Homework 6 **ENGR 130, AU 23**

This assignment has one MATLAB Grader question and two coding problems. Submit all code as a single .m file. Submit your algorithm for Question 3 as a .pdf file. Follow all instructions in the Assignment Submission Guide posted in the Canvas Resources area. Failure to do so will result in a reduced (or possibly zero) grade.

Question 1 (2 points)

Go to the assignment HW6 – MATLAB Grader and complete the assignment that is linked there.

Question 2 (10 points)

Some engineers are helping design a new style of pressure washer that should deliver pressure between 1300 and 2000 PSI. They are using computer simulations to evaluate five potential designs. The results of these five different simulations are in a file named HW6_design_data.mat. The name of the matrix storing the data is DesignData, with each column containing the pressures from a different design. There is a time period of .1 s between successive pressure readings. Your job is to write a MATLAB script that analyzes these data to

a. determine how often the pressure is less than the desired minimum pressure. It should ask the user to enter a value for the minimum pressure and a design number (1 through 5), then use logical indexing to identify and display all the pressure values less than the threshold for that specific design simulation. Save these values as a new .mat file. Also print to the screen the number of instances that are below the threshold.
b. display the maximum and minimum values for each machine, along with their corresponding times.
c. plot the data of pressure vs. time for all machines on one graph. Format and label your plot so that the information is easily understood.

The output for parts a and b should be formatted as shown below:

```
Enter the threshold value: ####
Enter the simulation number (1-5): #
Simulation # generated values below the threshold ## times.

Simulation 1:
Maximum value: #### PSI at ##.# s.
Minimum value: #### PSI at ##.# s.

Simulation 2:
Maximum value: #### PSI at ##.# s.
Minimum value: #### PSI at ##.# s.
…
Simulation 5:
Maximum value: #### PSI at ##.# s.
Minimum value: #### PSI at ##.# s.
```

Question 3 (10 points)

Before starting the code for this problem, write an algorithm describing the logic of the code you will write. Remember that it should be understandable by an intelligent person who has never coded. You will submit the algorithm as part of this assignment.

The next time you are in the bathroom at the rear of a plane, know that there is a giant cabin pressure bulkhead a couple of inches away keeping you safe, supporting all the forces from pressure differences inside the cabin. There is an extensive safety system with many sensors regularly taking pressure readings. As a simplification, assume there are two sensors; one measures the pressure on the bulkhead while the other measures the cabin pressure. Measurements are taken every two seconds, and a comparison is made based on the bulkhead pressure and the change in the cabin pressure during the previous two seconds.

After a recent flight from Detroit to Cleveland, the pilot received early warning signs based on data from these sensors. The data, in units of MPa, are stored in the file `HW6_PressureSensors.mat` in two vectors: `bulkhead` and `cabin`. Maintenance engineers will analyze these data to determine which actions to take next. If the pressure on the bulkhead drops to less than 60 MPa and the rate of change of cabin pressure in the previous two seconds is greater than 5 MPa/s, then a warning should be recorded. The first decision the engineers must make depends upon the number of warnings detected. If there are no warnings, no action is required; if there are from one to twenty warnings, the "potential risk" protocol will be started, and if there are twenty-one or more, the engineers will follow the "probable risk" protocol. Write the MATLAB code to analyze the data from the sensors and tell the engineers what action to take.

There are opportunities in this analysis to incorporate MATLAB's logical indexing, but it is up to you to decide how much you would like to use logical indexing in your analysis. However, your code must work for a flight of any length of time.