

GRADTDA 5621 - Syllabus

Course Information

- Course times: Asynchronous: Sync. Time: Thursday 6-7 PM.
- Credit hours: 3
- Mode of delivery: Distance Learning

Instructor

- Name: Raghu Machiraju
- Email: machiraju.1@osu.edu
- Office location: The correct Zoom Location - <https://osu.zoom.us/j/93255698092?pwd=VGIIRHg3N1BvSkp4UmdhWnVpQ1FFUT09>; Please consult announcement on Teams and Carmen for a passcode.
- Office hours: M:5:00-6:00 PM, W: 5:00-6:00 PM
- Preferred means of communication:
 - My preferred method of communication for questions is email
 - Class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your [notification preferences](#)
 - My preferred forum for extensive discussions will be in Teams (Link to be provided).

Grader

- Name: Chaitanya Kulkarni
- Email: kulkarni.132@buckeyemail.osu.edu
- Office location: Zoom Location - <https://osu.zoom.us/j/93255698092?pwd=VGIIRHg3N1BvSkp4UmdhWnVpQ1FFUT09>; Please consult announcement on Teams and Carmen for a passcode.
- Office Hours: T: 5:00-6:00 PM, F: 5:00-6:00 PM
- Preferred means of communication:
 - My preferred method of communication for questions is email
 - My class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your [notification preferences](#)
 - My preferred forum for extensive discussions will be in Teams (Link to be provided)

Course Prerequisites

Good standing in the MTDA program. Course enrollment is restricted to graduate students enrolled in the program. Some experience in Data Analysis and have ample and suitable undergraduate preparation. No other academic preparation is sought.

Course Description

The successful working professional engaged in real-world, problem-solving contexts often found in many modern enterprises must be able to construct schemas that locate data sources and scrape them, followed by

practical workflows that ingest and clean data, extract useful information for exploration and visualization, and use that information to address work-related challenges. A successful outcome of this instructional offering is to construct programming-based data-driven tools to facilitate context-aware problem-solving. The enrollee will also gain proficiency in identifying, sourcing, manipulating, and interpreting data. Further, he or she will also be highly capable of creating workflows for a variety of data types and representations.

This is the first course in a two-semester sequence comprised of two, 3 credit-hour courses focusing on the use of Python programming and tools/environments. The sequence is to be taken in parallel with the sequence focusing on fundamental statistical data analytic methods.

Learning Outcomes

By the end of this course, students should successfully be able to:

- Use programming languages of Python and the companion integrated development environment of Jupyter/Google-Collab to import, manipulate, and visualize data.
- Learn to locate data sources and scrape data from collections and ingest them. Clean the data and wrangle or munge them into formats and representations amenable for further analysis and visualization. Become adept at constructing workflows to scrape and wrangle data for a variety of applications.
- Learn to create high-utility and efficacious workflows using Python-based tools to extract summary information inherent in the data from a variety of applications.
- Create high-information and useful Python-based tools that interface with the data analytic workflows to create meaningful and useful visualizations and in turn realize the use of feedback loops to alter the data analysis in useful ways.
- Conduct application-driven, exploratory analyses that use other contextual information including ontologies to contribute to problem-solving and achieve true translation.
- Author effective summary reports of the performed analysis using Jupyter notebooks.

Dos and Don'ts

Mode of delivery: This course is 100% online. There are no required instructional sessions when you must be logged in to Carmen at a scheduled time. The only exceptions for attendance will be quizzes, exams, and presentations.

The pace of online activities: This course is divided into weekly modules that are released days ahead of time. Students are expected to keep pace with weekly deadlines but may schedule their efforts freely within that timeframe.

Credit hours and work expectations: This is a 3 credit-hour course. According to [Ohio State bylaws on instruction](#), students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of C average. Computing courses often require up to 12-15 hours of work.

Attendance and participation requirements: Because this is an online course, your attendance is based on your online activity and participation. The following is a summary of students' expected participation:

- Participating in online activities for attendance: at least once per week
You are expected to log in to the course in Carmen/Teams every week. During most weeks you will probably log in many times. If you have a situation that might cause you to miss an entire week of interaction, discuss it with me as soon as possible.

