GEOG 4/590: GIS Programming

Course content:

Skill sets related to programming are in high demand in academic and commercial GIScience research and GIS development. This level course is aimed at students with a solid foundation in GIS techniques and applications interested in expanding their knowledge into the area of scripting in the context of GIS. The course introduces programming approaches to geoprocessing and modeling that can serve as powerful tools for the development of custom spatial analysis tools and workflows. It introduces students to basic computational concepts using Python, an object-oriented scripting language, for data processing, analysis and application development.

Learning objectives:

Upon completion of this course, students should:
- know basic terminology common to higher-language programming languages, in general, and Python, in particular
- be able to evaluate the design and purpose of Python code
- understand basic principles used in Python programming, with a focus on fundamental concepts such as variables, scope, loops, functions, packages, and debugging
- possess a basic understanding of the techniques and procedures involved in conceptualizing, implementing, testing, sharing, and executing of geoprocessing operations using Python and ArcGIS

Prerequisites:

- Introduction to GIS course or equivalent experience.
- No prior programming knowledge required.

Course resources:

- Software: ArcGIS Pro; Python 3.x
- ArcGIS Online

- ESRI's online education system
- Python in ArcGIS Pro online documentation
- Lecture PowerPoint files and lab notes available on the D2l course site.
- A personal USB "thumb" drive to store and back up projects
- Required readings:
  - Allen Downey, Jeffrey Elkner, and Chris Meyers: *Think Python - How to think A.B. Downey: Think Python: How to Think Like a Computer Scientist; 2nd ed; free course book*
  - Other readings might be assigned

- Other resources:
  - *[The Official Python Tutorial](#)*
  - *LearnPython.org: [Interactive Python Tutorial (The Basics)](#)*
  - *Python.org: [The Official Python 3 Standard Library](#)*
  - *C. Carver on Freecodecamp.org: [Things I Wish Someone Had Told Me When I Was Learning How to Code](#)*
  - *C. H. Swaroop: [A Byte of Python](#); free ebook*
  - *M. Pilgrim: [Dive into Python](#); free ebook; if you are <u>not</u> new to programming*

Expectations:

Students should have solid knowledge of ArcGIS, including the GIS-related vocabulary that goes with that. You are expected to attend the class sessions, actively participate in class, read the assigned course materials (where and when applicable), and complete a number of lab assignments, both inside and outside of class time. The lab activities provide the stepping-stone to mastering the concepts and techniques that are discussed in class. In addition, we will take full advantage of the course offerings within ESRI's online education library to reinforce course concepts and understanding.

Requirements:

Attendance/participation: I will be taking attendance in each course session and will use your attendance record to derive a participation score. Many studies on instructor-led learning point out that the performance of a student is directly related to his/her attendance in class. You will learn more and boost your grade. Attending the course sessions and keeping up with the lab assignments are important factors for succeeding in the course. In the case of a planned absence (medical appointment or study-related field trip), I expect that you get in touch with me in advance of the class session that you are going to miss.
I will make PowerPoint slides available on D2L. Keep in mind that there is a lot of material that we cover in class that is not easily visible on the slides. In other words, PowerPoint slides are by no means a substitute for class attendance.

Lab assignments: The goal of the lab exercises is to build and reinforce concepts introduced in class, by building understanding and expertise in different aspects of programming in Python. Assignments are due on the date indicated on the respective lab documents and/or course schedule. The lab exercises constitute an important component of your grade, so it is **important to submit assignments on time and avoid falling behind**. Even though I expect and encourage interaction among students in the course, note that **it is crucial that you showcase in your code, comments, and documentation that you completed all lab-related assignments individually.** Writing code is an exercise in problem solving with many possible approaches and written code is often imbued with one's own style and preferences (e.g., naming of variables, spaces and tabs)--and I expect to see such idiosyncrasies reflected in your submissions.

In general, you will have one week to complete an assignment. Having said that, some assignments might be due at the end of the current or during the following course session. Depending on the assignment, late work will either be rejected or be subjected to a penalty. Keep in mind that it is your responsibility to submit the assignments before the deadline so please budget and allocate your time accordingly. The type and method of delivery will be specified by the instructor and/or TA for each assignment. As for submitting your assignment, you will have to upload your **tested, working, and documented programming code to D2L, including all auxiliary files and data that are required to run your code.**

Computers: Students must have a PSU ODIN account and working knowledge of the Desire2Learn learning management system (https://d2l.pdx.edu) and ESRI software. Students should also be familiar with the basics of operating personal computers running the Microsoft Windows operating system (e.g., copying files, creating folders, compressing/zipping multiple files, and accessing USB and network storage devices). It is highly recommended that you work on and test the lab assignments on the computers in the department computing labs, where and when possible. Please note that the instructors will not do software trouble-shooting if you use your own personal computer.

