GEOG 276: Principles of Python Programming and Geocomputing

Department of Geographical Sciences
University of Maryland
Summer II, 2025

COURSE INFORMATION

INSTRUCTOR
Rachel Marks
Email: rmoore8@umd.edu
Office Hours: Online, by appointment

TA(s)
Shi Jun Wee, sjwee@umd.edu
Sumi Lee, sumilee@umd.edu

COURSE SCHEDULE
M-F 12:00pm – 2:30pm, online via Zoom

COURSE SUMMARY

Introduces conceptual and practical aspects of programming for geographic applications. The main focus is on developing a solid understanding of basic programming techniques irrespective of the specific programming language including variables, looping, conditional statements, nesting, math, strings, and other concepts. In addition, students will develop a proficiency in applying these basic programming principles to manipulating spatial data sources within the context of Geographic Information Systems (GIS).

LEARNING OUTCOMES

After successfully completing this course you will be able to:

- design a solution for a geographic program using pseudo-code and available spatial analysis functions;
- automate geospatial data processing using the Python programming language;
- appropriately use common programming techniques and structures including variables, flow control, looping, Boolean expressions;
- implement automated grid-based analysis functions;
- automate manipulation of spatial and non-spatial data and text manipulation using Python;
- develop automated data processing flows and map generation based on user input.

REQUIRED RESOURCES
Course website: All students enrolled in the course have access to course materials (lecture, slides, assignments, etc.) through CANVAS and Google Collaboratory. Lectures and labs will be available live via Zoom (info below, in the Course Schedule section).

There are no required textbooks.

RECOMMENDED RESOURCES
These optional books may prove useful throughout the course:

- *Learning to Python* by Mark Lutz
- *Learning Geospatial Analysis with Python* by Joel Lawhead

COURSE STRUCTURE

The class structure includes lectures, syntax sessions, and labs.

- Lectures & syntax sessions will be lead by the instructor
- Labs will be lead by the TA(s).

All class session will be held via Zoom, which can be accessed on your computer.

A link to the Zoom meeting will be provided before each class via CANVAS. You can copy and paste the link into a web browser to join each class session.

Date	Lecture/Lab	Topic	Assignment (Due Date) (Grader)
Week 1			
Mon 7/14	Lecture 1 Lab 1	Course Overview Intro to Computer Programming for GIS Data types, variables, and operators Working with Strings	Lab 1 (7/15) (Sumi Lee)
Tues 7/15	Lecture 2	Lists, dictionaries, tuples, and arrays	
Wed 7/16	Lab 2		Lab 2 (7/17) (Shi Jun Wee)
Thurs 7/17	Lecture 3	Loops, conditionals, and flow control	
Fri 7/18	Lab 3		Lab 3 (7/21) (Sumi Lee)
Week 2			
Mon 7/21	Lecture 4	Functions, modules, and classes	
Tues 7/22	Lab 4		Lab 4 (7/23) (Shi Jun Wee)
Wed 7/23	Lecture 5	Intro to numpy and data arrays	
Thurs 7/24	Lab 5		Lab 5 (7/25) (Sumi Lee)
Fri 7/25	Lecture 6	Intro to pandas and data mining	
Week 3			
Mon 7/28	Lab 6		Lab 6 (7/29) (Shi Jun Wee) **Midterm exam due (Lecture 1 - 5)**
Tues 7/29	Lecture 7	Intro to geopandas and shapely geometries	
Wed 7/30	Lab 7		Lab 7 (7/31) (Sumi Lee)
Thurs 7/31	Lecture 8	More geopandas: Mapping and geometric operations Basic raster handling	
Fri 8/1	Lab 8		Lab 8 (8/2)** (Shi Jun Wee)

LECTURE

The lecture sessions will introduce concepts and code that play a fundamental role in learning to program.

SYNTAX SESSION

While new concepts will be introduced in the lecture component, the syntax sessions will involve hands-on problem solving, demonstrations, writing code in-class, and some discussion. Problem sets will be posted to CANVAS before the class, and the syntax sessions will involve going over example problems that will be useful for the assignments and your future career. Preparing a laptop/computer ready to use during the class is highly recommended.

LAB SESSION

The course includes a lab component, which is of equal importance to, if not more than, the lecture and syntax session.

At the start of the course, students will be assigned to lab groups that will persist through the duration of the semester. During lab time, students will work together to practice skills developed in the class within the python scripting environment.

For each lab assignment, each lab group will turn in ONE Google Collab notebook with the solution to the exercise. The link to your notebook should be submitted online via CANVAS before posted deadlines. Late assignments will be given a 10% penalty per day up to a maximum of 2 days (including weekends). Assignment submitted more than 2 days late will be given a grade of 0. Labs will contribute ~70 % to the total grade for the course.

