MAD 2502: Computational Mathematics with Python

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Fall 2024, Section 1224

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Office: LIT 442 Class Room: LIT 201
Office Hours: MWF 11:45am-12:35pm (P5) Class Hours: MWF 1:55-2:45pm (P7)

This syllabus is subject to change depending on the conditions of the class.
The most up-to-date information can be found on Canvas.

Course Description

The course provides an introduction to the use of computers for solving mathematical problems. For this, basics of Python programming Language (see http://www. python.org) are introduced, and are used to demonstrate how a programming language can enable the solution of mathematical problems. The course does not assume prior programming experience and does not aim at an in-depth understanding of the details of Python. Rather the focus is on understanding concepts and techniques of how programming can help to expand the spectrum of tractable mathematical problems. After completion of the course you should be acquainted with the use of different data types and programming concepts. You should be able to write simple programs in Python to solve computational problems from different areas within mathematics, including analysis, number theory, combinatorics, algebra, linear algebra, numerical analysis, and probability. Finally, this course should enable you to read more advanced material on Python, and prepare you to learn other programming languages or packages that are commonly encountered in computational mathematics.

Prerequisite(s): MAC 2311 or MAC 3427, minimum grade of C.
Credit Hours: 3
Text (required): *Python Programming And Numerical Methods: A Guide For Engineers And Scientists*, First Ed.; **ISBN-13:** 978-0128195499 **Author:** Qingkai Kong, Timmy Siauw, Alexandre Bayen
Link to Text: https://pythonnumericalmethods.berkeley.edu/notebooks/Index.html

Course Objectives

- be able to analyze problems from a computing perspective, propose and evaluate solutions to problems;
- understand the importance of and consistently use data and process abstraction;

- understand the importance of and consistently use good programming practices including good documentation;
- write simple programs in Python to solve computational problems from different areas within mathematics.
- analyze and test programs against a set of requirements;
- be able to use packages in Python that are commonly used in data science.

This is a course on how to think about and solve problems using Python and Mathematics, not a course on merely how to write programs in the Python language

Grade Distribution

Homework	15%
Computere Projects	12%
Attendance	5%
Discussion Board	3%
Exams	45%
Capstone Presentation	20%

Letter Grade Distribution

[93%, 100%]	A	[73%, 77%)	C
[90%, 93%)	A-	[70%, 73%)	C-
[87%, 90%)	B+	[67%, 70%)	D+
[83%, 87%)	B	[63%, 67%)	D
[80%, 83%)	B-	[60%, 63%)	D-
[77%, 80%)	C+	[0, 60%)	E

Course Policies

- **General Policies**
  - It is expected that students bring a computer capable of running Python code to class. Use of the device for non-class activities will result in loss of participation points for the day.
  - Exams are closed book and closed notes.
- **Grade Policies**
  - Grades are maintained in the Canvas course shell. Students are repsonsible for tracking their progress in the gradebook.
  - Grade disputes must be resolved within one week of the grade being returned. After a week passes, that grade is final.

- **Homework**
  - Homework assignments are to be done **individually**.
  - Homework will be assigned as we cover material and will be collected intermittently. Typically homework is collected every one or two weeks.
  - Some homework questions will require programming, but some may be purely mathematical.
- **Exams**
  - Exams will be administered during class time.
  - As mentioned above, exams are closed book and closed notes.
  - Tentative Exam dates: Sept. 20, Oct. 28, Nov. 22
- **Computer Projects**
  - For this class, we will use Python 3 (**not Python 2**) for all programming projects. Python can be obtained at https://www.python.org/downloads/. We will be using Python 3.12.x, as that is the most recent supported version at this time.
  - The textbook suggests the use of Anaconda (https://www.anaconda.com/) for getting started with Python. This will be suitable for assignments in this class. My personal preference is to use the PyCharm IDE (https://www.jetbrains.com/pycharm/). Both are available from UF through UF apps (https://info.apps.ufl.edu/).
  - Students will submit either a .py or .ipynb file which runs under Python 3.12.
  - Computer projects may be done in groups of at most three students.
  - Grading is based not only on correct program execution but also on implementation details (using the techniques requested by the assignment) and good coding practices (documentation, descriptive variable names, etc).
- **Discussion Board Participation**
  - Each unit (one per exam) on Canvas has a corresponding discussion board. Students may earn up to 2 points on each module by:
    1. Asking a coherent mathematical or programming question (+1 each) or
    2. Answering a fellow student's question. (+1 each)
- **Capstone Presentation**
  - Students will develop a small application and demonstrate its use to the class. The application will use the techniques covered in this class. You may be as creative as you want. The main objective is to create a program that is useful, interesting, or fun.
  - Students may work in groups of at most 3. Students who work in groups must also submit a document which clearly explains how each student contributed oto the development of the application.
  - While project topics can be very broad, the project must be approved. Please see me as soon as your group has determined a topic. If you're having trouble choosing a topic, then come see me.

