

ENGR 16200

HW 3 MATLAB PROGRAMMING PROBLEMS

Individual Assignment: See the course syllabus for a definition of what this constitutes.

Note: Failure to submit any programming assignments with a correct filename may result in no points earned. Use the Gradescope programming assignment output to verify that the autograder found your submission.

Note: For this and all subsequent programming assignments, final program outputs should exactly match the given examples' output in terms of text and values.

Programming Problem 1 (of 1)

Learning Objectives: Use file I/O commands to create files in specified formats; manipulate data read in from files; apply course code standard.

Background:

You are working in a biological engineering laboratory with researchers that are observing the health and growth of a number of plants that have each received a different concentration of a treatment against a disease. The researchers are trying to discover the best treatment concentration that will allow the plant to grow the most while still being able to fight against both the disease and the potential detrimental effects of the treatment's concentration. The results of this study are contained in a file called `plant_treatment_data.txt` . For each plant, the following data has been recorded:

- **PlantId:** this is a three-digit integer used to identify each plant
- **Status:** this is an integer used to indicate the plant's state of health at the end of the study. There are only three possible values for this quantity:
 - A value of 2 indicates that the plant survived the treatment and did not contract the disease.
 - A value of 1 indicates that the plant survived the treatment but did contract the disease.
 - A value of 0 indicates that the plant did not survive the treatment. You may assume that this is due to the effects of the treatment and not due to the disease.
- **StartingHeight:** this is a floating point number with two decimal places of accuracy that indicates the height of the plant at the start of the treatment process (in cm).
- **EndingHeight:** this is a floating point number with two decimal places of accuracy that indicates the height of the plant at the end of the treatment process (in cm).
- **Concentration:** this is a floating point number with two decimal places of accuracy that indicates the concentration of treatment used (in grams/liter or g/L). You may assume that all values of this data are less than 100 g/L.

An example of the file contents is shown below. Note that the first line of this file contains the text headers for each column. Each subsequent line contains the relevant data for each plant, separated by

blank spaces. Because several different researchers have contributed to the data collection, it is not known ahead of time how many lines of data are contained in the file.

Instructions:

The head researcher for the lab has requested that you write a MATLAB script that performs the following two tasks:

- A. Because so many people contributed to the file, it is in a somewhat disorganized state. So, the head researcher wants your program to create a new data file organized as follows:
 - 1) The first line of the file should be the following headings (in this order):
`PlantId Status Growth Concentration`
 - 2) Subsequent lines of the file should be ordered by the `PlantId` value, smallest to largest.
 - 3) The value of `Growth` should be `EndingHeight - StartingHeight` for each line.

This file should be named `sorted_treatment_data.txt`, and you should assume that this file does not exist prior to its creation by your program.

- B. Your program should output to the screen the following information:
 - 1) The lowest `Concentration` value for a plant that died.
 - 2) The lowest `Concentration` value for a plant that survived and did not contract the disease.
 - 3) The highest `Concentration` value for a plant that survived but contracted the disease.

Save this file as `HW3_Prob1_login.m` (where *login* is your user name) and submit it to the appropriate programming dropbox on Gradescope. Also, create a flowchart of the relevant algorithm for this problem, and include this flowchart in your PDF submission of the written portion of this assignment. Please note that the PDF for the written portion of the assignment will be submitted to its own dropbox -- do not submit this PDF to the programming dropbox or vice versa.

Examples:

Example Format for `plant_treatment_data.txt`:

<code>PlantId</code>	<code>Status</code>	<code>StartingHeight</code>	<code>EndingHeight</code>	<code>Concentration</code>
153	1	12.49	14.54	4.79
327	2	14.80	18.43	3.00
228	1	10.23	11.47	3.60
101	0	15.57	17.48	5.99

Example Format for `sorted_treatment_data.txt`:

PlantId	Status	Growth	Concentration
101	0	1.91	5.99
153	1	2.05	4.79
228	1	1.24	3.60
327	2	3.63	3.00

Example Output:

The lowest concentration for a plant that died: 5.99 g/L

The lowest concentration for a plant that survived and did not contract the disease: 3.00 g/L

The highest concentration for a plant that survived but contracted the disease: 4.79 g/L

Important Information:

- In the example output, you will notice that some of the outputs extend across two lines. This text wrapping is simply due to the width of the page in this document, and different widths will cause the text to wrap differently. You should not try to imitate this behavior artificially in your program.
- MATLAB has a built-in function called `sort()` that can be used to sort data. You are encouraged to look up this function on the Mathworks website to see how it can be used. (There are multiple ways to use it, and there is no one way that is necessarily better than the others.) You are not required to use this function, but you may find it helpful.