ASTR 121 – Spring 2016

Lab 1a – Introduction to MATLAB (Part 1)

Important dates:

- Prelab due: Monday, [Date TBA]
- Part One due: Friday, [Date TBA]
- Part Two due: Friday, [Date TBA]

Goals:

At the end of this lab, you should be able to…

- Use MATLAB to generate, visualize, and analyze data
- Write self-sufficient, organized, and commented scripts
- Teach yourself additional MATLAB skills

In the following, "you" refers to "you and your partner," since most activities will be done in two-person groups to promote collaboration. You will hand in materials jointly with your partner, with both your name and the name of your partner indicated clearly. For this to be the most effective learning experience, you and your partner should share equally in conducting and writing up each lab. This can be accomplished, for example, by taking turns at the keyboard. If for some reason you are without a partner, you will be asked to join an existing two-person group so that no one is working alone.

Preparation

1. If you have not yet completed the tutorial portion of the pre-lab assignment for this lab, do so now. This will familiarize you with the basic operations in MATLAB. Take your time—this is an important step.

2. On the desktop of your workstation, find and open the "ASTR121" folder. Create a new folder within it, and name it using the initials of each lab partner, and the number 1 (for lab 1).

3. Open MATLAB, if you haven't already, and change your current directory to the folder you just created. You can do this either using the GUI (i.e., MATLAB's "Graphical User Interface"—look for the "Browse for folder" icon), or with the command cd directory, where directory is the path to the folder you created (which is C:\Users\Student\Desktop\ASTR121\initials1). (Note: in MacOS or Linux, the path will be different, and the separators will be forward slashes (/) instead of backslashes (\)

4. Using a browser, log in to ELMS and access the "MATLAB Tips & Tricks" section under Pages for ASTR121. Skim through the topics and then complete the following exercises.

Procedures

In this part of the lab, you will practice using the MATLAB data analysis and visualization environment. This is a valuable tool supported by the University of Marylnd that may be required to use in other courses, or simply find to be helpful in general.

Provide answers to questions in a Word document, which will be turned in along an m-file of your scripts. Remember to list the names of everyone in your group.

1. What is the reason for placing a semicolon at the end of a MATLAB command?

2. What is the purpose of the MATLAB hold command?

3. Provide a MATLAB expression using compact colon notation to generate the following 2-dimensional array (matrix):

$$A = \begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 2 & 4 & 6 & 8 & 10 & 12 \\ 3 & 6 & 9 & 12 & 15 & 18 \end{matrix}$$

4. Consider the following MATLAB commands:

```
A = [1:5; zeros(1,3),ones(1,2); 10:-1:6];
S = size(A);
Q = S(1) + length(A) - A(2,5) + length(zeros(1,3));
```

   What is the value of Q? Try to figure it out first before entering the commands into MATLAB. Hint: write out what you think each command does.

5. Use MATLAB to generate 8 random values between 0 and 1, sort them in ascending order, and compute the mean value. Publish the results of these steps and print it out

6. Create a function m-file that takes one input, x, and outputs y, where $y = \sqrt{x^2 + 15}$. Be sure to suppress the output, and also include a clarifying comment or two using the percent symbol (%) to explain your function—this is always good practice and will help you and others know what your code is supposed to do. Once you have it working, print out the published version.

7. Create a script m-file that does all of the following in order (suppress the output from each expression, and remember to include comments where appropriate):

   a. Create an array with the numbers 1 4 7 in the first row and 3 5 8 in the second row.

   b. Create an array that runs from 10 to 50, with an increment of 0.1, using the colon operator.

   c. Create an array that runs from 10 to 50 with 1900 equally spaced points, using `linspace`.

   d. Create an array that is the result of the equation 5 cos x, where x is the array you created in part 7b.

   e. Create an array that is the result of the equation $3 \sin^2 y$, where y is the array you created in part 7c. Remember, you need to do something to prevent MATLAB from attempting to do matrix math.

   f. Create a single plot that shows both the solution to part 7d using a solid blue line and the solution to part 7e using a dashed black line. Label the axes and give the plot a sensible title.

   g. Create an array that is the solution to your function from step 6, where the input to the function is the array from part 7b.

   h. Plot the solution from 7g, but reverse the x axis on the plot. Label and title your plot.

8. Publish your m-file from step 7 and print the resulting html page using the lab printer. It won't print in color, but that's OK.