# Yale

---

# CPSC 110 Python Programming for Humanities and Social Sciences
Spring 2023

## Distributional Designations
This course can be applied towards the *Quantitative Reasoning* Yale College distributional requirement.

## Meeting Information
MW 1 pm - 2:15 pm
Location to be announced.

## Instructor(s)
Sohee Park, sohee.park@yale.edu AKW 003 51 Prospect St. New Haven, CT 06520

## Undergraduate Learning Assistant (ULA)
To be announced.

## Format
This course has two lectures and one discussion section each week.  The lectures present the majority of the course content, while discussion sections reinforce the concepts with walk-throughs and programming exercises.  We recommend coming to the office hours.

## Limited Enrollment
None

## Course Description
This multidisciplinary course introduces both fundamentals of computer science and practical approaches to extract knowledge from data. In the first five weeks, students will learn the foundation of Computer Science, Computational Thinking, and the fundamentals of Python programming. During the rest of the semester, students will apply Python programming to the field of Data Science. Students will first learn what Data Science is, and then learn how to preprocess, analyze, and visualize the data Students will also learn how to encapsulate the information into models to make forecast/predictions, how to validate models, and how to evaluate and present the results. Students will finish the semester with a Data Science project using the data in the areas of students' interests/majors.

## Learning Objectives
Students will be able to understand fundamental building blocks of programming, write programming using the Python language, and develop algorithms and solutions to computation problems. Students will also be able to use, analyze and present domain-specific data using Python language and develop computational foundation for research and application development for Humanities and Social Sciences.

## Required Materials

How to Think Like a Computer Scientist, Interactive Edition
The Data Science Design Manual (Texts in Computer Science), by Steven S. Skiena, Springer-Verlag

## Readings & Assignments

Provide an overview of the readings and assignments associated with your course. Many students find it helpful for their planning to have a class-by-class or weekly schedule.

| Wk | Date | Contents | Reading Sections / Chapters |
|---|---|---|---|
| | | Part 1. Foundations of Computer Science \| Computational Thinking | How to Think Like a Computer Scientist (HTCS): Interactive Edition |
| 1 | 18-Jan | L1. Course Overview. What is Computer Science and Computational Thinking? | HTCS Sec. 1.1, 1.2 |
| | 20-Jan | L2. What is Inside a Computer? What is a Program? | HTCS Sec. 1.3, 1.5, 1.11, 1.12, 1.13, 2.1 - 2.7, 2.9 ~ 2.11 |
| 2 | 23-Jan | L3. Debugging: Dealing with Errors, Python Modules and Functions | HTCS Sec. 1.6 ~ 1.10, Chap. 3, HTCS Sec. 5.1 ~ 5.3, 6.1 ~ 6.4, 6.6, 6.7, 6.9, 6.10 |
| | | Part 2. Python Syntax, Types of Data, and Data Structures | |
| 2 | 25-Jan | L4. If-statements, Strings | HTCS Sec. 7.1, 7.4 ~7.7, 9.1 ~9.9 |
| 3 | 30-Jan | L5. Iteration, Strings, and Lists | HTCS Sec. 4.4, 4.5, 4.7, Chap. 10 |
| | 1-Feb | L6. Iteration and Lists | HTCS Sec. 4.4-4.7, Chapter 10 |
| 4 | 6-Feb | L7. Logical Operators and while-loops | HTCS Sec.7.2~7.3, 8.3~8.8, 9.12 |
| | 8-Feb | L8. Dictionaries | HTCS Sec. 12.1~12.3 |
| 5 | 13-Feb | L9. Classes and Objects | HTCS Chap. 17 |
| | 15-Feb | L10. Review for Midterm Exam #1 | |
| | | Part 3. Reading and Visualizing Data using Python | |
| 6 | 20-Feb | Midterm Exam #1 | HTCS Chap.11, python.org, csv, Module, JASON, XML |
| | 22-Feb | L11. Extracting data from text files | |
| 7 | 27-Feb | L12. NumPy, SciPy, and Pandas | Official NumPy Beginner's Guide, Official NumPy Quickstart Tutorial, Official pandas Quickstart Tutorial |
| | 1--Mar | L13. Data Visualization with matplotlib | Official pyplot Tutorial |
| | | Part 4. Understanding Data in Context, Glimpse of Data Science | **The Data Science Design Manual (DSDM)** |
| 8 | 6-Mar | L 14. Introduction to Data Science | DSDM Chap. 1 |
| | 8-Mar | L15. Data Pre-processing, Exploratory Data Analysis | DSDM Chap. 3 |
| 9 | 13-Mar | No Class (Spring Recess) | |
| | 15-Mar | No Class (Spring Recess) | |

| 10 | 20-Mar | No Class (Spring Recess) | |
| --- | --- | --- | --- |
| | 22-Mar | No Class (Spring Recess) | |
| 11 | 27-Mar | L16. Principles of Visualizing Data | DSDM Chap. 6 |
| | | Part 5. What do I See from the Data? | |
| 11 | 29-Mar | L17. Linear Regression | DSDM Sec. 9.1 ~ 9.3 |
| 12 | 3-Apr | L18. Classification and Logistic Regression | DSDM Sec. 9.6 ~ 9.7 |
| | 5-Apr | L19. Nearest Neighbor Classification | DSDM Sec. 10.1, 10.2 |
| 13 | 10-Apr | L20. Clustering | DSDM Sec. 10.5 ~ 10.6 |
| | 12-Apr | L21. Other Machine Learning Approaches | DSDM Chap. 11 Sec. 8.5.2, datacamp PCA, sci-kit learn PCA |
| | | Part 6. My Stories: What I learned from the Data. | |
| 14 | 17-Apr | L22. Learning from Data in Social Sciences and Humanities. Financial and Economic Data Application | Human Centric Data Science DSDM Sec. 12.7 Societal and Ethical Implications |
| | 19-Apr | L23. Web Development / Review for Midterm Exam # 2 review | HTCS Chap. 14, Google sites (https://support.google.com/sites) |
| 15 | 24-Apr | L24. Project Presentation | |
| | 26-Apr | L25. Project Presentation | |
| 16 | 1-May | Reading Period (No Class) | |
| | 3-May | Reading Period (No Class) | Final Project Report Due |

