CAAM 210: Introduction to Engineering Computation

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Contact Information

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Course Description

This course serves as a reasonably fast-paced and intense introduction to mathematical and scientific computing via MATLAB and Python. Programming concepts include: variables, programming arithmetic, if-else statements, while- and for-loops, arrays, matrices, cells, and data management. Mathematical concepts include: finding roots via bisection method and Newton's method, sensitivity analysis, population modeling via ODE, bridge-load modeling, neural networks, shape classification and simulation of the spread of an infectious desease over time.

At any time questions are welcome and encouraged!

Course Objectives and Learning Outcomes

Among the goals of this course are for students to

- develop MATLAB and Python programming skills; easily translate between English and mathematics; identify appropriate numerical methods to aid in the solution of a problem; be able to successfully produce graphs and other visuals to help present results;
- take real-world problems and be able to successfully develop and design code via MATLAB and Python to compute a solution;
- develop the necessary fortitude to persevere through difficult projects (particularly the debugging) from beginning to end;
- improve problem solving skills and abstract thought

Required Texts and Materials

There is no required textbook for this class. All material will be distributed on the course website on Canvas.

All students are required to have a fully functional copy of MATLAB with the "*Optimization*" toolbox (other toolboxes may be used, but will be optional and announced in advance). Rice University provides MATLAB to all students for free. To obtain your copy go to https://www.mathworks.com/academia/tah-portal/rice-university-40580441.html and follow the instructions.

All students are required to install Python 3 with Anaconda.

Exams and Assignments

There is no exam for this class.

Students are expected to complete weekly projects where they will be required to translate written instructions into a program that will produce the desired output. **Every assignment is pledged to some degree, it is the student's responsibility to understand what assistance is allowed for each assignment** (see below for more details). If there are any questions, ask! There will be two "fully pledged" assignments where no assistance from others can be used (though students may use any notes or references provided in lecture). For the other assignments, *students are allowed and encouraged to discuss implementation methods, but each student is required to write, document, understand, and submit his or her own work.* In all cases, you are required to follow the guidelines set forth in the Honor Code section.

Assignment Procedure: For each MATLAB project students are expected to submit a report with a header in the following format:

```
First Name Last Name, CAAM 210, SPRING 2022, Project Name
name of the code.m
program description
list of input, list of output (only if exists)
Last modified: date
```

For each Python project students are expected to submit a report with a header in the following format:

```
First Name Last Name, CAAM 210, SPRING 2022, Project Name
name of the code.ipynb
program description
list of input, list of output (only if exists)
Last modified: date
```

More details on the header will be provided in class. This report should consist of a single pdf containing a copy of the code, a list of commands written in the command window, and each of the figures the code generated. The reports should be uploaded to the course Canvas page. **In addition, students should upload all .m files used for the project (or .ipynb for the case of Python project during the last weeks of the classes).**

Each individual project will have a submission deadline. Projects may be submitted up to two days beyond their due date, with penalties in increments of 10% beginning at 0%. For example, the third late submission would incur a 20% penalty. Note that this means you get one late submission for "free." Projects submitted later than two days beyond the posted due date will not be accepted without a valid written excuse. There will be NO extension for the deadline of quizzes or group assignments!

All deadlines we mention in slides/lectures are in CST zone.

Be forewarned that some of the assignments are cumulative in nature. That is, a few of the assignments require knowledge or use of assignments from the previous weeks. The solutions to previous projects will NOT be given out in this course. Therefore, failing to complete an assignment by the due date does not excuse a student from the material if it is needed for a subsequent project.

Groups

Groups in your section will be assigned by the instructor during the first week of the classes.

On group tasks students are supposed to work in assigned groups. Groups should meet up (virtually or in-person) for discussions and rotate weekly on a representative in-charge of writing and submitting the group response. It is the students' responsibility to manage their group and complete assignments. Contact the instructor in case of serious group issues or if group shrinks to three or less members due to students dropping out. Students are free to consult any generic sources for help (i.e., class notes, MathWorks/Python help pages, video tutorial websites, etc).

Grade Policies

All changes in dates should be done through the instructor.

The grade for this class will be broken down as follows: Unpledged projects (50%), Pledged projects (20%), Quizzes (15%), Group assignments (5%), RLA session attendance (10%), Optional project (1%). Notice that if you come unprepared for RLA session (i.e. you haven't read the quiz/project description in advance), RLA may remove up to 2 points from the 10 participation points. While assignments may be worth different point totals, all recorded grades will be based on percentages (i.e. not points) unless otherwise stated in advance. Please see the table below to determine how letter grades will be assigned for this course. Note that grades will not automatically be rounded up, meaning that (as an example) an 89.9 will be considered a B+. Total grade computed for pledged/unpledged projects, group assignments, quizzes and RLA attendance will be proportional to the assigned points, respectively.

	A	B	C	D
+	100 99 98 97	89 88 87	79 78 77	69 68 67
	96 95 94 93	86 85 84 83	76 75 74 73	66 65 64 63
-	92 91 90	82 81 80	72 71 70	62 61 60

Absence Policies

Except for extreme circumstances, no extensions or exemptions will be granted on projects or RLA session attendance. Keep in mind that attendance at RLA sessions comprises 10% of the final grade for this course. It is the student's responsibility to foresee any obstacles in completing the assignments and complete them ahead of time. If a student cannot attend the RLA session on a regular basis, he or she should not take the course. In the event of an excused absence, emergency situation or COVID symptoms, please communicate both the instructor and your RLA as soon as possible.

