**Home Assignment Hand-out**

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| Course: | Python: Introduction to Coding for Artificial Intelligence and Mechatronics |
| Assignment: | Day 1 |
| Lecturer: | Dr. Jonathan Lesage [jonathan.lesage@gmail.com](mailto:jonathan.lesage@gmail.com) |
| Handed out: | Tuesday, January 10, 2023 |
| Submission deadline: | Monday, January 23, 2023, 11:59 PM EST |
| To be submitted to: | SCFI at [scfi@magna.com](mailto:scfi@magna.com) |
| Format: | python script |
| File name should be: | Assignment\_Python\_D1\_studentlastname\_firstname.ipynb |
| Subject of e-mail should be: | SCFI |

**INSTRUCTIONS**:

Please answer all questions.

If an answer requires a calculation, show it. Don’t just quote an answer.

If doubt exists as to the interpretation of any question, contact the lecturer for clarification. See the table above for contact information. If no help can be obtained, for any question requiring a written answer, then submit a clear statement of any assumptions you make to get to an answer.

This assignment is an open book. For the purpose of study, you may consult outside papers, books, and electronic sources of information, but you cannot use text or figures from outside sources as part of your answers.

You can never represent as your own the work of anyone else. Everything you write must be your individual work and must be in your words. Absolutely no collaboration is allowed among students in activities used for academic performance evaluation. The word “collaboration” includes activities such as copying parts of assignments from each other (or from a third-party source), comparing answers, transferring templates or answer formats from one student to another, and discussing methods to arrive at answers.

Please only submit your PYTHON script Assignment\_Python\_D1\_studentlastname\_firstname.ipynb, no need to transcribe answers to a separate word file.

Follow the file naming protocol as given in the information table above.

If there are attachments, print your name on the top left corner of the first page of every attachment you submit and follow the file naming protocol.

Always follow the file format requirements given in the assignment handout. If, for example, the instructor asks for PDF files only, don’t send Word documents, Excel files, or scanned JPG picture files as those will be rejected.

Submit separate files for separate assignments. Don’t combine the assignments of different modules of the course into one file or zip folder, even if those are to be forwarded to the same lecturer who taught various modules of the course. SCFI can only track assignment submissions if those files are received as separate files and can be saved in separate folders dedicated to each course module.

Magna’s email system allows for attachments of 20MB or 25MB (check with your IT team), which should be enough for your file, so whenever possible, avoid submitting zipped files and folders. If any single file would exceed this limit, use only the zip format natively supported by Windows.

You work for an auto manufacturer as part of the legal team. A motorist has filed a lawsuit against your company claiming that during a minor accident occurring less than a week after purchasing one of your company’s cars, they experienced “whiplash” due to a flaw in the driver’s side seat design. A medical expert has advised you that for a driver to experience “whiplash” their head must experience a maximum forward (positive) acceleration greater than 10 m/s2 followed by a maximum backwards (negative) acceleration greater than 2.5 m/s2 within the span of 0.5 seconds. You have been able to obtain readings from an embedded sensor in the driver’s side headrest recorded during the time of the accident - these have been provided to you in a text file called “Assignment\_Python\_D1\_Data.txt”. This file contains a series of accelerometer readings in m/s2, separated by commas, taken at discrete time intervals 0.01 seconds apart. You have been tasked with assessing the veracity of the plaintiff’s claims using the acceleration sensor data provided.

To this end, you will need to provide a Jupyter Notebook (.ipynb) file which does the following:

1. Read the file into a list containing floating point numbers. Hint: You may use the float(string\_variable) to convert string\_variable from type str to type float. Do not use the len() method to determine the length of the string read from the file, rather determine this manually, as was shown in the lecture.
2. Determine the maximum forward (positive) acceleration from the list of sensor readings as well as the index at which it occurs. Print the maximum forward acceleration, corresponding index, and whether the value exceeds 10 m/s2.
3. Determine the maximum backwards (negative) acceleration from the list of sensor readings as well as the index at which it occurs. Print the maximum backwards acceleration, corresponding index, and whether the value exceeds 2.5 m/s2. Hint: you may find the absolute value of a number by first checking if the number is negative and, if it is, multiplying the number by -1.
4. Determine the time between the maximum backwards acceleration and maximum forward acceleration of the driver’s head (assuming the acceleration of the headrest is well approximated by the acceleration of the headrest) using the answers determined in steps 3. and 4. Print your answer.
5. Based on the answer to parts 2, 3, and 4, determine whether they are likely to have actually suffered “whiplash” as they allege and use a Markdown cell to state your answer to this question.

Students should follow the general steps outlined above, and partial marks will be assigned accordingly. However, the majority of the assigned grade will come from running the notebook cells to produce the correct output. Note that for the purposes of this assignment, the file must be parsed manually using the str output from the file.read() command as was demonstrated in the lecture. Also, reading the txt file contents into a list and answering parts 2, 3, and 4 should be done using only loops and conditional statements and not any of PYTHON’s built-in list methods such as len().