Assigned in Laboratory 2, Due Start of Laboratory 3

Please perform the following activities. This assignment is unpledged. However, you may not work with anyone else on this assignment. You are allowed to talk with others, but your work must be your own.

Objective

The object of this assignment is twofold: to practice coding programs that do interactive input and output, and to make sure that you understand how to write simple programs that compute useful things. Good programmers often write small programs to do a short, useful computation.

Problem

Produce a program that computes and displays the apparent *Fahrenheit* temperature accounting for wind chill given two user-supplied double-precision floating point inputs: a Fahrenheit temperature T and the wind velocity V. The velocity is given in miles per hour. There are several slightly different formulas for computing the wind chill temperature. The formula you will use for your calculation comes from the National Weather Service and is metric-based. Therefore, after extracting the inputs you will first need to determine the Celsius equivalent T_c of T and the kilometers per hour equivalent V_k of V. The formula for computing the wind chill temperature T_{wc} using T_c and V_k is

$$T_{wc} = 0.045(5.27\sqrt{V_k} + 10.45 - 0.28V_k)(T_c - 33) + 33$$

Because T_{wc} is a Celsius temperature, one more conversion is necessary before displaying the answer to the user. This conversion computes the Fahrenheit equivalent T_f of T_{wc}.

For your convenience, conversion formulas for Fahrenheit to Celsius, Celsius to Fahrenheit, and miles to kilometers are given below.

$$CELSIUS = \frac{5}{9}(FAHRENHEIT - 32)$$

$$FAHRENHEIT = \frac{9}{5}CELSIUS + 32$$

$$KILOMETERS = 1.60934 MILES$$

For your information, the home page of the National Weather Service is *http://www.nws.noaa.gov/*. A small write-up on wind chill is available at the *USA Today*'s weather website at *http://www.usatoday.com/weather/wchilfor.htm*.

Besides displaying the wind chill value, your program should supply a legend that warns the user that the calculated value is inaccurate for wind velocities less than 4 miles per hour. Remember to prompt the user for the inputs and to echo them in a meaningful fashion.

Notes

You *must* use our formula and do the conversions. We know that there are non-metric wind chill formulas out there, but we do not want you to use them. Part of the purpose of this assignment is giving you practice developing expressions.

As you should know from lecture and your reading of the textbook, C++ has neither a √ nor an exponentiation operator. However, C++ does have a mathematics library that contains in part a function *sqrt()* that computes square root values. Function *sqrt()* expects a numerical expression as its argument. The function returns a double-precision floating-point value that is the square root of its argument expression. For example, if x has the value 6.25, then *sqrt(x)* returns the value 2.5 and if y has the value 3.75 then *sqrt(x + y)*

returns a value close to 3.1623. To use the *sqrt*() function, you must instruct the compiler to include the mathematics library when translating your program. You can do so by placing the following include statement immediately after your inclusion of the iostream library.

```
#include <cmath>
```

Our conversions formulas for Farhrenheit to Celsius and vice-versa are written in mathematical notation. Remember that we want double-precision floating-point calculations to be performed and not integer calculations.

Please review the CS101 style sheet before starting on the assignment. Be sure to use the standard header (i.e., your name, section number, etc.) in your program. The standard header for all of our programs (unless instructed otherwise) will contain the following information:
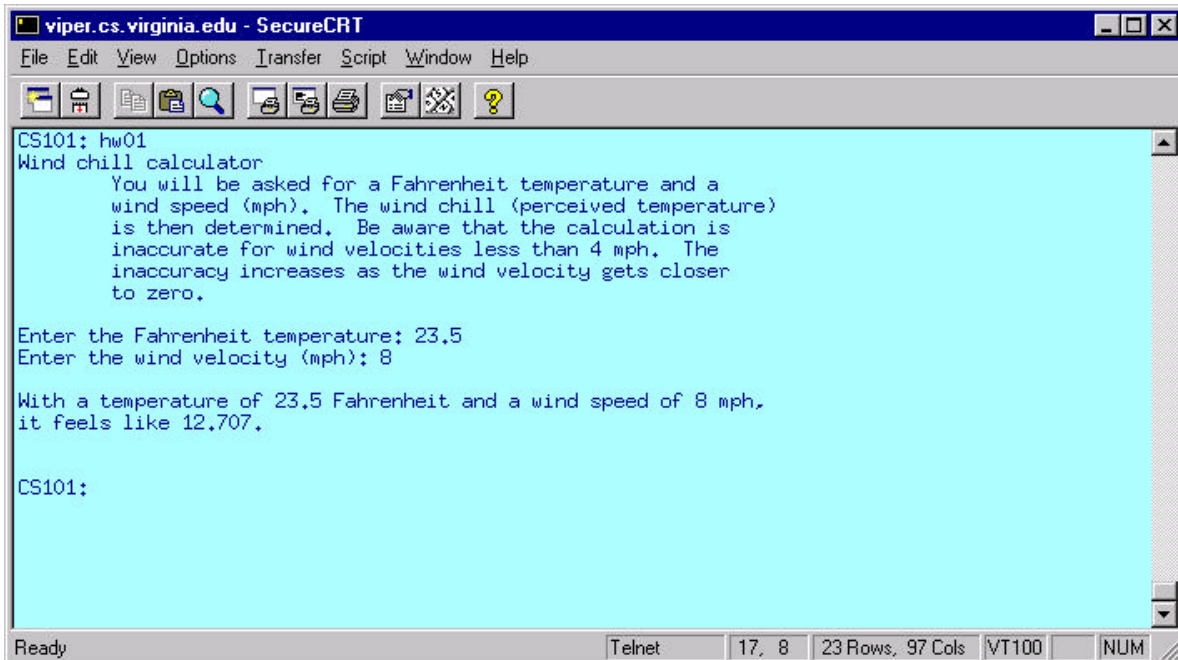
```
// Programmer:
// Student ID:
// E-mail:
// CS101 Lab Section:
// CS 101 Lab time:
```

You should submit your program electronically before the start of laboratory 3. See the CS101 website (*http://www.cs.virginia.edu/cs101*) for information on how to do this. Your program *must* be called `hw01.cpp`. All letters in the filename must be lowercase! Do not submit any other files.

You should also turn in a hardcopy (printed copy) at the beginning of your laboratory when the program is due. This hardcopy is due at the beginning of laboratory 3.

The grading criteria for this assignment can also be found at our class website. It will be posted there by the Monday before the assignment is due.

A sample run of the type of output that your program should produce is given below. Observe the legend, nice prompts, and labeled output. The phrasing that you use does not need to exactly mimic this sample, but it does need to be of similar or better quality. In doing your input and output, you must use the standard iostream library. Do not use any console or graphical libraries.