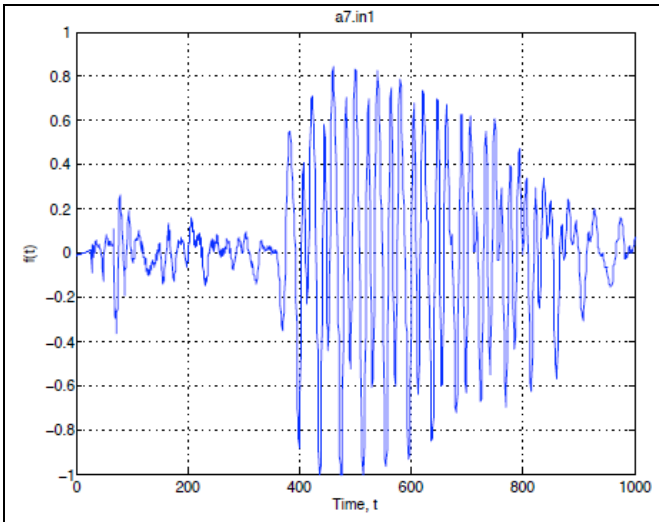
CS410P

LAB 11L

Purpose

The purpose of this assignment is to give you practice with reading from an input file and working with lists, loops and functions.

Scenario



An acoustical signal can be converted into an electrical signal by a microphone and the electrical signal can then be converted into a series of numbers representing the value of the electrical signal at discrete time intervals. These values have been stored in a data file. We are interested in analyzing this data to measure various aspects of the acoustical signal.

Problem

Read from a file containing noise signal data and print out several pieces of information on the signal.

Input

The input file consists of a series of floating point numbers representing the acoustical signal. You should read these values into a list until end of file.

Output

The output should consist of a neat well labeled message with the following information in this order:

1. Number of sample points
2. The variance
3. The standard deviation
4. Number of zero crossings

(Sample input and output files are under the public folder)

Details:

In this program you should read the data from an input file (prompt the user for an input file name). Following are the operations that you need to perform, each of these should be done inside a separate function:

- Accept a file name from the user, the file must be present in the same folder as your program. Download the input files in1, in2, in3 from the public folder into your local folder where your program resides i.e. your 12L folder on your machine.

- Read the data into a list (argument is the file name, function return value is the list)
- Compute the variance and standard deviation (argument is the list, function return values are: variance and standard deviation). **You must use your own expressions to compute the variance and standard deviation and not use any library functions!**
- Compute the number of zero crossings (argument is a list, function return value is the number of zero crossings)
- Printing the results must be done only in the main function
- Two files must be submitted: **main.py** contains only the main function; **signals.py** contains all the other functions to be named as read_data(), compute_variance_std(), computer_zero()

The **variance** (denoted σ^2) of the data points in the sample: the variance of a list of n values $x_0, x_1, x_2, \cdots, x_{n-1}$ is given by:

$$\sigma^2 = \frac{1}{n-1}\sum_{k=0}^{n-1}(x_k - \mu)^2$$

where μ is the mean value ($\mu = \frac{1}{n}\sum_{k=0}^{n-1} x_k$).

The **standard deviation** of the data points in the sample: the standard deviation of a list of n values $x_0, x_1, x_2, \cdots, x_{n-1}$ is the square root of the variance.

The number of zero crossings. The number of zero crossings is the number of times the signal changes from positive to negative or negative to positive. For this we will consider 0 as "positive", that is a change between a negative and 0 is a zero crossing while a change between a positive and 0 is not.

Grade Key

A	Comments (including Name, brief description about program)	**5**
B	main function: prompt user for input file name and pass it read_data function	**10**
C	read_data function: reads data from input file and returns a list of values. If you don't close input file (-2)	**15**
D	compute_variance_stddev function: uses list which is argument and computes the two values: variance and std deviation and returns both. (-15 if library functions are used to compute these). Printing of results done in caller	**35**
E	Compute_zero_crossings: uses list which is argument and returns the number of zero crossings. Printing of result done in caller.	**35**