Grading:

There will be a number of in-class and take-home **lab assignments** that will be evaluated based on a rubric specific to programming code (see the D2L course website for the rubric document). For these assignments, students **will not get any points for incomplete, non-functioning, illogical, or under-commented code submissions.** In other words, it is important for the scripts to provide the requested functionality and output, and that they can be executed without any error messages. In addition, there will be **web-based course assignments** pertaining to the satisfactory completion of Python courses offered by ESRI's online education system. Certificates of completion for these courses will inform students' overall grade. Lastly, there may be a number of low-stakes in-class or take-home **exercises and/or quizzes**. Your final grade will be based on a standard grading system using the following weighting:

Component	Percent
Attendance	*10%*
ESRI Course Completions	*10%*
Exercises/Quizzes	*10%*
Lab Assignments	*70%*
Total	100%

General course policies:

Submitting work online
For assignments that require uploading files to D2L, it is the student's responsibility to verify that (1) all files are submitted in D2L prior to the deadline and (2) all submitted files are those that the student intends to be graded for the assignment. Submitting the "wrong" file(s) by accident is not acceptable grounds for a deadline extension. Assignment grades will be based on the file(s) submitted prior to the posted deadline. File(s) submitted in a format that cannot be accessed by the instructor cannot be graded and will therefore receive a 0. Acceptable file formats are MS Office formats (e.g., Word, Excel, Powerpoint) or PDF files. Individual assignment instructions may contain a required file format.

Technology access
Proficiency in the use of D2L, PSU email, and other computer software and tools such as ZOOM and the Google Suite of software products (e.g., Gmail, Google Calendar) is required for this course. This course requires consistent access to functioning computer equipment and Internet access throughout the length of the course. Reliance on a cellular connection may not provide reliable and fast access to online learning resources. Information on broadband Internet programs that are free or low-cost can be accessed at the following link:

https://www.highspeedinternet.com/resources/are-there-government-programs-to-help-me-get-internet-service

Electronics, aids, and distractions during lecture
Please be aware that accessible tables or chairs in any teaching facility should remain available for students who cannot use standard classroom seating. If you have a particular need or preference for using an electronic device or aid for notetaking, please talk to me about it to clear its use. Generally, electronic devices that are not used for notetaking (e.g., smartphones and tablets) are an unnecessary distraction to not only you but to those around you and me, so please put them away. If you need to leave lecture early, it is appropriate to let me know in advance, and sit near the back of the room in order to leave unobtrusively. If you must arrive to class late, please do not create a commotion–slip in and sit in the back. I do not mind eating and drinking in the lecture, but please do so in a way that is not distracting to others. Other distractions such as talking, snapping gum, snoring, picking at your teeth, drooling, spilling your coffee, etc. should also be done elsewhere.

Active learning
I definitely encourage questions, comments, and interactions in class. I will try to integrate "active learning" assignments, such as one-minute questions, in-class activities, guest lectures, student presentations and other things besides me lecturing to you. **All of these are fair game for quizzes or exams.**

My expectations

I want you to do well, to enjoy the class, to feel like you are respected, and to learn skills that may be important to the rest of your career (academic or otherwise) in geography and GIS. I want to create an intellectual environment that encourages and fosters your learning. I enjoy meeting students outside of class so please do not hesitate to seek me out during my office hours. Foremost, if you realize that you are struggling, reaching out to me or your TA is the only way that we can help you. We expect, however, that such help is earned by applying yourself to the class and putting in your best effort and work.

Incomplete grades

University policy states explicitly that students do not have a right to receive/demand an incomplete (I) grade. The option of assigning an incomplete grade is at the sole discretion of the instructor. I only consider granting an incomplete grade when a student is forced to miss several weeks of class due to extraordinary circumstances such as a documented confining illness or a family emergency. To be eligible for an incomplete grade, you must discuss the matter with and obtain approval from me before the last day of class. In addition, the following criteria apply:

- *Required satisfactory course completion/participation*. The quality of the work is satisfactory, but some essential work remains. In addition, the student must have successfully completed most of the course work at the time the student requests the incomplete grade, with a minimum grade up to that point of a C- for undergraduate, or B- for a graduate level course.
- *Reasonable justification for request.* Reasons for assigning the incomplete grade must be acceptable by the instructor. A student does not have the right to demand an incomplete grade. The circumstances should be unforeseen or be beyond the control of the student. The instructor is entitled to request appropriate medical or other documentation to validate the student's request.
- *Incomplete grade is not a substitute for a poor grade.* The incomplete grade is not meant to create the opportunity for special or additional work for a student to raise a poor grade, or for the opportunity to take the course over by sitting in on the course in a later term without registering or paying for it.
- *Written agreement.* A written or electronic agreement in the form of the "Contract for Assigning an Incomplete" will be endorsed by both the instructor and student. The document will specify a) the remaining work to be completed, b) the highest grade which may be awarded upon submission of remaining items, and c) the date by which the missing work is due. The "Contract for Assigning an Incomplete" form can be obtained from the instructor.

