EXAM 1 – Computer PORTION

Put all of your code in one m-file and name it: `lastname_firstname.m` (all lower case). Include your name, section number, and CM number in the header section of your code. There should be no output other than what is asked for.

Problem (50 pts)

Download the Excel spreadsheet named "`turb_jet.xls`" from the course web page at `http://www.rose-hulman.edu/ME123/courseware.shtml`

The data file you have is the velocity measurements taken at the edge of a turbulent jet. It contains two columns of data. The first column lists the time in seconds while the second column lists the instantaneous jet velocity in m/s. The time data is evenly spaced; the difference between all times is a constant.

Write a MATLAB code to

a) (10 Points) Read in the data stored in the Excel spreadsheet. Plot the jet velocity in m/s against the time in seconds. Properly label both axes, and provide a meaningful title to the figure.

b) (10 points) Invoke the MATLAB built-in command `mean` to determine the average velocity value in the data set, in m/s. (Hint: You may learn how to use the `mean` command by looking up the documentation.) Print out the average velocity value to the command window in the following format.

```
The average velocity of the data set is xxx.xx m/s.
```

You should display 5 significant figures and 2 of them should come after the decimal point.

c) (15 points) Obtain the velocity fluctuation, u', in m/s by subtracting the average velocity from each instantaneous velocity value in the data set. Take the absolute value of the velocity fluctuations. Have your program print out the minimum and the maximum velocity fluctuation magnitude to a text file named `lastname_firstname.txt`, where `lastname` and `firstname` should be replaced by *your* last and first names, respectively. Your results should be displayed in the following format.

```
By magnitude,
the minimum velocity fluctuation is xx.xxxx m/s while
the maximum velocity fluctuation is xx.xxxx m/s.
```

d) (15 Points) The turbulence intensity is measured by the root-mean-squared value of the velocity fluctuations obtained in Part (c), *i.e.*

$$\text{turbulence intensity} = \sqrt{\frac{\sum_{i=1}^{N} (u')^2}{N}}$$

where u' is the velocity fluctuation in m/s, and N is the total number of velocity data points in the file. Use a `for` loop to compute the turbulence intensity of the velocity data provided. Have your program print out the turbulence intensity of the jet to the command window in the following format.

```
The turbulence intensity is x.xxxxe+xxx m/s.
```

When you are done, post your m-file answer to the correct folder:

1. Double-click on “Documents” on your desktop.
2. Double-click on “DFS Root” on the left column.
3. Double-click on AcademicAffairs.
4. Double-click on ME.
5. Double-click on ME123.
6. Double-click on Exams.
7. Double-click on the folder with your section number.
8. Copy and paste your m-file to this folder.

NOTE: All programming must stop at 8:30 pm. You will have a few minutes after that to post your file if you need that time.