intervals. In this program, you will perform a calculation similar to what the Prius computer does, to calculate fuel economy (in miles per gallon) for a given duration of time. In particular, your program will ask the user to enter the following information: the interval of time the car has traveled (in minutes), the average speed of the car during that interval of time (in miles per hour), and the amount of gasoline that has been consumed in the interval (in gallons). Your program will read in this information and then output the fuel efficiency of the user's car for that portion of the trip, to two decimal places, in miles per gallon.

Input Specification
1. The number of minutes the car has traveled will be an integer.
2. The speed of the car will be a positive real number.
3. The gasoline consumed will be a positive real number.

Output Specification
Output the fuel efficiency in miles per gallon to two decimal places. Your output should follow the format below, where XX.XX is the desired fuel efficiency.

```
Your car averaged XX.XX miles per gallon.
```

Output Sample
Below is one sample output of running the program. Note that this sample is NOT a comprehensive test. You should test your program with different data than is shown here based on the specifications given above. In the sample run below, for clarity and ease of reading, the user input is given in *italics* while the program output is in bold. **(When you run your own program, no italics or bold will appear.)**

Sample Run #1
```
How many minutes did you drive?
```
30
```
What was the average speed of the car during that time?
```
40
```
How many gallons of gas did your car use?
```
0.8
```
Your car averaged 25.00 miles per gallon.
```

Problem B: Calculating Distance Traveled

The manner in which distance traveled is typically calculated by a car such as the Prius is not by using the average speed and the time traveled. Instead, the calculation is made by using the radius of the tires and counting the number of revolutions the tires make. In this problem, you will ask the user for these two pieces of information and then calculate the distance the car traveled. Note: this portion of the problem involves defining a constant for π and looking up information (on-line) about converting between inches and miles. Please define π to be 3.14159 for the purposes of this problem.

Input Specification

1. The radius of the tires will be a positive real number in inches.
2. The number of revolutions of the tires will be a positive integer.

Output Specification

Output the number of miles the car has traveled based on the given information, to two decimal places. Follow the format below, where XX.XX is the distance traveled, in miles, to two decimal places.
```
Your car traveled XX.XX miles.
```

Output Samples

Below are two sample outputs of running the program. Note that these samples are NOT a comprehensive test. You should test your program with different data than is shown here based on the specifications given above. In the sample run below, for clarity and ease of reading, the user input is given in *italics* while the program output is in bold.

Sample Run #1
```
What is the radius of your tires, in inches?
```
15
```
How many revolutions did your car's tires make?
```
10000
```
Your car traveled 14.87 miles.
```

Sample Run #2
```
What is the radius of your tires, in inches?
```
16
```
How many revolutions did your car's tires make?
```
3151
```
Your car traveled 5.00 miles.
```

Problem C: Revised Fuel Economy Calculation

Using your solutions to problems A and B, you will solve the original problem, with different input data. This time, you will prompt the user for the following information: the radius of the car's tires, the number of revolutions the car's tires went through in a given time period, and the amount of gas (in gallons), the car used during that same time period. Your program should read in this information and then output the fuel efficiency of the car in miles per gallon.

Input Specification

1. The radius of the car's tires will be a positive real number in inches.
2. The number of revolutions the car's tires make will be a positive integer.
3. The amount of gas, in gallons, the car uses will be a positive real number.

Output Specification

Output the fuel efficiency in miles per gallon to two decimal places. Your output should follow the format below, where XX.XX is the desired fuel efficiency.
```
Your car averaged XX.XX miles per gallon.
```

Output Samples

Below are two sample outputs of running the program. Note that these samples are NOT a comprehensive test. You should test your program with different data than is shown here based on the specifications given above. In the sample run below, for clarity and ease of reading, the user input is given in *italics* while the program output is in bold.

Sample Run #1

What is the radius of your tires, in inches?
15
How many revolutions did your car's tires make?
10000
How many gallons of gas did your car use?
0.75
Your car averaged 19.83 miles per gallon.

Sample Run #2

What is the radius of your tires, in inches?
16
How many revolutions did your car's tires make?
3151
How many gallons of gas did your car use?
0.11
Your car averaged 45.45 miles per gallon.

<u>Deliverables</u>
Three source files:
      1) *mpg.c*, for your solution to problem A
      2) *distance.c* for your solution to problem B
      3) *mpgfinal.c* for your solution to problem C
All files are to be submitted over WebCourses.

<u>Restrictions</u>
Although you may use other compilers, your program must compile and run using Dev C++. Each of your three programs should include a header comment with the following information: your name, course number, section number, assignment title, and date. Also, make sure you include comments throughout your code describing the major steps in solving the problem.

<u>Grading Details</u>
Your programs will be graded upon the following criteria:

1) Your correctness
2) Your programming style and use of white space. Even if you have a plan and your program works perfectly, if your programming style is poor or your use of white space is poor, you could get 10% or 15% deducted from your grade.
3) Compatibility to Dev C++ (in Windows). If your program does not compile in this environment, **the maximum credit you will receive is 50%.**