- Office hours and live sessions: optional
All live, scheduled events for the course, including my office hours, are optional. The exceptions are the days of quizzes, exams, and presentations.
- Participating in discussion forums: two or more times per week
As part of your participation, each week you can expect to post at least twice as part of our substantive class discussion on the week's topics.

Course Materials and Technologies

Required Texts (for now)

- A. Python for Data Analysis - Data Wrangling with Pandas, NumPy, and IPython, William McKinney, O'Reilly Media, 2021, Third edition.
 - a. An electronic version is available for online reading on the OSU Safari website. You will need to be logged in to OSU Safari (O'Reilly Media). Please use this link - <https://library.ohio-state.edu/record=e1002334~S7>
- B. Python Data Science Handbook by Jake VanderPlas. Copyright © 2017 Jake VanderPlas.
 - a. An electronic version is available for online reading on the OSU Safari website. You will need to be logged in to OSU Safari (O'Reilly Media). Please use this link - <https://learning.oreilly.com/library/view/python-data-science/9781491912126/>
 - b. A Jupyter Colab notebook is available at - <https://colab.research.google.com/github/jakevdp/PythonDataScienceHandbook/blob/master/notebooks/Index.ipynb#scrollTo=GXOf9k9xO6sZ>

Recommended/Optional Materials

Other required texts and material will be provided as needed through the semester. Some more are listed here with summaries.

Practical Python: Data Wrangling and Data Quality (2022)

Summary: This book will help you learn how to better clean, evaluate, and analyze data to generate meaningful insights and compelling visualizations. Through foundational concepts and worked examples, author Susan McGregor provides the tools you need to evaluate and analyze all kinds of data and communicate your findings Use Python 3.8+ to read, write, and transform data from a variety of sources. Understand and use programming basics in Python to wrangle data at scale. Organize, document, and structure your code using best practices. Complete exercises either on your own machine or on the web Collect data from structured data files, web pages, and APIs.

Robust Python (2022)

Summary: In this book, Patrick Viafore shows you how to use Python's type system to the max. You'll look at user-defined types, such as classes and enums, and Python's type hinting system. You'll also learn how to make Python extensible and how to use a comprehensive testing strategy as a safety net. With these tips and techniques, you'll write clearer and more maintainable code. Learn why types are essential in modern development ecosystems Understand how type choices such as classes, dictionaries, and enumerations reflect specific intents Make Python extensible for the future without adding bloat. Use the tools provided to increase the safety and robustness of your codebase Evaluate current code to see common maintainability gotchas. Make your codebase more maintainable with off-the-shelf open source tools.

Fluent Python, 2nd Edition (2021)

Summary: Python's simplicity lets you become productive quickly, but often this means you aren't using everything it has to offer. With the updated edition of this hands-on guide, you'll learn how to write effective, modern Python 3 code by leveraging its best ideas. Don't waste time bending Python to fit patterns you learned in other languages. Discover and apply idiomatic Python 3 features beyond your past experience. Author Luciano Ramalho guides you through Python's core language features and libraries and teaches you how to make your code shorter, faster, and more readable. Featuring major updates throughout the book, Fluent Python, second edition,

covers: Special methods: The key to the consistent behavior of Python objects
Data structures: Sequences, dicts, sets, Unicode, and data classes
Functions as objects: First-class functions, related design patterns, and type hints in function declarations
Object-oriented idioms: Composition, inheritance, mixins, interfaces, operator overloading, static typing and protocols
Control flow: Context managers, generators, coroutines, async/await, and thread/process pools
Metaprogramming: Properties, attribute descriptors, class decorators, and new class metaprogramming hooks that are simpler than metaclasses.

