

CS23021 Computer Science I

Project #2

Due by 11:59pm on Friday, October 17, 2008

Weather Reporting

Preliminaries. In Ohio there is an old adage about the weather “*if you don’t like the weather - wait 10 minutes it’ll surely change*”. Meteorologists use several index’s to help us determine what to expect with regards to how the temperature will actually feel on any given day. Two examples of these types of indexes are described below.

1) The index called the wind chill factor, takes into account the wind speed and the temperature. The index provides a measure off the chilling effect of wind at a given air temperatures. Wind chill may be approximated by the formula:

$$W = 13.12 + 0.6215 * t - 11.37 * v^{0.16} + 0.3965 * t * v^{0.16}$$

where

v = wind speed in km/hour: valid only for v in the range 5 to 100 km/hr

t = temperature in degrees Celsius: valid only for $t \leq 10$ (50° F)

W = wind chill index (in degrees Celsius)

Wind Chill and Frostbite Guidelines:

- 30° F to 15° F Generally unpleasant (chilly)
- 15° F to 0° F Unpleasant (cold)
- 0° F to -15° F Very unpleasant (very cold)
- -0° F to -20° F Frostbite possible (bitter cold)
- -20° F to -60° F Frostbite likely. Outdoor activity becomes dangerous (extremely cold)
- -60° F or less Exposed flesh will freeze within 30 seconds (frigidly cold)

2) In the summer month’s meteorologists may report a Summer Simmer Index (SSI). The SSI is used to measure what the temperature will feel like when the overnight low temperature is reached. It takes into account the relative humidity and the air temperature. SSI may be calculated by the following formula:

$$SSI = 1.98 * (t - (0.55 - 0.0055 * h) * (t - 58)) - 56.83$$

where

h = relative humidity expressed as a whole number (i.e. 65% = 65)

t = temperature in degrees Fahrenheit: $t \geq 80$ (27 °C)

W = wind chill index (in degrees Celsius)

SSI and Heat Stress Guidelines:

- 70° F to 77° F most people are comfortable, but slightly cool.
- 77° F to 83° F nearly everyone feels quite comfortable
- 83° F to 91° F most are comfortable, but slightly warm.
- 91° F to 100° F increasing discomfort is experienced (warm)

- 100° F to 112° F caution of sunstroke and heat exhaustion exists for prolonged exposure and activity, along with significant discomfort (extremely warm).
- 112° F to 125° F virtually everyone is uncomfortable; a danger of heatstroke and great discomfort exists (hot)
- 125° F to 150° F there is an extreme danger of heatstroke, especially for the weakened or elderly, and even young children, whose body metabolism demands cooler effective temperatures than most adults. Maximum discomfort exists at these conditions (extremely hot).

Assignment. Write a program that allows a user to determine the Wind Chill index or the Summer Simmer Index depending on the value of an initial temperature entered. Calculate either the Wind Chill or the Summer Simmer Index depending upon the temperature value enter (e.g. calculate Wind Chill if the temperature entered is less than 10° C (50° F). Prompt the user for the appropriate additional parameter (i.e. wind velocity or relative humidity) for the index you will be calculating. Depending upon the resulting Wind Chill/Summer Simmer Index print out the result followed by an appropriate Frostbite/Heat-Stroke warning based upon the guidelines provided above.

Here is an example dialogue. User input is shown in bold.

```

Welcome to the Weather Index Calculator -
Please enter a temperature followed by either a C or F indicating the
value is either a Celsius or Fahrenheit temperature: 10 F
Enter the wind velocity: 40
Based upon your inputs the Wind-Chill is -14.8°F
WARNING: It is very cold outside - to most people it would feel very
unpleasant

Would you like to enter another temperature? (y/n) y

Enter a temperature followed by either a C or F indicating the value
is either a Celsius or Fahrenheit temperature: -17 C
Enter the wind velocity: 20
Based upon your inputs the Wind-Chill is -26.7 C
WARNING: It is bitter cold outside - Frostbite is possible

Would you like to enter another temperature? (y/n) y

Enter a temperature followed by either a C or F indicating the value
is either a Celsius or Fahrenheit temperature: 94 F
Enter the relative humidity: 60
Based upon your inputs the Summer-Simmer-Index is 113.6°F
WARNING: You are in danger of Heat-Stroke

Would you like to enter another temperature? (y/n)
...

```

Your program should detect if which index to use based upon the initial temperature entered. Results must be displayed in the same scale as the initial temperature was entered (e.g., either Celsius or Fahrenheit). Use at least the following functions (besides `main()`):

1. A function to output the initial prompts and take the initial user input;
2. A function to compute the Wind Chill
3. A function to compute the Summer Simmer Index

You are free to use more functions as needed. You are allowed to use functions, passing parameters by value, branching and looping constructs. You are not allowed to use any constructs we have not yet studied, such as arrays, pointers, pass-by-reference, etc.

Submission. Ensure that your code is properly commented and has good programming style. In the subversion repository create a subdirectory named `Project2` and deposit your source file(s) there.