Homework #1:Matlab Introduction, Lab Prep, Open and Closed Loop Systems

Due Thursday, 8/27/15 hardcopy in lecture and softcopy in Canvas

Where applicable, use the Homework Template file (<http://www.engr.sjsu.edu/bjfurman/courses/ME190/HW_related/HW_template.docx>) for your homework responses. Don’t forget to fill out the cover sheet completely. Include a summary of what the assignment was about, and what you learned in doing it. Where written responses are requested, please type them. Make sure that you show how you arrive at any answers involving numerical calculations. Answers that do not show intermediate steps will likely not earn many, if any points. Remember that you must turn in a softcopy of your work in Canvas in order to receive any credit for this assignment. Hand written solutions can be included by scanning them or by including a *clear* picture of them in the softcopy submission. (Be aware that if the scan or picture is not legible for the grader, you will likely not receive credit for your submission!) Copy and paste additional table cells as needed. For answers completed using Matlab, use the Publish feature to create your output. These can be included in your submission as separate files, if desired, and indicated as such in the homework template (e.g., “See published result for Problem XYZ attached separately”), but don't forget to attach the files to your submission!!!!

1. (2 pts) Get and install the student version of Matlab and Simulink. You can buy it online at: <http://www.mathworks.com/academia/student_version/> . Include evidence in your submission that you have installed the software.
2. (2 pts) Download and review the Introduction to MATLAB, which you can find at: <http://www.maths.dundee.ac.uk/software/MatlabNotes.pdf> . Comment on a few things you learned from this Introduction.
3. (2 pts) Watch the MATLAB Fundamentals Academic Tutorial, which you can find at: <https://www.mathworks.com/academia/student_center/tutorials/player/player/content/CoursePlayer.html> . Comment on something you learned from this Tutorial.
4. (2 pts) Watch the video on publishing MATLAB scripts, and use this feature whenever you submit work with Matlab: <http://www.mathworks.com/academia/student_center/tutorials/ps_publishing/player.html> Comment on something you learned from this Video.
5. Read these plotting tips:

* (5 pts) <http://www.mathworks.com/help/matlab/ref/plot.html>. Show how you could modify the example that makes two sub-plots of the sine waves to ONLY show points in the upper subplot (for sin(5x)) and a red dashed line for the lower subplot (for sin(15x)). How many points are being plotted in either of the two graphs? How did you verify that number?
* <http://www.mathworks.com/help/matlab/creating_plots/using-high-level-plotting-functions.html>

1. (2 pts) Download Plot Digitizer, and read the homepage description: <http://plotdigitizer.sourceforge.net/>. What file formats will Plot Digitizer work with?
2. (2 pts) Review the materials for Lab 1 Matlab Refresher and Data Handling: <http://www.engr.sjsu.edu/bjfurman/courses/ME190/Lab_related/Lab1_Matlab_refresh_related/ME190_Lab_1_Matlab.docx>. In what format will you need to put your Matlab code and what must the first section of your submission include?

**Exercises**

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**Exercise 1)** (5pts) **Questions from the MATLAB Tutorial – (Section on ‘Working with the Matlab User Interface’)** (<https://www.mathworks.com/academia/student_center/tutorials/player/player/content/CoursePlayer.html>) . You can find the data set for the gas prices here: <http://www.engr.sjsu.edu/bjfurman/courses/ME190/HW_related/gasprices.csv>

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1a. From the section,‘Working with the Matlab Interface, what is the mean gas price for Germany over the years listed in the data set? (Show or explain how you arrived at your solution)

1b. What price was inserted in the NaN cell during the tutorial?

1c. What is the file type of variables you have saved from the Matlab Workspace?

1d. By default, where is the data file saved (unless you change the location)?

1e. Suppose you wanted to plot the gas prices of Germany, Italy, the UK, and the U.S. on the same graph. What plot type would you use from the Plot tab? (Include the plot in your report, and use the drop-down menus in the Figure Window to add an xtitle, ytitle, title (for the plot). From the Command Window, type the command, grid to the command prompt.

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**Exercise 2)** (4 pts) **Questions from the MATLAB Tutorial – (Section on ‘Variables and Expressions’)** (<https://www.mathworks.com/academia/student_center/tutorials/player/player/content/CoursePlayer.html>)

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2a. From the section, ‘Variables and Expressions’, what command would you issue on the Command Line (Command Window) to save just the U.S, UK, and German gas prices to a Matlab data file named, ‘US\_UK\_Ger\_prices’?

2b. True/False: To create a row vector, you must separate values between square braces [ ] by semicolons. Explain your answer.

2c. Which operator creates a row vector having elements that are equally spaced? Include an example for elements from 2 to 10 equally spaced by two.

2d. Show how you would create a column vector of 10 points logarithmically spaced between 1 and 10.

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**Exercise 3) Plotting in Matlab**

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3a) (5 pts) On one plot, show a sine wave and a cosine wave. The waves should start at t = 0 and show about two cycles of each. Use a different color and different line types for each wave. Label the axes. Include a title, ‘Sine and Cosine Signals’. Include a grid on this plot, a legend, and indicate with an arrow and text, a point on the sine wave where it crosses the y = 0 axis. Your .m file to make this plot must include the plot and the code to annotate the figure as described.

3b) (5 pts) Repeat the plotting from 3a), but do it so that the waves are shown in separate subplots, but side-by-side next to each other. Include an arrow and text for the cosine plot showing a point where it crosses the y = 0 axis.

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**Exercise 4) Reading from the textbook - Read Chapter 1 Introduction in the Astrom and Murray text (**[**http://www.cds.caltech.edu/~murray/amwiki/index.php/Main\_Page**](http://www.cds.caltech.edu/~murray/amwiki/index.php/Main_Page)**)**

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4a) (5 pts) Do Problem 1.6 from the Astrom-Murray text.