Python and R for the Modern Data Scientist (2021)

Summary: Success in data science depends on the flexible and appropriate use of tools. That includes Python and R, two of the foundational programming languages in the field. With this book, data scientists from the Python and R communities will learn how to speak the dialects of each language. By recognizing the strengths of working with both, you'll discover new ways to accomplish data science tasks and expand your skill set. Authors Boyan Angelov and Rick Scavetta explain the parallel structures of these languages and highlight where each one excels, whether it's their linguistic features or the powers of their open source ecosystems. Not only will you learn how to use Python and R together in real-world settings, but you'll also broaden your knowledge and job opportunities by working as a bilingual data scientist. Learn Python and R from the perspective of your current language
Understand the strengths and weaknesses of each language
Identify use cases where one language is better suited than the other. Understand the modern open source ecosystem available for both, including packages, frameworks, and workflows. Learn how to integrate R and Python in a single workflow
Follow a real-world case study that demonstrates ways to use these languages together.

Effective Python: 59 Specific Ways to Write Better Python (2015)

Summary: It's easy to start coding with Python, which is why the language is so popular. However, Python's unique strengths, charms, and expressiveness can be hard to grasp, and there are hidden pitfalls that can easily trip you up. Effective Python will help you master a truly "Pythonic" approach to programming, harnessing Python's full power to write exceptionally robust and well-performing code. Using a concise, scenario-driven style, Brett Slatkin brings together 59 Python best practices, tips, and shortcuts, and explains them with realistic code examples.

Required Equipment

- **Computer:** current Mac (macOS), PC (Windows 10+, and Linux) with high-speed internet connection
- **Webcam:** built-in or external webcam, fully installed and tested
- **Microphone:** built-in laptop or tablet mic or external microphone
- **Other:** a mobile device (smartphone or tablet) to use for BuckeyePass authentication

Required Software

- Microsoft Office 365: All Ohio State students are now eligible for free Microsoft Office 365. Visit the [installing Office 365 link](#).
- Google Collab: <https://colab.research.google.com/>
- Python Libraries: <https://python.org>
- Jupyter Libraries: <https://jupyter.org/>

CarmenCanvas Access

You will need to use [BuckeyePass](#) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the [BuckeyePass - Adding a Device](#) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click Enter a Passcode and then click the Text me new codes button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- [Install the Duo Mobile application](#) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

Technology Skills Needed for This Course

- [Navigating CarmenCanvas](#)
- [CarmenZoom virtual meetings](#)
- [Recording a slide presentation with audio narration and recording, editing and uploading a video](#)
- Google Collab: <https://colab.research.google.com/>

Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, questions or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- Self Service and Chat: osu.edu/it
- Phone: 614-688-4357 (HELP)
- Email: servicedesk@osu.edu

Digital Flagship

Digital Flagship is a student success initiative aimed at helping you build digital skills for both college and your career. This includes offering an engaging collection of digital tools and supportive learning experiences, university-wide opportunities to learn to code, and a Design Lab to explore digital design and app development. Digital Flagship resources are available to help Ohio State students include on-demand tutorials, The Digital Flagship Handbook (your guide for all things tech-related), workshops and events, one-on-one tech consultations with a peer or Digital Flagship staff member, and more. To learn more about how Digital Flagship can help you use technology in your courses and grow your digital skills, visit go.osu.edu/dfresources.

Grading and Faculty Response

How Your Grade is Calculated

<u>Assignment Category</u>	<u>Points</u>
Individual Homeworks (5 x 5%) – content	25%
Groupwise Case Studies (5 * 10%) – content, participation	50%
Group Final Project – content, participation	25%

See the module list for recommended due dates.

Descriptions of Major Course Assignments

Python Homework 1-5

- **Basics of Python:** especially learn that it is nothing about snakes
- **A bit more advanced Python**
 - Useful data structures (lists, sets, dicts, etc.)
 - Functions (comprehensions, lambdas, generators, etc.).
 - Timing functions and algorithms
- **A tad more advanced Python**

- Numpy
- Pandas (and not the cuddly bears)

Case Studies

Case Study I: Analysis and display of multimedia (image and audio) data

Case Study II: Handling missing data

Case Study III: Time series analysis - filtering, data handling; visualization of univariate data

Case Study IV: Tables and spatiotemporal maps; analysis and visualization.

