EML3041: Computational Methods

Sample Project Statement

Semester and Year
Summer 2015

Due Dates
None. This is a sample project statement.

Title
Calculating the flow rate in a water flow pipe

Points
100 points

Learning Objectives
- Identify the correct procedure to solve a given problem
- Implement a programming procedure for a given problem
- Improve existing programming skills of debugging, documentation, loops and conditional statements
- Write your own numerical methods programs
- Reinforce prerequisite knowledge of programming and college mathematics
- Solve real-world problems

Background of the Experiment
Water is flowing through a circular pipe. With several pitot tubes, the velocity of the water is measured along the radial location from the center of the pipe to the wall of the pipe.
The flow rate Q in a pipe is given by

$$Q = \int_0^a v(r)dA = \int_0^a 2\pi r v(r)dr \qquad (1)$$

where
$v(r)$ = velocity along the radial location, r
a = radius of the pipe.
The regression model for the velocity is given as

$$v(r) = C\left(1 - \frac{r^2}{a^2}\right) \qquad (2)$$

where

$$C = \frac{\sum_{i=1}^n v_i\left(1 - \frac{r_i}{a^2}\right)}{\sum_{i=1}^n \left(1 - \frac{r_i}{a^2}\right)^2} \qquad (3)$$

n = number of data points.

Data Collected

Water is flowing through a circular pipe of 6 in radius, and flow velocity (ft/s) measurements are made from the center to the wall of the pipe as follows.

Radial location, r (ft)	0	0.083	0.17	0.25	0.33	0.42	0.50
Velocity, v (ft/s)	10	9.72	8.88	7.5	5.6	3.1	0

Grading

This project is NOT part of the Computer Projects grade. Your solution will be graded on the following categories:

- The merit of the conceptual portion
- The merit of the programming portion
- The format of the submission

What to submit

There are **two** submissions you have to make on CANVAS for the sample project. Submission one is the whole mini-project report, and Submission two is just the mfile.

Submission One

The whole project report submission on CANVAS will have the following submitted as a **single** pdf file (learn how to make a single pdf file).

1. A signed typed affidavit sheet (Your printed name can be considered to be the signature). PDF   DOC
2. Published mfile. Use any format that allows you to submit it successfully as a pdf file. Click here to learn how to publish a mfile.
3. Any typed pages when asked for. Each answer needs to start on a fresh page.
4. Attach completed checklist given at the end of this assignment. Checkmark the boxes you have accommodated in your assignment. Do not checkmark this blindly.

Submission Two:

The mfile needs to be submitted on CANVAS. It is a single mfile.

1. Name it as lastname_firstinitial_conv_sum15.m. For example, if your name is Abraham Lincoln, the name of your file would be Lincoln_A_conv_sum15.m

Why do I ask for a separate mfile submission?

There are two reasons: 1) Your mfile is put through a plagiarism checker along with mfiles from previous semesters. Some overlap is expected because of the nature of the program. Each program that is flagged for plagiarism is looked at manually as well for it to progress to an academic dishonesty case. 2) Sometimes, while grading your project, the grader may not follow your logic. So, the grader may need to run your mfile.

Project (100 points) – Never Due. This is a sample project

1. Type in a word processor the velocity vs radial location data collected as well as any other data that is needed to conduct this project.

2. Assign all the required input data (experimental data and other data that is needed for the project to variables as MATLAB statements at the beginning of the mfile as one section. Do not change the units of the inputs – enter them as given. Of course, fprintf/sprintf/disp the input data using the variables.

    a. Any variables that are calculated from the input variables should be done in the first section where you need them – not here, as this section is reserved for input variables only.
    b. Any changes in the input data should not require one to change any part of the rest of the program, and that is what is called "avoiding hardcoding".

3. Change the units of input variables, if needed, to the USCS system in a new section. No fprintf/sprintf/disp should be used in this section.
4. Use the regression formula (2) to display the velocity profile just in terms of the radial location.
5. Illustrate the plot of the data points and the regression curve from #5. Use axes labels with names, symbols and units, figure title, and legends.
6. Estimate the flow rate of the water using the regression curve found in #5.
7. Estimate the flow rate from the (average velocity × area) formula.
8. Use another scientific method of your choice to estimate the flow rate.
9. Did you expect the flow rates to be similar in value from #7, #8 and #9? If yes, why? If not, why? In 50-100 words, type out your response on a separate sheet(s) of paper. The response should be complete including defining all the variables, using appropriate equation editors of your word processor.

Look at the checklist on the next page that needs to be attached to the hard copy of your submissions.

Checklist for submission

Name _____

Semester _____

Project Number _____

- ☐ I submitted this submission as a SINGLE pdf file.
- ☐ I followed the general format as given in the sample project.
- ☐ I uploaded the mfile as a separate submission.
- ☐ I attached the affidavit sheet.
- ☐ I wrote the code only by myself.
- ☐ I did not show my code to anyone else.
- ☐ I attached any handwritten pages if asked for.
- ☐ I attached any typed pages if asked for.
- ☐ I followed the section format as given in the sample project.
- ☐ I published the mfile in published format.
- ☐ I wrote proper and reasonable comments.
- ☐ I put the comments on their own lines, as seen in the sample project mfile (not at the end of a code line).
- ☐ I identified my methods for each problem.
- ☐ I suppressed all statements.
- ☐ I showed input and output variables using fprintf/sprint/disp statements for all exercises unless specified otherwise.
- ☐ I checked for cut off errors in the published file.
- ☐ I avoided all hard-coding (i.e., the program should still work if ANY of the input data is changed).