○ 标记为完成

截止 5月20日 由 23:00 编辑 **得分** 40

Lab 1 - Stevenson Shelters

Objective

To practice implementing and testing a class from a provided interface.

Description

A Stevenson Screen (pictured above) is a standard shelter that protects very precise meteorological instruments which measure things like temperature, dew point, wind speed, rain, etc. These readings are used to calculate the different temperatures that appear in your weather report. For instance:

- **Heat index** is a measure of how hot it feels when relative humidity is factored in with the actual temperature. It is calculated in a number of different ways but for our example, consider the formula for heat index (HI):

  $$HI = c_1 + c_2T + c_3R + c_4TR + c_5T^2 + c_6R^2 + c_7T^2R + c_8TR^2 + c_9T^2R^2$$

  where T is the temperature in degrees Celsius, R is the relative humidity in percent, and the coefficients are: c_1 = -8.78469475556, c_2 = 1.61139411, c_3 = 2.33854883889, c_4 = -0.14611605, c_5 = -0.012308094, c_6 = -0.0164248277778, c_7 = 0.002211732, c_8 = 0.00072546, and c_9 = -0.000003582.

- **Wind chill** is related to heat index and is used when the real-feel temperature is lower than the actual temperature. There is some variation on how it is calculated depending on where you are but here in the United States, it is calculated with this formula:

$$WC = 35.74 + 0.6215T - 35.75v^{+0.16} + 0.4275Tv^{+0.16}$$

where WC is the wind chill based on the air temperature in degrees Fahrenheit (T) and the wind speed in miles per hour (v).

Hint: The formula convert temperature from Celsius to Fahrenheit is $F = \frac{9}{5}C + 32$

Furthermore, the **relative humidity** can affect the way we perceive temperature. The relative humidity is the amount of moisture in the air relative to the amount of moisture the air can hold. It is calculated as a percentage of the *actual vapor pressure* (calculated from the dew point) over the *saturated vapor pressure* (calculated from the actual temperature). Where vapor pressure is calculated using this formula:

$vp = 6.11 * 10 * \left(\frac{7.5*temp}{237.3+temp}\right)$ (see this page for more information (https://www.wikihow.com/Calculate-Humidity#Calculating-Relative-Humidity-with-Dew-Point-and-Temperature))

What to do

Assignment Directory: lab01-stevenson

Starter files: WeatherReading.java (https://northeastern.instructure.com/courses/146237/files/21109984?wrap=1) (https://northeastern.instructure.com/courses/146237/files/21109984/download?download_frd=1)

Package: weather

Start by downloading the provided `WeatherReading` interface and implement it in a class called `StevensonReading`. Each instance represents a single reading of a weather station. In this assignment, we will implement a `StevensonReading` whose primary purpose is to store a reading that was taken from a Stevenson Station, the only thing an object of this class needs to do is to provide different values related to the reading. Methods like this are called *accessor methods* or *getters.*

Your implementation should:

- Ensure that your class cannot be modified or extended in any way.
- Include a constructor that takes four parameters: the air temperature in Celsius, the dew point temperature in Celsius which cannot be greater than the air temperature, the non-negative wind speed in miles per hour, and the non-negative total rain received in the last 24 hours in millimeters (where millimeters is the smallest unit the total rain is measured in). It should throw an `IllegalArgumentException` for invalid values.
- Implement a `toString` method. The string representation of your class should have this format:

```
Reading: T = 23, D = 12, v = 3, rain = 12
```

- Implement a proper `equals` and `hashCode` that is based on the four values read by the Stevenson Shelter

Testing

Whenever you write a class, you should also write tests for that class that proves not only that your code CAN work but that it WILL ALWAYS work. Additionally, your tests should be sufficient to ***convince someone else that your code works correctly***.

What to Submit

1. Create a zip file that directly contains only your src/ and test/ folders. When you unzip the file, you must see only these two folders.
2. Navigate to Gradescope through the link on Canvas.
3. Navigate to this lab and submit the zip file.
4. Wait for a few minutes for the grader's feedback to appear, and take action if needed.
5. Once you are completely happy with your submission, complete the corresponding *lab report*.

Grading Criteria

This assignment is worth ~ 3.5% of your final grade and will be assessed two ways:

1. Correctness and style will be assessed via *automatic testing* on Gradescope.
2. Implementation and completeness of your testing suite is assessed via the *lab report* completed on Gradescope *after submitting the final version of your code*. The questions will ask you:
   - **specifics about your implementation**: Did you use the concepts in this week's module to solve this problem thereby achieving the assignment's objective? Did you write a test suite of your own that would convince someone else that your code works correctly?
   - **to provide pointers into your code:** Using class names, method names and/or line numbers, be specific about where you implemented a specific element of the assignment or a specific test case.
   - **to provide explanation:** Can you explain what you did and why you did it?