  - Grades are determined both by the submitted program and the presentation.

- **Attendance and Absences**
  - We will use clicker-style questions during class to assess participation. These will be administered through Canvas, and students will use the laptop they bring to class to answer them.
  - Students who are absent from class will receive a 0 for the day's participation unless a valid excuse is provided.

Acadmic Honesty Policy Summary

Introduction

The University of Florida aims to teach students not just skills and knowledge, but appropriate ethical and professional standards of conduct as well. The Academic Honesty Policy exists to inform students and faculty of their obligations in upholding the highest standards of professional and ethical integrity. All student work is subject to the Academic Honest Policy. Any attempt to deceive a faculty member or to help another student to do so will be considered a violation of this standard.

Instructor's Intended Purpose

The student's work must match the instructor's intended purpose for an assignment. The instructor will establish the intent of each assignment, but it is up to each student to obtain clarification from the instructor when there is any question concerning that assignment's intent.

Authorship

The student must clearly establish authorship of a work. Referenced work must be clearly documented, cited, and attributed, regardless of medium or distribution. Even in the case of work licensed as public domain, the student must provide attribution of that work in order to uphold the standards of intent and authorship. (See, for example, http://creativecommons.org/)

Declaration

Online submission of, or placing one's name on, an exam, assignment, or any course document constitutes a statement that the student has complied with the Academic Honesty Policy in completing that work; in particular, that the student has not received or given inappropriate assistance.

Honor Pledge

We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

Software Use

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Consequences of Violations

The webpage https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/ specifies a number of behaviors that are in violation of the Student Honor Code and the possible sanctions. Furthermore, students are obligated to report to appropriate personnel any condition that facilitates academic misconduct. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Students With Disabilities

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the Disability Resource Center by visiting https://disability.ufl.edu/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Student Feedback

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Health and Wellness

- *U Matter, We Care*: If you or a friend is in distress, please contact umatter@ufl.edu or 352-392-1575 so that a team member can reach out to the student
- *Counseling and Wellness Center*: https://counseling.ufl.edu/, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.
- *Sexual Assault Recovery Services (SARS)*: Student Health Care Center, 392-1161

Diversity and Inclusion

I am committed to diversity and inclusion of all students in this course. I acknowledge, respect, and value the diverse nature, background and perspective of students and believe that it furthers academic achievements. It is my intention to present the material in this course that is respectful to the diverse backgrounds of the student body in aspects such as ethnicity, race, religion, culture, gender, gender expression, sexuality, disability, and socieoeconomic status. If I fall short of this or you have suggestions on improving inclusivity in this course, please reach out.

Weekly Schedule

Material	Weeks Spent
Chapter 1: Python Basics	1
Chapter 2: Variable and Basic Data Structure	1
Chapter 3: Functions	1
Chapter 4: Branching Statements	1
Chapter 5: Iteration	1
Chapter 6: Recursion	1
Chapter 7: Object Oriented Programming	2
Chapter 8: Complexity	1
Chapter 9: Representation of Numbers	1
Chapter 10: Errors, Good Programming Practices and Debugging	1
Chapter 11: Reading and Writing Data	1
Chapter 12: Visualization and Plotting	1
Chapter 16: Least Squares Regression	1
Chapter 19: Root Finding	1
Chapter 21: Numerical Integration	1

The primary goal of the class is to cover through chapter 12. Topics in the remaining weeks may change depending on the needs of the class.