



Programming for the Mathematical Sciences

Spring 2024

MWF 11:35am–12:45pm

MEY 154

<http://cs.wheaton.edu/~tvandrun/cs240>

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Office hours:

Drop-in: MWF 3:30–4:30pm;

Or by appointment through Calendly

Contents

CATALOG DESCRIPTION. An introduction to computer programming for students who want to apply programming to mathematics or the natural sciences, but are unlikely to take more than one computer science course. Emphasis is put on applying programming logic to data analysis and on using specialized tools like libraries for statistics and numerical processing. Not open to students who have passed CSCI 235 or the equivalent.

TEXTBOOK. Wes McKinney. *Python for Data Analysis*, 2nd edition. O'Reilly, 2017.

PURPOSE OF THE COURSE. This course provides a one-semester experience in programming tailored to math majors and other students interested in data analysis. The course introduces problem-solving techniques with algorithms and data structures in the context of the Python programming language with an emphasis on analyzing and visualizing data. Students should leave this course with an understanding of the logic of programming, the ability to apply programming to their area of study, and the confidence to continue learning on their own.

Note that this course is intended as a one-semester experience and is not a prerequisite for any other computer science course.

GOALS, OBJECTIVE, AND LEARNING OUTCOMES. The goals of this course are that students will

1. Develop basic algorithms according to specifications.
2. Implement basic algorithms using the programming language chosen for this course.
3. Use libraries in the chosen programming language to build data analysis applications.

The objective of the course is that students will be able to apply their programming ability to their own field of study and continue developing their programming skills after this course.

In addition to these, together we have the general objective of seeing computational linguistics as a way of knowing God's world and a tool for doing good, to God's glory.

OUTLINE.

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| <ul style="list-style-type: none"> I. A "quick burst" of programming elements <ul style="list-style-type: none"> A. Programming environments B. Core language features II. Thinking carefully about the elements <ul style="list-style-type: none"> A. Types B. Booleans C. State and invariants | <ul style="list-style-type: none"> D. Indexing E. Lists F. Strings G. Functions H. Nested loops <ul style="list-style-type: none"> III. Data structures and files <ul style="list-style-type: none"> A. Ranges and iterables |
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- B. Dictionaries
 - C. Comprehensions
 - D. File input and output
 - E. File formats
- IV. Python libraries
- A. Structure of a library
 - B. Python standard libraries
 - C. Python math and science libraries
- V. numpy and matplotlib
- A. Arrays
 - B. Indexing and slicing
- C. Matrix operations
 - D. Matrix applications
 - E. Vectorized operations
- VI. pandas
- A. Data structures
 - B. Queries
 - C. Data wrangling
- VII. scikit-learn
- A. Machine learning basics
 - B. Classification
 - C. Visualization

Course procedures.

HOW WE DO THIS COURSE. This course is very hands-on. Most class sessions will involve practice problems that exercise the new concept or language feature of the day. Students are then given practice problems to do and turn in (about two problem sets per week). Most of students' work outside of class will be in these programming assignments. Quizzes, administered through Canvas about once per week, will measure students' understanding of the concepts.

IMPLEMENTATION PLATFORM. This course uses the Python programming language. We use several environments for Python, such as the interactive interpreter, IDLE, and Jupyter Notebooks. In particular, many in-class activities are contained in Jupyter Notebooks, and programming assignments are distributed through GitHub and turned in through the CSCI lab file system.

ELECTRONIC COURSE ORGANIZATION. Course material can be found on Canvas; additionally, the course schedule and some of the material can be seen through a course website I have made which presents the course as in a calendar format. Unless otherwise noted, assignments are to be submitted through the CSCI lab.

All programming problems can be done on the machines in the CSCI lab. See the programming guide on Canvas for information on how to work on problems on your own computers. Students are required to make a Github account using their Wheaton email address.

When sending Python code to the instructor (such as to ask for homework help), please either (a) rename the Python file by adding `.txt` as a file extension (so, change `example.py` to `example.py.txt`) and attach that renamed file to an email, or (b) paste the text of the code into the body of an email. Please **do not** (a) send Python code through a Canvas message, (b) attach a file ending with `.py` to an email, or (c) attach a screenshot to an email. **Please note that Wheaton's email system silently rejects emails with a .py attachment. If you send me a .py file by email, I will not get it and you will not know that I didn't get it.**

ASSIGNMENTS. Most assignments consist in a few programming problems for students to solve. These happen at a rate of about two assignments per week, or about twenty during the course of the semester. In a typical week there will be one programming assignment due Tuesday and one due Thursday, each at 11:59pm.

QUIZZES. Quizzes are administered through Canvas. In a typical week there will be one quiz, due on Monday at 10:30am (that is, before chapel time).

GRADING. The graded elements of this course are in three categories: *Assignments*, mostly programming problems; *quizzes*; and *tests* (two during the semester plus a cumulative final).

Assignments	25%	
Quizzes	10%	
Tests	40%	(20% each)
Final exam	25%	

To pass the course (to receive a D or better), a student must have a minimum of 60% of the total points, and a minimum of 50% on assignments and a minimum of 50% on the final exam. Letter grades for students who pass are to be determined by score clustering.

I use the “Gradebook” feature on Canvas only to communicate scores on individual assignments and tests. I do **not** use the Canvas gradebook for my official record-keeping for scores, for calculating semester scores, or determining letter grades. Please **ignore** any grade estimate that Canvas gives you for this course.

