

Assignment 7: How Mean are Function Scopes?

Assigned: Thursday, April 4, 2013

Due: 12:30 MST, Thursday, April 11, 2013

The coded solution to the following problem is to be done by you and only you. You may use your text, notes, online tutorials, etc., but the code must be your own. Bear in mind that any help you seek should be for MATLAB issues, not for help writing your program! If you have trouble compiling or debugging your code, see the professor as soon as possible. Be sure to submit a .zip folder called “Last_Name, First_Name” with (1) a .txt file documenting the command window followed by text of all your code, and (2) all M-files you wrote for the assignment.

Problem Statement

In statistics, there are definitions for many types of means that are useful in different situations. Some of them are listed below for a sample of n data values x_i :

The *power mean*

$$\bar{x} = \left(\frac{1}{n} \sum_{i=1}^n x_i^m \right)^{\frac{1}{m}}$$

gives the quadratic, arithmetic, and harmonic means for $m = 2, 1, -1$ respectively.

The *weighted arithmetic mean*

$$\bar{x} = \frac{\sum_{i=1}^n w_i x_i}{\sum_{i=1}^n w_i}.$$

The *geometric mean*

$$\bar{x} = \left(\prod_{i=1}^n x_i \right)^{\frac{1}{n}}.$$

The *contraharmonic mean*

$$\bar{x} = \frac{\sum_{i=1}^n x_i^2}{\sum_{i=1}^n x_i}.$$

The *root mean square*

$$\bar{x} = \sqrt{\frac{1}{n} \sum_{i=1}^n x_i^2}.$$

Inside a directory for this project, write functions to execute the above (italicized) means such that:

- The power mean function called `power_mean` should be able to return any one of the quadratic, arithmetic, or harmonic means and take up to three inputs: an array of data points x , the desired m , and an array of weights w for the data points. If `power_mean` is called with one input variable, it should default to return the arithmetic mean. If `power_mean` is called with three input variables, it should return the weighted arithmetic mean and the other desired mean corresponding to the input for m .

- The weighted arithmetic mean function and the geometric mean should be separate functions both called `mean`. We only want to be able to call the arithmetic mean function from within `power_mean` and we only want to be able to call the geometric mean function from within the project (without confusing the two).
- Functions for the contraharmonic mean and the root mean square should be called `contra_mean` and `root_mean` respectively. Write a function called `sum` exclusively used for functions in the project that returns $\sum_{i=1}^n x_i^m$ and takes two inputs: a set of data values x , and the exponent m . Use the user-defined function `sum` in the execution all applicable means (i.e. all but geometric mean)