CS 1026B – Assignment 1

Windchill and Humidex Calculators

Due: February 15, 2022 – 6:00 PM

Updates:

- Jan 25, added closing bracket to Humidex formula, added reference to programming standards in program requirements.

Overview

Write a program using user input, loops, and conditionals to calculate the windchill or humidex.

Reminders

- Your code must be done individually.
- Your code will be graded in part by an automated system.
- Your code may be compared to other submissions using computer software.
- You can submit your code up to 48 hours late, with a deduction of 0.5% per hour (or part of an hour) that the assignment is late.

Background

There are two measurements used in Canada used to indicate the difference between the actual air temperature and what it "feels like". In the summer, the **humidex** gives an indication of how humidity affects how hot it feels. In the winter, the **windchill** indicates how wind speed affects how cold it feels.

These measurements are calculated using formulas:

Measurement	Variables used	Formula
Humidex (**H**)	D: dew point (deg C) T: air temperature (deg C)	$F = 6.11 * e^{(5417.7530 * (1/273.16 - 1 / (273.16 + D)))}$ $G = 5/9 * (F - 10)$ $\mathbf{H} = T + G$
Windchill (**W**)	v: wind velocity (km/h) T: air temperature (deg C)	$\mathbf{W} = 13.12 + 0.6125 * T - 11.37 * v^{0.16} + 0.3965 * T * v^{0.16}$

In the formula for humidex, e is Euler's number (approximately 2.71828). In the math module, this can be accessed using the `math.exp()` function, i.e., to calculate e^t for some value t, write `math.exp(t)`. Note that we will assume that the dew point is always less than or equal to the air temperature. Environment Canada provides a calculator for these two measurements online at https://weather.gc.ca/windchill/wind_chill_e.html. **Note** that this website may differ from the formula for extreme values (e.g., very low windspeeds). The website is provided for reference only and the formula is always considered the correct value.

Additionally, Environment Canada provides guides for both measurements (these are slightly adapted).

Humidex	
Humidex Range	**Comfort rating**
20 to 29	Little or no discomfort
30 to 39	Some discomfort
40 to 44	Great discomfort. Avoid exertion
Above 45	Dangerous. Heat stroke possible

Wind chill	
Wind chill range	**Exposure Risk**
0 to -9	Low risk
-10 to -27	Moderate risk
-28 to -39	High Risk. Skin can freeze in 10-30 minutes
Below -40	Very High Risk. Skin can in under 10 minutes

In this assignment, you will write a program in python that prompts the user for information and then displays the appropriate measurement. In particular:

1. You should ask the user for the (air) temperature. The temperature should be allowed to be a floating point number, but you can assume that the user types a valid number (no letters or other non-number characters). If the user types a value outside the range of typical values in Canada (less than -50 or greater than +50), prompt for the user to enter a new value until an appropriate value is entered.
2. If appropriate, you should calculate the windchill or humidex. Prompt the user for the additional information needed, under these conditions:
    a. Report the windchill if the temperature is 0 or below, as well as the exposure risk. Windchill should be reported as a whole number (rounded to the nearest integer using `round()`, i.e., with `round(x)`).
    b. Report the humidex if the temperature is 20 or above, as well as the comfort rating. Humidex should be reported as a whole number (rounded from the formula provided).
    c. If neither of the conditions is true at the temperature, report this to the user and continue.

    For wind speeds, the input can be a floating point and should be in the range from 1 to 99 km/h (inclusive). For dew point, the temperature must fall in the same range as the air temperature and must also be less than or equal to the air temperature. In both cases, if these conditions are not met, the user should be prompted for a new value until an appropriate value is entered.

3. After reporting the outcome, ask the user if they would like to continue with a Y/N question. If the user wants to continue, then you should prompt for temperature again and continue. If the user wants to quit, the program should end. The prompt should work correctly when the answer the user gives starts with an Y or N (upper or lower case). If any other character is entered as the first character, the user should be prompted again.

To help make sure your code behaves exactly as specified, a text file with all the prompts has been provided. You should copy these into your code to prevent typos in your submission. Follow the format precisely to avoid lost marks due to automated grading. Do not put any extra blank lines in your output.

Code Requirements

Your code must satisfy the following requirements in addition to producing correct output.

1. Your code must be documented appropriately. Do not document every line of code, but major portions of your code must be commented.
2. Your code must include a comment at the top of program that includes your name and describes the overall function of the program.
3. Your code should use appropriate structures, such as user input, if statements, loops and formatted output code.
4. You should review the programming standards document for information on commenting, variable naming and other issues.

Submission Details

- You must submit your code using the instructions on the owl site.
- You must name your code Assign1.py.
- You must match the prompts from the file provided to you (a1-prompts.txt).
- You must follow the format of the output shown in the example below.

Assignment Marking

- Your code will be marked by an automated tool. The testing program assumes that
    - The code is saved as a file called Assign1.py
    - You are using a python3 version (recommended python3.9 or higher). If you use python2, you will likely lose marks.

  If your code has to be marked manually due to failure to follow these instructions, you will receive a deduction from your final mark.
- Your code will be evaluated by the Teaching Assistants for the code requirements described above.

Example Execution

The following sample run of the program is provided for your reference only. It is not a complete example of all possible cases. You should design your own test cases to ensure your code is working.

```
Enter a temperature between -50 and 50: -30
Calculating windchill.
Enter a wind speed between 1 and 99 km/h: 15
The windchill is -41. Very High Risk. Skin can freeze in under 10 minutes.
Check another weather condition (Y/N)? y
Enter a temperature between -50 and 50: 25
```

```
Calculating humidex.
Enter the dewpoint between -50 and 50: 24
The humidex is 36. Some discomfort.
Check another weather condition (Y/N)? Y
Enter a temperature between -50 and 50: 15
Windchill and humidex are not a factor at this temperature.
Check another weather condition (Y/N)? n

Process finished with exit code 0
```