ENVIRONMENTAL & OCCUPATIONAL HEALTH SCIENCES
UNIVERSITY of WASHINGTON | SCHOOL OF PUBLIC HEALTH
(https://deohs.washington.edu/)

Course Information

ENV H 590: Scientific Programming, Modeling, and Data Visualization with Environmental Health Applications

Course Time: T/TH 4:00-5:20pm
Meeting Location: Via Zoom

Instructor: Cory Morin
Clinical Assistant Professor
Department of Environmental and Occupational Health Sciences

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Office: Hans Rosling Center 771A
Office Hours: Arranged

Download full syllabus (Syllabus (https://canvas.uw.edu/courses/1449284/files/75466273?wrap=1))

About the Course

Course Overview

Increases in computing power and growth in the availability of data have allowed scientists to expand their research, create effective data visualizations, and develop and run quantitative models. This course will introduce students to computer programming, data visualization, and modeling methods for conducting scientific research with a focus on environmental health. Because it is free, easy to

learn, and one of the most popular scientific computing languages, this course will focus primarily on the Python language and its associated scientific libraries. It is important to note, however, that the concepts taught in this class can be applied to other languages and programs commonly used in science, such as Matlab and R. The course will be composed of 3 modules: 1) basic programming, 2) data manipulation and visualization, and 3) empirical and mechanistic modeling. The course does not assume students have prior programming experience or an advanced mathematical background, but they should have completed an introductory data analysis or statistics course such as BIOST 511, BIOST 517, PHI 512, or an equivalent course.

Learning Goals

· Develop and describe basic computer coding skills and concepts.

· Demonstrate an ability to import, manipulate, and export data.

· Create graphs, maps, and other figures to visualize data in an effective way.

· Describe various modeling techniques, including their advantages and disadvantages.

· Apply the knowledge and techniques introduced in the course to their own research.

Required Texts

- Think Python 2e: How to Think Like a Computer Scientist, by Allen B. Downey (Available free **here** **(https://greenteapress.com/wp/think-python/)**)
- Numerical Python: Scientific Computing and Data Science Applications with Numpy, SciPy and Matplotlib, by Robert Johansson (Available from Amazon and other retailers)
- Modeling and Simulation in Python, by Allen B. Downey (Available free **here** **(https://greenteapress.com/wp/modsimpy/)**)
- Think Complexity 2e, by Allen B. Downey (Available free **here** **(https://greenteapress.com/wp/think-complexity-2e/)**)

Grading

Grades in this course will be based on:

- Homework (60% of grade): These assignments will include questions and exercises related to material covered over the previous weeks. This will entail writing code, generating figures, doing analyses, and describing the associated methods and results. The homework will be submitted individually through canvas, however, students are welcome and encouraged to discuss the assignments as long as the material submitted is their own.
- Final project (30% of grade): Students will use the material learned during the course to conduct a short analysis on a topic related to their field of study. This assignment is very open-ended with the only constraint that it includes methods and visualizations derived from the material in the course. The project can be completed individually or with a partner. The student(s) will be

required to submit the code and necessary files used to conduct their analysis and a manuscript (3-5 pages without references) describing the project. The manuscript should include the following sections: background, methods, results, and discussion.

- Class participation (10% of grade): Students are expected to join the zoom sessions, ask questions, and participate in small group activities and discussions. Attendance will not be taken and occasional tardiness and absence is understandable. Full credit will be given in most instances where the student gives an honest effort to attend and participate in class.

Grade breakdown:

Homework (4 assignments)	15 points each	60%
Final Project	30 points	30%
Class Participation	10 points	10%

Academic Integrity

Students at the University of Washington (UW) are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity.

The UW School of Public Health (SPH) is committed to upholding standards of academic integrity consistent with the academic and professional communities of which it is a part. Plagiarism, cheating, and other misconduct are serious violations of **the University of Washington Student Conduct Code (https://www.washington.edu/studentconduct/)** (WAC 478-120). We expect you to know and follow the university's policies on cheating and plagiarism, and **the SPH Academic Integrity Policy (https://sph.washington.edu/students/academic-integrity-policy)**. Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington Community Standards and Student Conduct website.

Course Schedule

Below is a preliminary schedule. Topics and assignment due dates may be extended/condensed/shifted depending on student understanding and interest.