## Assessments & Grading

This course will have 7 weekly Python programming assignments, two in-class midterm exams, and a final group project.

Grade breakdown:
   45% Homework Assignments
   15% Midterm Exam #1
   15% Midterm Exam #2
   25% Final Project

## Final Project

Towards the end of the course, you will work on a month-long data science project. The goal of the project is to go through the complete data science process to answer questions you have about some topic of your own choosing. You will acquire the data, design your visualizations, run statistical analysis, and communicate the results. You will work closely with other classmates. We recommend a team project of 2-3 people per team.

Potential project Ideas and guidelines will be announced when we cover the topic of Part 3~ 4.

## Late Submission Policies

To allow for the exigencies of computer failures and personal crises, each student has **4 discretionary late days** for homework assignments, but any one assignment may only be up to 2 days late (enforced on Gradescope), so that we can discuss solutions, return grades in a timely fashion, and move on to the next assignment.  These late days can be used for any reason and there is no need to get a Dean's excuse or special permission to use them.  If you do have a Dean's excuse, it will be honored and we still encourage you to talk to your Dean if you have a serious incapacitating issue, but we hope that the flexibility of this policy will reduce the overall need for Dean's excuses.

If all 4 late days have been used up, then assignments may still be submitted up to 2 days late, but they will incur a 10% late penalty per day (5 minutes after the deadline is still considered 1 day late).

## Academic Integrity

The homework assignments in this course are intended to give you practice at working through problems independently. Therefore, unless otherwise specified, the homework assignments are your individual responsibility and are not group assignments. Plagiarism is a violation of University rules and will not be tolerated. You must neither copy work from others (at Yale or elsewhere) nor allow your own work to be copied. In addition to grade penalties, additional consequences for breaking this policy may be imposed by the Yale College Executive Committee. Note that Gradescope will automatically check your submissions for code similarity with your peers and past submissions to similar assignments.

You *may*:

- Ask others or search online for help with general issues with programming languages, APIs, IDEs, tools, and high-level course concepts that are not specific to the assignment.
- Ask clarifying questions about the requirements of an assignment to TAs or on the course discussion board.
- Discuss more specific issues on an assignment with a TA or instructor.

You *may not*:

- Discuss your individual solution with your peers.
- Receive a printed or electronic copy of anyone else's work for the course from this term or any other term. This includes asking or paying someone else to complete the assignment for you.
- Give anyone else a printed or electronic copy of your work for the course for this term or any other term. This includes posting your work publicly on sites such as Github.
- Seek out solutions to similar assignments online.
- If you have any questions about this policy or are unsure if you may have crossed a line, discuss it with the instructor as soon as possible.

## Diversity, Equity, Inclusion, & Belonging

This class strives to be an inclusive community, learning from the many perspectives that come from having different backgrounds and beliefs. As a community, we aim to be respectful to all. We reject all forms of prejudice and discrimination, including but not limited to those based on age, color, disability, gender, gender identity, gender expression, national origin, political affiliation, race, religion, sexual orientation, and veteran status. Faculty and students are expected to commit to creating an

environment that facilitates inquiry and self-expression, while also demonstrating diligence in understanding how others' viewpoints may be different from their own.

## Accessibility

Our institution values diversity and inclusion; we are committed to a climate of mutual respect and full participation. Our goal is to create learning environments that are usable, equitable, inclusive and welcoming. If there are aspects of the instruction or design of this course that result in barriers to your inclusion or accurate assessment or achievement, please notify the instructor as soon as possible. Disabled students are also welcome to contact Student Accessibility Services to discuss a range of options to removing barriers in the course, including accommodations.

## Academic & Wellness Supports

Writing Tutoring (Yale College)
https://poorvucenter.yale.edu/undergraduates/writing-tutoring-and-programs

Graduate Writing Lab (Yale Graduate Students)
https://poorvucenter.yale.edu/writing/graduate

STEM Tutoring (Yale College)
https://poorvucenter.yale.edu/undergraduates/stem-tutoring-programs

Language Tutoring (All Students)
https://cls.yale.edu/programs/language-tutoring

Academic Strategies Program (Yale College)
https://poorvucenter.yale.edu/academic-strategies-program

Student Accessibility Services (All students)
https://sas.yale.edu

Mental Health and Wellness Resources
Yale College Community Care (YC3)
https://yalecollege.yale.edu/getting-help/yale-college-community-care

College Care Clinicians (Yale College)
college.care.clinicians@yale.edu

Community Wellness Specialists (Yale College)
community.wellness.specialists@yale.edu

Yale Well (All Students)
https://yalewell.yale.edu

Yale Mental Health and Counseling (All students)
(203) 432-0290