Case Study V: Analysis and basic visualization of planar graphs (think social networks)

Final Project

String manipulation, workflows for textual using language tools, and word cloud visualization on large supercomputers

Academic integrity and collaboration: Your written assignments, including discussion posts, should be your own original work. In formal assignments, you should follow the MLA/APA/Chicago, etc. style to cite the ideas and words of your research sources. When you collaborate in teams, it is assumed that you will contribute diligently and sincerely. All team members should agree to their roles before the start of all exercises. In case of conflicts, the instructional staff should be notified. This is essential also for fairness in grading.

Submission of Assignments

No assignment will be deemed late until the end-of-semester. There will be recommended deadlines. It will be recommended that all homework be submitted by the suggested dates. The goal is to complete and not adhering to strict deadlines. This is a shoutout to all those who work, have other obligations, yet chose to enroll in this class.

Instructor(s) Feedback and Response Time

Remember that you can call 614-688-4357 (HELP) at any time if you have a technical problem.

- **Preferred contact method:** If you have a question, please contact us first through Ohio State email address. We will reply to emails within 24 hours on days when class is in session at the university.
- **Class announcements:** We will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check [your notification preferences](#). (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Discussion board:** I will check and reply to messages in the discussion boards once mid-week and once at the end of the week.
- **Grading and feedback:** For large weekly assignments, you can generally expect feedback within seven days.

Grading Scale

93–100: A

90–92.9: A-

87–89.9: B+

83–86.9: B

80–82.9: B-

77–79.9: C+

73–76.9: C

70–72.9: C-

67–69.9: D+

60–66.9: D

Below 60: E

Other Course Policies

Discussion and Communication Guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style:** While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility:** Let us maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online. Also, please be cognizant of the wide variety of backgrounds in the class.
- **Citing your sources:** When we have academic discussions for case studies and projects, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link. For manuscripts use appropriate and suitable citation style (see above).
- **Backing up your work:** Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Academic Integrity Policy

See [Descriptions of Major Course Assignments](#) for specific guidelines about collaboration and academic integrity in the context of this online class.

Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understood the university's [Code of Student Conduct](#), and that all students will complete all academic and scholarly assignments with fairness and honesty.

Students must recognize that failure to follow the rules and guidelines established in the university's Code of Student Conduct and this syllabus may constitute "Academic Misconduct." The Ohio State University's Code of Student Conduct (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's Code of Student Conduct is never considered an excuse for academic misconduct, so I recommend that you review the Code of Student Conduct and, specifically, the sections dealing with academic misconduct.

If we suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's Code of Student Conduct (i.e., committed academic misconduct), the

sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me. Other sources of information on academic misconduct (integrity) to which you can refer include:

- [Committee on Academic Misconduct](#)
- [Ten Suggestions for Preserving Academic Integrity](#)
- [Eight Cardinal Rules of Academic Integrity](#)

Copyright for Instructional Materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources. If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options on [Ohio State's Title IX website](#) or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin, and disability. For more information, visit the [OIE website](#) or email equity@osu.edu.

Commitment to a Diverse and Inclusive Learning Environment

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach their own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating, and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. No matter where you are engaged in distance learning, The Ohio State University's Student Life Counseling and Consultation Service (CCS) is here to support you. If you find yourself feeling isolated, anxious, or overwhelmed, [on-demand mental health resources](#)

are available. You can reach an on-call counselor when CCS is closed at 614- 292-5766. 24-hour emergency help is available through the [National Suicide Prevention Lifeline website](#) or by calling 1-800-273-8255(TALK). [The Ohio State Wellness app](#) is also a great resource.

Accessibility Accommodations for Students with Disabilities

Requesting Accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with [Student Life Disability Services \(SLDS\)](#) [\(Links to an external site\)](#). After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

Disability Services Contact Information

- Phone: 614-292-3307
- Website: osu.edu
- Email: slds@osu.edu
- In-person: [Baker Hall 098, 113 W. 12th Avenue](#)

Accessibility of Course Technology

This online course requires the use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- [CarmenCanvas accessibility](#)
- Streaming audio and video - talk to instructors
- [CarmenZoom accessibility](#)
- Collaborative course tools - talk to instructors