Rice Honor Code

In this course, all students will be held to the standards of the Rice Honor Code, a code that you pledged to honor when you matriculated at this institution. If you are unfamiliar with the details of this code and how it is administered, you should consult the Honor System Handbook at http://honor.rice.edu/honor-system-handbook/. This handbook outlines the University's expectations for the integrity of your academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process.

Plagiarism is not acceptable and all cases of plagiarism will be referred to the honor council.

- You MAY NOT post a question directly relating to a CAAM 210 project on any online forum beyond CAAM 210 discussion in CANVAS. Soliciting external assistance constitutes cheating, whether or not you get a useful answer.
- You MAY post a question that is not directly related to CAAM 210 project, such as trying to understand how some MATLAB programming concepts and mathematical concepts are working. One of the great resources for MATLAB related questions is MathWorks website. For Python you can use Stackoverflow, Python primer...But copying pieces of codes are not permitted.

- For your projects, you may find internet resources that have partial or maybe even complete written solutions. Use of these resources in any fashion constitutes plagiarism.
- Copying then trivially rewriting large blocks of code (e.g. changing variable names, indentation) is treated as copying.
- Also be aware the we compare this years submissions to each other and to prior year's submissions. If you submit work that's not your own, we will detect it and will refer you and the original author to the Honor Council. You are also forbidden from consulting any material from previous semesters.

Unpledged Projects: On unpledged assignments students are strongly encouraged to work in assigned groups. However, students are expected to write, document, understand, and submit their own work. Furthermore, in all cases, students should only submit work they fully understand. Students are free to consult any generic sources for help (i.e., class notes, MathWorks/Python help pages, video tutorial websites, etc); however, students are not allowed to consult any person not affiliated with the course (i.e., anyone other than students, RLAs, or the instructor), including external tutors, without express permission from the instructor.

Pledged Projects: Students are expceted to complete the pledged projects using only material provided in lecture, on the course Canvas page, or from official MATLAB documentation. Students are not allowed to consult classmates, RLAs, or any other individual besides the instructor.

Quizzes: Students may complete the quizzes with any aids or references they wish to use, excepting classmates, RLAs, etc. In short, students are expected to do so without collaboration.

In summmary, students are expected to write, document, understand, and submit their own work. At no point will copying and pasting the code of others be accepted or tolerated, especially code that has been submitted in previous semesters of CAAM 210. Additionally, publicly posting/sharing project's code is not allowed.

Disability Resource Center

If you have a documented disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with the Disability Resource Center (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Syllabus Change Policy

This syllabus is only a guide for the course and is subject to change with advanced notice.

Wellbeing and safety

Rice University cares about your wellbeing and safety. Rice encourages any student who has experienced an incident of harassment, pregnancy discrimination, gender discrimination, or relationship, sexual, or other forms interpersonal violence to seek support through The SAFE Office. Students should be aware when seeking support on campus that most employees, including ourselves, as the instructor/RLAs, are required by Title IX to disclose all incidents of non-consensual interpersonal behaviors to Title IX professionals on campus who can act to support that student and meet their needs. For more information, please visit safe.rice.eduLinks to an external site. or email titleixsupport@rice.edu.

Lecture Schedule

January 10, 2022

MATLAB installation. Introduction to MATLAB: variables, scripts, functions, publishing.

January 12, 2022

Introduction to MATLAB: drivers, if-else statmenets, for/while loops, logical operators.

January 17, 2022 - NO CLASS

January 19, 2022

Introduction to MATLAB: anonymous functions, plots, debugging.

January 24, 2022

Introduction to MATLAB: matrices, vectors, matrix operations.

January 26, 2022

Project 1: Grow a fern.

January 31, 2022

Project 2: Finding roots of real-valued functions (mathematical description).

February 2, 2022

Project 2: Finding roots of real-valued functions (MATLAB implementation).

February 7, 2022

Pledged project 3: Modeling infectious diseases (mathematical description).

February 9, 2022

Pledged project 3: Modeling infectious diseases (MATLAB implementation).

February 14, 2022

Project 4: Sensitivity analysis (mathematical description).

February 16, 2022

Project 4: Sensitivity analysis (MATLAB implementation).

February 21, 2022

Project 5: Complex Newton's method (mathematical description).

February 23, 2022

Project 5: Complex Newton's method (MATLAB implementation).

February 28, 2022

Project 6: Population project (mathematical description).

March 2, 2022

Project 6: Population project (MATLAB implementation).

March 7, 2022

Project 7: Bridge Project in MATLAB (mathematical description).

March 9, 2022

Project 7: Bridge Project in MATLAB (implementation).

March 14, 2022/March 16, 2022 - NO CLASS

March 21, 2022

Project 8: Shape Curve Analysis (mathematical description).

March 23, 2022

Project 8: Shape Curve Analysis (MATLAB implementation).

March 28, 2022

Project 9: Python installation. Introduction to Python: lists, tuples, if-else statmenets, for/while loops, functions.

March 30, 2022

Project 9: Introduction to Python. Numpy: arrays and matrices in Python.

April 4, 2022

Project 10: Bridge Project in Python (implementation).

April 6, 2022

Project 10: Bridge Project in Python (implementation).

April 11, 2022

Project 11: Neural Networks in Python (mathematical description).

April 13, 2022

Project 11: Neural Networks in Python (implementation).

April 18, 2022

Pledged project 12: Cryptography (mathematical description).

April 20, 2022

Pledged project 12: Cryptography (MATLAB implementation).