Date	**Topic**	**Readings**	**Assignment**
30-Mar	Introduction, Setup	TP Chapter 1 (optional)	
1-Apr	Variables, Expressions, Functions	TP Chapter 2, 3.1-3.5	
6-Apr	Functions, Conditionals	TP Chapters 3.5+, 5, 6.1-6.4	
8-Apr	Iteration	TP Chapters 4, 7	
13-Apr	Strings, Lists	TP Chapters 8, 10	

15-Apr	Dictionaries and Tuples	TP Chapters 11.1-11.4, 11.6, 12	
20-Apr	Numpy Arrays, Import, Export	NP Chapter 2 (up to page 88)	
22-Apr	Pandas	NP Chapter 12 (up to page 434)	HW1
27-Apr	Statistics 1	NP Chapter 13	
29-Apr	Statistics 2	NP Chapter 14	
4-May	Machine Learning	NP Chapter 15	
6-May	Plotting with Matplotlib	NP Chapter 4	
11-May	NetCDF Files and Cartopy	NetCDF documentation (link (https://unidata.github.io/netcdf4-python/)) and Cartopy website "Getting Started" (link (https://scitools.org.uk/cartopy/docs/latest/))	HW2
13-May	Classes and Objects	TP Chapters 15-17	
18-May	Modeling and Simulation 1	MSP (Chapters 1-4)	HW3
20-May	Modeling and Simulation 2	MSP (Chapters 5-9)	
25-May	Modeling and Simulation 3	MSP (Chapters 11-14)	
27-May	Complexity 1	TC (Chapters 5 and 7)	
1-Jun	Complexity 2	TC (Chapters 9, 11, and 12)	HW4
3-Jun	TBD	TBD	

TP = Think Python, NP = Numerical Python, MSP = Modeling and Simulation in Python, TC = Think Complexity

Supplementary Materials

Writing is an important transferable skill for all career pathways. Establishing a strong foundation in writing skills will help you be successful throughout your future course work and career. Therefore, this course includes written assignments with the goal to help you identify areas of strength and improvement in your writing. However, if you feel that you could benefit from additional opportunities to improve your writing skills, a list of resources at the UW and others accessible online can be found on the SPH website at https://sph.washington.edu/sites/default/files/inline-files/Writing-Resources-4.3.19.pdf. (https://sph.washington.edu/sites/default/files/inline-files/Writing-Resources-4.3.19.pdf)

Learning Remotely

Remote learning presents both challenges and opportunities. I encourage everyone to attend the live lectures when possible. This will enable you to ask questions and engage in discussions and in-class exercises. However, I realize many of you have busy schedules and unexpected events do arise, so the lectures will be recorded. If you are having difficulty, please let me know as soon as possible.

Access and Accommodations

Your experience in this class is important to me. If you have already established accommodations with **Disability Resources for Students (DRS)** (https://depts.washington.edu/uwdrs/), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course.

If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or **uwdrs@uw.edu** (mailto:uwdrs@uw.edu) or **disability.uw.edu.** (http://depts.washington.edu/uwdrs/) DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

Religious Accommodations

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at **Religious Accommodations Policy** (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the **Religious Accommodations Request form** (https://registrar.washington.edu/students/religious-accommodations-request/).

Safety

Call SafeCampus at 206-685-7233 anytime – no matter where you work or study – to anonymously discuss safety and well-being concerns for yourself or others. SafeCampus's team of caring professionals will provide individualized support, while discussing short- and long-term solutions and connecting you with additional resources when requested.

Guidance for Students Taking Remote Courses from Outside the U.S.

Faculty members at U.S. universities – including the University of Washington – have the right to academic freedom which includes presenting and exploring topics and content that other governments may consider to be illegal and, therefore, choose to censor. Examples may include topics and content involving religion, gender and sexuality, human rights, democracy and representative government, and historic events. If, as a UW student, you are living outside of the United States while taking courses remotely, you are subject to the laws of your local jurisdiction. Local authorities may limit your access to course material and take punitive action towards you. Unfortunately, the University of Washington has no authority over the laws in your jurisdictions or how local authorities enforce those laws. If you are taking UW courses outside of the United States, you have reason to exercise caution when enrolling in courses that cover topics and issues censored in your jurisdiction. If you have concerns regarding a course or courses that you have registered for, please contact your academic advisor who will assist you in exploring options.

Recording of Remote Class Sessions

This course is scheduled to run synchronously at the scheduled class time via Zoom. These Zoom class sessions may be recorded. The recording will capture the presenter's audio, video and computer screen. Student audio and video will be recorded if they share their computer audio and video during the recorded session. The recordings will only be accessible to students enrolled in the course to review materials. These recordings will not be shared with or accessible to the public. The University and Zoom have FERPA-compliant agreements in place to protect the security and privacy of UW Zoom accounts. Students who do not wish to be recorded should change their Zoom screen name to hide any personal identifying information such as their name or UW Net ID, and not share their computer audio or video during their Zoom sessions.

Notice to Students - Use of Plagiarism Detection Software

Notice: The University has a license agreement with SimCheck, an educational tool that helps prevent or identify plagiarism from Internet resources. Your instructor may use the service in this class by requiring that assignments are submitted electronically to be checked by SimCheck. The SimCheck Report will indicate the amount of original text in your work and whether all material that you quoted, paraphrased, summarized, or used from another source is appropriately referenced.