ME 350 Problem Set 1 Winter 2017

Complete the following problems and upload your solutions to the dropbox before the start of the next class (week 2).

1. **(5 points)** Students should help each other learn the material in this class. That includes discussing the course content, helping each other debug code, and discussing the *concepts* and MATLAB syntax required to complete homework. Unlike homework, the lab exercises provide an opportunity for unlimited collaboration.

   Students *should not* share copies of their solutions to homework exercises. That means, do not give each other m-files or word-processing documents with all or part of the solutions to the homework exercises.

   As part of your solution to problem 1, please provide short answers to these questions.

   a. What is the URL for the PSU Code of Student Conduct?

   b. In the code of conduct, how many items are proscribed by Portland State University?

   c. When someone cheats in a class, say by submitting homework done by another student, does it harm you? Please give a yes/no answer and a one sentence reason for your answer.

   d. What could you say to a friend who asks you to give them a copy of your solution to a problem so that they can copy it? Please give a one sentence answer that expresses your values in a professional way.

   Note The purpose of problem is not to preach or moralize. My goal is to remind you of our mutual expectations. I also want to remind you that our professional and community values are always present, even in the most technical classes. I also want to give everyone a chance to think about and get clarity before these issues arise during the term.

   Thanks for taking this seriously.

2. **(6 points)** Write an m-file that evaluates each of the following mathematical expressions with reasonable values for the variables on the right hand side.

   a. $v = \dfrac{x+y}{x-y}$

   b. $v = \sqrt{r^2 + s^2 + t^2}$

   c. $v = e^{25s} cos(rt)$

   d. $v = \texttt{ln}\left(e^{12s}\right)$

   Your solution is simply to write the MATLAB expressions in an m-file and show the output of running the m-file. That will require you to assign reasonable values to any of the variables like `x`, `y`, `r`, `s` and `t` that appear on the right hand side of expressions. In the document you turn in for grading, show the output of your code.

   For example, suppose the sample expression was

   $$y = \frac{1 + e^{-\alpha t}}{1 - e^{\alpha t}}.$$

   The solution in your assignment could be in the `formulaEvaluation.m` file with the following content.

```
function formulaEvaluation

% -- First test case
alfa = 0.2;    %  misspell on purpose because 'alpha' is a built-in function
t = 3;         %  sample value
y = ( 1+exp(-alfa*t) ) / ( 1 - exp(-alfa*t) );
fprintf('First test: alfa, t, y = %f %f %f\n',alfa,t,y)

% -- Second test case
alfa = 4;
y = ( 1+exp(-alfa*t) ) / ( 1 - exp(-alfa*t) );
fprintf('Second test: alfa, t, y = %f %f %f\n',alfa,t,y)

end
```

Running the `formulaEvaluation` function produces the following output

```
>> formulaEvaluation
First test: alfa, t, y = 0.200000 3.000000 3.432738
Second test: alfa, t, y = 4.000000 3.000000 1.000012
```

It should be obvious that everyone can get full points for this problem because you can test your code in MATLAB. *And that is the point!*. With MATLAB running on your computer (or a computer in the lab), you can *always* test your code. For more complex problems, developing a good test will require more effort that the examples here. However, devising and using tests is both a skill *and* a *habit of good engineers*.

3. **(9 points)** The viscosity of water can be approximated by

$$\ln\frac{\mu}{\mu_0} = a + b\,\frac{T_0}{T} + c\left(\frac{T_0}{T}\right)^2 \qquad (1)$$

where $T_0 = 273.15\,\mathrm{K}$, $\mu_0 = 0.001792\,\dfrac{\mathrm{kg}}{\mathrm{m\,s}}$ $a = -1.94$, $b = -4.80$, and $c = 6.74$.

The `viscosityPlot_shell.m` file on the homework web page has data for the viscosity of air and water. Download the `viscosityPlot_shell.m` file and save it as `viscosityPlot.m`. Add code to evaluate the formula for $\mu(T)$ in Equation (1) for the viscosity of water. Create a plot with open circles for the table data and a dashed black curve for the data from the formula. Add appropriate axis labels and a legend.

Hint: Define a variable, say `logMuRatio`, that is the value of the right hand side of Equation (1). With a vector of values for `logMuRatio` solve $\ln(\mu/\mu_0) =$ `logMuRatio` for μ.