
The following problems should be done in Julia. Type up the code you used to find your results and answer all questions. Submit your homework via Blackboard by using any program you want and submitting the PDF version of it or an ipynb file. This assignment should be submitted no later than 11:59pm on November 12, 2014.

1. The mean and standard deviation of set of numbers is an important way to condense a large set to a two numbers. Recall that the mean of $\{x_1, x_2, \dots, x_n\}$ is

$$\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

and the standard deviation is

$$s = \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \dots + (x_n - \bar{x})^2}{n - 1}}$$

- (a) Write a function that takes a 1-D array of numbers and returns the mean. Call this function `the_mean` to distinguish from the built-in one. You may use the built-in `sum` function, but not the built-in `mean` function. You may also use a `for` loop.
 - (b) Write a function that takes a 1-D array of numbers and returns the standard deviation. Call this function `the_std` to distinguish from the built-in one. You should not use the built-in `std` function, but other functions are fine. Hint: you can use the `reduce` or `sum` function with a function to write this compactly, but may use a `for` loop as well.
 - (c) You should test your functions on some small arrays/vectors and you can use the built-in functions `mean` and `std` to help debug.
 - (d) Load the `RDatasets` package. You may have to add the package first and then load it with the `using` keyword. Note: the first time you add the package, it may take some time to load, since it is pulling in a lot of data. There are a lot of interesting datasets here, but today we will only look at the waiting time between eruptions from Old Faithful in Yellowstone National Park. Load this data by typing:


```
data = dataset("datasets", "faithful")
```
 - (e) Extract only the 2nd column of this and store it in a variable called `eruptions`. In order to use it correctly, you will need to convert the column to a `Vector` by wrapping `Vector()` around the result.
 - (f) Find both the mean and standard deviation of waiting time using your functions above.
2. Adapt your quadratic solver from HW #3 to make it more robust. In particular, check to see if the solution is real. If not, you should throw a `ErrorException` with an appropriate message. Give some samples which shows that the code is working.
 3. In this problem, we investigate the *multiple dispatch* capabilities of Julia. Again, this means that we can give functions the same name if they have different number of argument or argument types.
 - (a) Write a function that returns the mean called `the_mean` of the following number and type of parameters.
 - (i) 2 numbers
 - (ii) 3 numbers
 - (iii) any number of numbers (Hint: use variable arguments)
 - (iv) A `FloatRange`. (Hint: you should determine a formula for the mean based on the min, max and step size of the `FloatRange` and use the `first`, `last` and `step` functions)
 - (b) Provide some tests of these above.