- *Resolving the Incomplete.* Students cannot "sit in" an entire future course in order to resolve the incomplete grade. If the student needs to retake the entire course, s/he will be given the grade presently earned, and must formally register for the future class offering. If the missed portion of the course is no longer available, instructors may offer an alternative assignment. Grading weight of the alternative assignment should not exceed the original assignment. Students are fully responsible for monitoring all due dates.

Academic honesty and conduct
Students are expected to be ethical not only in the classroom, but also out of the classroom. It is in all students' interest to avoid committing acts of academic dishonesty or misconduct and to discourage others from committing such acts. Academic dishonesty includes, but is not limited to, the following examples: engages in any form of academic deceit; refers to materials or sources or uses devices not authorized by the instructor for use during any quiz or assignment; provides inappropriate aid to another person in connection with any quiz or assignment; engages in plagiarism. Plagiarism is the act of claiming someone's work as your own through copying it without giving the creator of the work credit. Plagiarism can also include using another person's theories, ideas, or phrases without proper attribution. The simplest way to avoid plagiarizing is to always cite the sources from which you gather information or develop arguments. Plagiarism is a serious issue and is a violation of the [PSU Student Code of Conduct](#).

Academic dishonesty may result in a minor penalty (e.g., a zero for that week's assignment) or a major penalty (e.g., a referral to the Office of the Dean for further disciplinary actions and/or an academic dishonesty failure for the course), at the discretion of the instructor. The university has [specific procedures](#) for dealing with cases of academic dishonesty and misconduct.

University policy may require instructors to report instances of academic misconduct and penalize the perpetrator(s) according to the aforementioned procedures.

In a lab class such as this, it is not unlikely for groups to work together. It is your responsibility to ensure that labs done in groups *clearly show your individual work*, leaving no doubt that each of you completed all the work as assigned. Copying another person's work, either in the class or from another class, and turning it in as your own work, or sharing your work knowing that another student will be turning it in as his or her own work, constitutes academic dishonesty.

Sexual harassment, sexual assault, dating/domestic violence and stalking
Portland State is committed to providing an environment free of all forms of prohibited discrimination and sexual harassment (sexual assault, domestic and dating violence, and gender or sex-based harassment and stalking). Sexual harassment means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any university activity or program.

If you have experienced any form of gender or sex-based discrimination or sexual harassment, know that help and support are available. PSU has staff members trained to support survivors in navigating campus life, accessing health and counseling services, providing academic and on-housing accommodations, helping with legal protective orders, and more. Information about PSU's support services on campus, including confidential services and reporting options, can be found on PSU's Sexual Misconduct Prevention and Response website at http://www.pdx.edu/sexual-assault/get-help. You may also call a confidential IPV Advocate at 503-725-5672 or schedule a time online at https://psuwrc.youcanbook.me. You may report any incident of discrimination or discriminatory harassment, including sexual harassment, to either the Office of Equity and Compliance or the Office of the Dean of Student Life.

Please be aware that all PSU faculty members and instructors are required to report information of an incident that may constitute prohibited discrimination, including sexual harassment and sexual violence. This means that if you tell me about a situation of sexual harassment or sexual violence that may have violated university policy or student code of conduct, I have to share the information with my supervisor, the University's Title IX Coordinator or the Office of the Dean of Student Life. For more information about Title IX please complete the required student module "Creating a Safe Campus" in D2L.

Equity, diversity, equal opportunity, and affirmative action
The university will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. Preventing equal access to learning for all is grounds for dismissal from the class.

Access and inclusion for students with disabilities
PSU values diversity and inclusion; we are committed to fostering mutual respect and full participation for all students. My goal is to create a learning environment that is equitable, useable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me.

The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment. So, if you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact DRC to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu, http://www.pdx.edu/drc.

If you already receive accommodations through DRC, I encourage you to contact me to assure that I have received a faculty notification letter and to discuss your accommodations.

If you receive test-taking accommodations, please be proactive and follow-through with DRC and SHAC well before any given exam date to have your exam or test proctored with SHAC Testing Services. I have no control over the schedule of any of the teaching or instruction rooms beyond our class and can therefore not guarantee that accommodations can be met in our regular class room (e.g., CH 413). If possible, I suggest that you schedule your test with SHAC Testing Services during the time that the class is taking the test and no later than the end of the business week during the week in which the regular exam takes place.

For information about emergency preparedness, please go to the Fire and Life Safety webpage for information (http://www.pdx.edu/environmental-health-safety/fire-and-life- safety).

Mental health services
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 and may reduce your ability to participate in daily activities. Portland State University services are available to assist you, and your instructor and TAs can guide you to these resources. Foremost, the Center for Student Health and Counseling (SHAC) provides counseling services for PSU students. Please contact SHAC for their hours of operation and more specific information on appointments and services: 503-725-2800 and https://www.pdx.edu/shac/center-for-student-health-and-counseling.