Programming Fundamentals
CS1336

Assignment #2

Assignment #2 – Basic Calculations

Introduction

Your second programming assignment will consist of two small C++ programs. Each program will be independent of the other program. Each one should compile correctly and produce the specified output.

Please note that each of the programs should comply with the commenting and formatting rules we discussed in class. For example, there should be a header for the whole program that gives the author's name, class name, date, and description. End braces should be commented, and there are alignment and indenting requirements as discussed. Please ask if you have any questions.

Program #1

This problem is a modification of Problem 11 on page 83 of the text (9E). In that problem is described a car that can go 23.5 miles per gallon when driven in town and 28.9 miles per gallon when driven on the highway. The problem in the book then asks the programmer to calculate how far that car can go on one tank of gas under both conditions.

Let's modify that problem in the following way. We'll assume that the user of the program is going to take a trip, and that part of the trip will be on the highway and part of it will be in town. Have your program ask the user how far he has to go under each condition. Your program will then print out the total number of gallons required for the trip.

For example, let's say the user plans to take a trip that will require 120 miles of in-town driving and 250 miles of highway driving (we're not trying to be realistic :-)). Your program run might look like the following:

```
Please enter the number of in-town driving miles:   120
Please enter the number of highway driving miles:   250

The total number of gallons required is:  13.8 gal.
```

As usual, we should print out a prompt when asking the user for information. For clarity, we should also print out an explanatory statement when printing a value to the screen.

This week, we are going to talk about how to get data from the keyboard. In C++ we use the `cin` object to do that.

For example, the first line of input might be accomplished with the following statements. Let's assume we are using the `double` variable `inTownMiles` to store the mileage.

```
double inTownMiles;

cout << "Please enter the number of in-town driving miles:   ";
cin  >> inTownMiles;
```

The first line declares the `double` variable `inTownMiles`, but does not give it a value. The second line prints a prompt to the screen. (Note that because there is no `endl` inserted in the output stream and no escape sequence '`\n`' inserted in the prompt string, the insertion cursor will remain at the end of that line. Therefore, when the user types in her response, it will appear at that position.) The third line uses the C++ `cin` object to get the value from the keyboard and put the result into the variable `inTownMiles`. That value can then be used in your calculations.

As always, please submit your source code to eLearning.

Program #2

Your second program is a modification of Problem 12 on page 146 of our text (9E) (Problem 12, p 144 in the 8th Edition). In that problem, the user inputs a temperature value in degrees Celsius and the program then calculates the equivalent temperature in Fahrenheit.

Let's modify the problem in the following way. Rather than requiring the user to input just a Celsius temperature and then calculating the Fahrenheit temperature from it, let's calculate equivalent temperatures in both directions. In addition, we'll add to the report the equivalent temperature in a third temperature scale, namely, Kelvin.

We'll first ask the user for a Celsius temperature and then print a report about both the Fahrenheit and the Kelvin temperatures. The output should like the following:

```
Please enter a number in degrees Celsius:     45.2

The equivalent Fahrenheit temperature is:     113.36 degrees.
The equivalent Kelvin temperature is:         318.35 K.
```

Your program will then ask the user to input a number in degrees Fahrenheit and print the equivalent Celsius and Kelvin degrees:

```
Please enter a number in degrees Fahrenheit:  45.2

The equivalent Celsius temperature is:        7.33 degrees.
The equivalent Kelvin temperature is:         280.48 K.
```

And finally, it should ask for a Kelvin temperature and print out the result in Celsius and Fahrenheit:

```
Please enter a number in Kelvin:     250.3

The equivalent Celsius temperature is:      -22.85 degrees.
The equivalent Fahrenheit temperature is:    -9.13 degrees.
```

Note that all calculated temperatures are printed to two decimal places.

The formulae for converting between the different temperatures are:

$$F = \left(\frac{9}{5}\right) C + 32$$

and

$$K = C + 273.15$$

To do the second part of the problem, you will need to rewrite the first formula so that Celsius can be calculated from the Fahrenheit, instead of the other way around. To do the third part of the problem, first calculate the Celsius equivalent using the second formulae and then apply the first formula to the Celsius to get the final result.

Finally, note that all calculated results are printed out to two decimal places this time. You can accomplish that by using the `setprecision()` manipulator described in HW 1 with an argument of 2 instead of 1.

As always, please submit your source code to eLearning.