

CS 105 – Introduction to Scientific Computing

Assignment 11 – File I/O and Recursion

Objectives

After completing this assignment you should be able to:

1. Output data to a text file
2. Parse text data from a file and load it into a vector for plotting
3. Write both recursive and non-recursive functions

This assignment builds upon many of the previous homework assignments, in particular:

- Extracting data from strings
- Sorting data
- Plotting
- Functions

Overview

One of the most important thing you can use Matlab to do is to read in data from external sources and then use the data however you like (plot, get statistics on it, etc..). In addition, you may want to export, or output, data generated in Matlab so that others can use it (in Matlab or something else).

In this assignment you will do both. Part I involves creating a *log file* based on a user's input. In Part II you will read in data from a text file and use it to compute statistics and to plot it.

In addition, many problems define themselves most naturally through earlier problems. In computer science it is often easiest to provide solutions to these types of problems through *recursion*, where a function calls itself until it arrives at a base case. In Part III you will implement and test a recursive function.

Part I – Creating a Log File

In this part you will write a script that gets a filename from the user and opens a file with that name in *append* mode. Then while the user doesn't type the word 'Goodbye' you should get a string from the user and write to the file a line in the format

linenum: whattheywrote

HINT1: Use a variable to keep track of how many times they have input something. This is the linenum stated above.

HINT2: The function strcmp(x,y) can be used to compare strings x and y. If they are equal it returns 1 (true), otherwise it returns 0 (false).

Example:

Enter the filename: *test.log*

Enter a line or type Goodbye to quit: *Hello*

Enter a line or type Goodbye to quit: *how are*

Enter a line or type Goodbye to quit: *You?*

Enter a line or type Goodbye to quit: *Goodbye*

Now you should have a file called *test.log* that contains the following:

1: Hello 2: how are 3: You?

Part II – Reading in Formatted Text Data

In this assignment you will read in **formatted text data** to an array, compute statistics on the data, and plot the data.

The text file contains several lines in the format

(x1, y1)

(x2, y2)

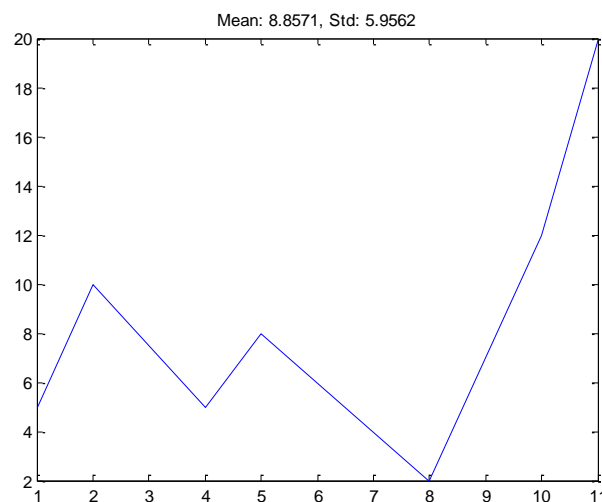
Etc...

That is, each line contains an open-parenthesis, a value, and command and a space, then another value, then a closed-parenthesis.

This data is in the file A11Data.txt (also on canvas)

Your task is to write a script that:

1. Reads in each line of the file, converting the values to numbers, and storing them as a new row in a data matrix
 - a. If the file has 20 lines in it, then your final matrix will be a 20x2 matrix
 - b. *HINT: You may want/need to use `strfind` and/or `strtok` to extract data from each line*
2. Sorts the data according to the 1st column
 - a. *HINT: See the `sortrows` function (or write your own)*
3. Plots the 1st column vs the 2nd column
4. As part of the plot **title**, put the mean and standard deviation of the 2nd columns values
 - a. *HINT: Use the Matlab help to find the function to compute standard deviation*



Part III – Creating a Recursive Function

In this part you want to create a function that makes recursive calls and then test this function by using it in the command line interface

Given 2 numbers, n and m , we can compute their product, $n*m$ using the *Russian Peasant Multiplication* algorithm, which is defined as follows:

$$product(n, m) = \begin{cases} product(\frac{n}{2}, 2m), & \text{if } n \text{ is even} \\ product(\frac{n-1}{2}, 2m) + m, & \text{if } n \text{ is odd} \\ m, & \text{if } n = 1 \end{cases}$$

Write a function called, *product* that takes 2 parameters n and m and returns their product using this recursive algorithm.

Test your function in the command line interface by doing stuff like *product(4,2)* and checking that the answer is 8

HINT: n is even if $mod(n,2)==0$

Submission

Submit a .zip file consisting of:

1. Your PDF report explaining what you did and experienced for each part. This should also contain the plot for Part II
2. The scripts for Parts I, II, and III
3. The output log for Part I