Policies etc

ACADEMIC INTEGRITY. Projects are individual assignments. Accordingly, do not share your code, do not get solutions to project problems from print or electronic media (including the Internet) or other people, and do not program with another person when working on a project for this course. You may discuss problems in the abstract, help (or receive help) to figure out compiler errors or program bugs, and share test cases, but students should not show each other *working code*. Any violations will be handled through the college’s disciplinary process. (See also the college’s statement below.)

Students must not use ChatGPT or similar tools for anything related to this course such as (but not limited to) help on or solutions to practice problems in class or programming assignments. Any student who is found to have used ChatGPT or similar tools on any programming assignment will receive a zero on that assignment. A second offense will result in failing the course.

LATE ASSIGNMENTS. Unless specified otherwise, assignments will not be accepted late. If you are unable to get a problem, turn in your best attempt by the time it is due. Any adjustment to this because of college-related activities (such as athletic participation) should be arranged in advance. In particular, no credit will be given for quizzes submitted during chapel time.

ATTENDANCE. Students are expected to attend all class periods. It is courtesy to inform the instructor when a class must be missed.

EXAMINATIONS. Students are expected to take all tests and exams as scheduled. In the case where a test must be missed because of legitimate travel or other activities, a student should notify the instructor no later than one week ahead of time and request an alternate time to take the test. In the case of illness or other emergency preventing a student from taking a test as scheduled, the student should notify the instructor as soon as possible, and the instructor will make a reasonable accommodation for the student. The instructor is under no obligation to give any credit to students for tests to which they fail to show up without prior arrangement or notification in non-emergency situations. The final exam is Thursday, May 2, 10:30am–12:30 pm. Students are not allowed to take the final exam at a different time (except for urgent reasons, approved by the department chair, as per the college’s policy), so make appropriate travel arrangements.

ACCOMMODATIONS. If you have a documented need for accommodations, I will have received a letter on your behalf from the Learning and Accessibility Services Office. But *please talk to me* about what accommodations are most useful to you. In particular, if you desire accommodations for test-taking, talk to me a reasonable amount time in advance (say, at least two class periods) so arrangements can be made. (See also the College’s statement below.)

OFFICE HOURS. My *drop-in* office hours this semester are MWF 3:30–4:30pm. You can make an appointment through Calendly; I’m available most of the day on Thursday and sometimes on other days.

ELECTRONIC DEVICES. Phones, tablets, laptops, and other electronic devices should be put away during class—that is, not seen or heard any time during class. Note that this means that your phone should not be on the table. If you absolutely need to check your phone for something, please discreetly step out in to the hall. **NO TEXTING OR SOCIAL MEDIA USE IN CLASS.**

All this, the Lord willing.

College syllabus statements

THE COLLEGE REQUIRES THAT THE FOLLOWING STATEMENTS BE INCLUDED IN ALL SYLLABI.

The “Academic Information” website referred to below is found and <https://catalog.wheaton.edu/undergraduate/academic-policies-information/academic-information/>

ACADEMIC INTEGRITY. (See “Integrity of Scholarship” on “Academic Information” website.)

The Wheaton College Community Covenant, which all members of our academic community affirm, states that, “According to the Scriptures, followers of Jesus Christ will... be people of integrity whose word can be fully trusted (Psalm 15:4; Matt. 5:33-37).” It is expected that Wheaton College students, faculty and staff understand and subscribe to the ideal of academic integrity and take full personal responsibility and accountability for their work. Wheaton College considers violations of academic integrity a serious offense against the basic meaning of an academic community and against the standards of excellence, integrity, and behavior expected of members of our academic community. Violations of academic integrity break the trust that exists among members of the learning community at Wheaton and degrade the College’s educational and research mission.

ACCOMMODATIONS. (See “Learning and Accessibility Services” on the “Academic Information” website).

Wheaton College is committed to providing access and inclusion for all persons with disabilities, inside and outside the classroom. Students are encouraged to discuss with their professors if they foresee any disability-related barriers in a course. Students who need accommodations in order to fully access this course’s content or any part of the learning experience should connect with Learning and Accessibility Services (LAS) as soon as possible to request accommodations <http://wheaton.edu/las> (Student Services Building -Suite209, las@wheaton.edu, phone 630.752.5615). The accommodations process is dynamic, interactive, and completely free and confidential. Do not hesitate to reach out or ask any questions.

BEHAVIOR POLICY. (See “Classroom Demeanor” on the “Academic Information” website).

GENDER-INCLUSIVE LANGUAGE. (See “Gender Inclusive Language” on the “Academic Information” website).

Please be aware of Wheaton College’s policy on inclusive language, “For academic discourse, spoken and written, the faculty expects students to use gender inclusive language for human being.”

TITLE IX AND MANDATORY REPORTING. Wheaton College instructors help create a safe learning environment on our campus. Each instructor in the college has a mandatory reporting responsibility related to their role as a faculty member. Faculty members are required to share information with the College when they learn of conduct that violates our Nondiscrimination Policy or information about a crime that may have occurred on Wheaton College’s campus. Confidential resources available to students include Confidential Advisors, the Counseling Center, Student Health Services, and the Chaplain’s Office. More information on these resources and College Policies is available at <http://www.wheaton.edu/equityandtitleIX>.

WRITING CENTER. The Writing Center is a free resource that equips undergraduate and graduate students across the disciplines to develop effective writing skills and processes. This academic year, the Writing Center is offering in-person consultations in our Center in Buswell Library, as well as synchronous video consultations online. Make a one-on-one appointment with a writing consultant here [<https://wheaton.mywconline.com/>].