ENGR/CS 101
Fall 2014 – Homework 3

Out: November 21, 2014
Due: December 3, 2014 at 4:30pm (Wednesday after Thanksgiving)

Problem Statement

In class we have been implementing various statistical measures for dispersion (namely range) and central tendency (namely mean, median, and mode) of a collection of data values. A second measure of dispersion is ***sample standard deviation***, which is a measure of how much the data values deviate from the mean. If the sample standard deviation is large, the numbers are scattered far from the mean. The sample standard deviation, S, of a list of N values named x_i is defined by the following formula:

$$S = \sqrt{\frac{1}{N-1}\sum_{i=0}^{N-1}(x_i - x_{mean})^2}$$

where x_{mean} is the mean of the N data values $\{ x_0, x_1, \ldots, x_{N-1} \}$.

Assignment

Write a Python program that allows the user to specify a file of data values and repeatedly allows the user to choose a statistical measure to be computed for the data values. The program should first asks the user for the name of a file containing data values, open the file, then store the values into a list. After this, the program should repeatedly allow the user to choose a statistical measure to be computed. The choices for measures must be range, mean, median, mode, and sample standard deviation.

Your program must define and use the following functions:

- **`getChoice()`** - this function prints out the menu of choices, asks the user for their choice, and returns the user's choice.
- **`computeRange(aList)`**, **`computeMean(aList)`**, **`computeMedian(aList)`**, **`computeMode(aList)`**, **`computeStdDev(aList)`** – a function for each statistical measure that receives a list of data values and returns the statistical measure. Note these functions were written during class except for **`computeStdDev`** which is to compute and return the sample standard deviation.
- **`main()`** - the main program function. It should have the main menu-driven loop that repeatedly asks the user for an choice and an if-statement that determines which statistical measure is to be computed and displayed the result. It should call functions to compute the results. If the user enters an invalid choice, an error message should be displayed.

Your program must interact with the user in exactly the manner shown in the sample run, stopping when the user enters **`q`** for their choice.

Coding Notes and Hints

- The **`computeStdDev`** function should call the **`computeMean`** function to compute the mean. It should not duplicate the code in the **`computeMean`** function
- As with computing the mean, the summation in the sample standard deviation formula is implemented using a for-loop that iterates over the list of data values.
- The square root function is in the **`math`** module. Put **`import math`** at the top of the program file and the name of the function is **`math.sqrt`.** (Or you can use exponentiation to the one-half power.)
- The output does not need to be formatted.

Sample Run (user input shown in **bold**)

```
Enter the name of the input file: numbers.dat

Choose a statistical measure
   a. Range
   b. Mean
   c. Median
   d. Mode
   e. Standard Deviation
   q. Quit
Enter your choice: a
The range of this collection is 94

Choose a statistical measure
   a. Range
   b. Mean
   c. Median
   d. Mode
   e. Standard Deviation
   q. Quit
Enter your choice: b
The mean of this collection is 49.84

Choose a statistical measure
   a. Range
   b. Mean
   c. Median
   d. Mode
   e. Standard Deviation
   q. Quit
Enter your choice: c
The median value of this collection is 44

Choose a statistical measure
   a. Range
   b. Mean
   c. Median
   d. Mode
   e. Standard Deviation
   q. Quit
Enter your choice: d
The mode values of this collection is [2, 9, 15, 16, 20, 22, 25, 26, 31, 34, 38,
 42, 44, 51, 52, 64, 69, 74, 76, 79, 83, 91, 93, 94, 96]

Choose a statistical measure
   a. Range
   b. Mean
   c. Median
   d. Mode
   e. Standard Deviation
   q. Quit
Enter your choice: e
The standard deviation of this collection is 29.8868421439
```

```
Choose a statistical measure
   a. Range
   b. Mean
   c. Median
   d. Mode
   e. Standard Deviation
   q. Quit
Enter your choice: f
Invalid choice.  Try again!

Choose a statistical measure
   a. Range
   b. Mean
   c. Median
   d. Mode
   e. Standard Deviation
   q. Quit
Enter your choice: q
All done
```

How to Submit

The submission system will not be ready to accept assignment until the evening of Saturday, November 29.

First, write a comment (lines starting with **#**) at the top of the program file with your name and the phrase "**`CS 101 Homework 3`**" with exact spacing, capitalization and spelling. This will be used to make sure you submit the correct program file. Save your program file and make sure it still runs.

In a web browser, go to URL submission.evansville.edu. Your login name is your ACENET username (unless you also are in CS 210, then your login name has "-cs101" appended to it). If you haven't changed it, your password is your student ID with the leading 0.

Click on the Submit Solution link for Homework 3, then click on the Browse button. Browse to your Homework 3 program file. Right-click on the program file, select Send to, then select Compressed (zipped) folder. Double-click on the ZIP folder, then click on the Submit button. (Mac users will need to zip their files before using the submission system.)

The submission system checks for the "CS 101 Homework 3" comment. It must be **exactly** as shown including spacing, capitalization and spelling. When this comment is not found, the submission will fail. Correct the comment, save the program file, then zip and submit it again.