AE 2790: Homework #4

Due Friday 2/22/2019 11:59pm

Submit on Canvas

For questions (1-3), reference Appendix C in the NASA Systems Engineering Handbook provided on Canvas. All code must be submitted with this homework. All non-mathematical questions should be answered in full sentences with proper grammar. Failure to comply with these rules will result in docked points.

When you submit your homework put all of your files in a folder named '`section#_lastname_firstname`. All plots should have x and y axis labels, there should also be a legend when you have multiple lines on the same plot. Your code must compile when we run it. If it does not compile you will not receive any points; however, if you bring in your computer and show that the problem is with our Maltlab versions, you will receive your points.

1. (6 points) What do each of the following terms mean in an RVM?

   shall -

   will -

   should -

2. (8 points) Answer the following true/false questions:

   (a) (2 points) _____ Requirement statements should have one subject a and one predicate.

   (b) (2 points) _____ The requirement should include the implementation, or the "HOW" to provide the function.

   (c) (2 points) _____ Requirements should be in the form "ABC shall XYZ".

   (d) (2 points) _____ Requirements can be stated positively or negatively.

3. (11 points) Insert the Mission Success Criteria table from the RVM completed in lab.

4. (5 points) You should always wash your hands after soldering to remove any residual _____, which is a toxic heavy metal found in solder.

5. (5 points) How hot should the soldering iron be when soldering (in degrees Fahrenheit)?

6. (5 points) In NX, what tool adds a 3^{rd} dimension to a sketch?

7. (5 points) In NX, what tool cuts away a circular area of a part?

8. (5 points) In NX, what operation constrains parts to form an assembly?

9. (15 points) Develop a CONcept of OPerations for your mission. The first step of your CONOPS should be the integration of your payload to the flight string, and your final step should be delivering processed data and scientific conclusions to the instructors. Specific detail should be paid to the data acquisition element of the flight.

10. (5 points) List three different places where unforeseen circumstances might cause the mission to deviate from the proposed CONOPS. In addition, describe how these problems could be fixed (if they occur before launch) or how the problems will affect your ability to draw your scientific conclusions (if they occur during launch).

11. (5 points) Take the following dynamics and write them in matrix form:

$$\begin{aligned} x_{k+1} &= 2x_k + 5y_k - 3z_k \\ y_{k+1} &= 5y_k - 3z_k \\ \Delta z &= 0.5x_k + 12y_k \end{aligned}$$

The result should be in the form

$$a_{k+1} = Ba_k$$

both a matrices are 3×1 vectors and B is a 3×3 matrix.

12. (15 points) Load the `values.mat` file. Find the mean and standard deviation of the data set. You may use the built-in matlab functions `mean` and `std`. Plot a normal pdf with the mean and standard deviation you found. Plot the normal distribution with x values ranging from 4 to 8 in increments of 0.1

$$p_n(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left\{-\frac{(x-\mu)^2}{2\sigma}\right\}$$

In the same figure, plot the histogram of the data with 20 bins and use a `pdf` normalization. Use the `histogram` function for this plot.

If you use `mean` and `std` in your code, write out the equations for both below.

13. (10 points) Repeat problem #5 from homework #3 without using `polyfit`. If you did not use the `polyfit` function in homework #3 simply resubmit your code and results from homework #3. You must use the least squares fit described in homework #3.