MIDTERM EXAM

The course includes 1 mid-term exam (worth ~ 18 % % of the total grade). Mid-term exam will cover material from lectures 1 – 5. The exam will be open note, and taken via CANVAS outside of class time.

The second half of the course is more focused on programming application such as applying powerful python packages to implement data analysis and spatial analysis tasks, so the course does not have final exam.

ATTENDANCE:

Attendance is **MANDATORY**, and will be recorded during each class. Lecture absences, late work, and make-up exams will be possible only for students having proof of a University approved excused absence. In the event of an excused absence, students should try to notify the Instructor **at least 24 hours BEFORE** a given due date to make alternative arrangements. Students also need to provide valid documents for absence, late work and make-ups. **Otherwise, no late work and make-ups will be accepted.**

GRADING:

Assignment	Description	Points
Lab 1	Variables, data types, and operators String Manipulation	20
Lab 2	Lists, tuples, and dictionaries	10
Lab 3	Loops, conditionals, and flow control	12
Lab 4	Functions, modules, and classes	12
Lab 5	Numpy arrays	12
Lab 6	Panda series and dataframes	12
Lab 7	Geopandas	12
Lab 8	Geopandas II and Rasterio	12
Midterm	-	25
Attendance	-	15
Total		**142**

Final Grade Cutoffs								
+	97.00%	+	87.00%	+	77.00%	+	67.00%	
A	94.00%	B	84.00%	C	74.00%	D	64.00%	F < 60.0%
-	90.00%	-	80.00%	-	70.00%	-	60.00%	

Final letter grades are assigned based on the percentage of total assessment points earned. To be fair to everyone I have to establish clear standards and apply them consistently, so please understand that being close to a cutoff is not the same this as making the cut (89.99 ≠90.00). It would be unethical to make exceptions for some and not others.

COMMUNICATION:

- **Course Email:** rmoore8@umd.edu

- **E-mail Subject Line**: GEOG_276_LastName_lecture or assignment in question
  Please use this format for the subject line of your emails, to allow for easy sorting/ organization. If your question does not pertain to a particular lecture or assignment, you can use an alternative keyword, such as GEOG_276_Marks_Attendance.

- **Communicate, communicate, communicate**!
  DO NOT hesitate to contact the instructor if you have any concerns, critiques and suggestions. I want you to feel comfortable and confident with all concepts and processes. Keep in mind, the earlier you ask a questions, the better and more thoroughly it can be addressed.

ACADEMIC ACCOMODATIONS/ DISABILITIES:

If you have a documented disability and wish to discuss academic accommodations, please speak to the instructor on the first day of class. We will make every effort to accommodate students who are registered with the Disability Support Services (DSS) Office and who provide us with a University of Maryland DSS Accommodation form by **Thursday, 7/17/25.**

ADMINISTRATIVE

Campus Policies:

It is our shared responsibility to know and abide by the University of Maryland's policies that relate to all courses, which include topics like:
• Academic integrity
• Student and instructor conduct
• Accessibility and accommodations
• Attendance and excused absences
• Grades and appeals
• Copyright and intellectual property

Please visit www.ugst.umd.edu/courserelatedpolicies.html for the Office of Undergraduate Studies' full list of campus-wide policies and follow up with me if you have questions.

ACADEMIC INTEGRITY:

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://shc.umd.edu/SHC/Default.aspx.

HONOR CODE:

The University also has a nationally recognized Honor Code, administered by the Student Honor Council. The Student Honor Council proposed and the University Senate approved an Honor Pledge. The University of Maryland Honor Pledge reads:

"I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination."

STUDENT CONDUCT:

Students must abide by the university's Code of Student Conduct. Please treat your peers and instructors with respect, turn off cell phones during class, remain quiet until called upon, and so forth. We do not anticipate any problems. However, as instructors and staff of the university, we have the right to ask any student disrupting the class to leave immediately. Such disruptions will be referred to the Office of Student Conduct (http://www.jpo.umd.edu).

NAMES/ PRONOUNS AND PERSONAL IDENTIFICATION

The University of Maryland recognizes the importance of a diverse student body, and we are committed to fostering inclusive and equitable classroom environments. I invite you, if you wish, to tell us how you want to be referred to both in terms of your name and your pronouns (he/him, she/her, they/them, etc.). The pronouns someone indicates are not necessarily indicative of their gender identity. Visit trans.umd.edu to learn more.

Additionally, how you identify in terms of your gender, race, class, sexuality, religion, and disability, among all aspects of your identity, is your choice whether to disclose (e.g., should it come up in classroom conversation about our experiences and perspectives) and should be self-identified, not presumed or imposed. I will do my best to address and refer to all students accordingly, and I ask you to do the same for all of your fellow Terps.

GET SOME HELP!

Taking personal responsibility for you own learning means acknowledging when your performance does not match your goals and doing something about it. I hope you will come talk to me so that I can help you find the right approach to success in this course, and I encourage you to visit tutoring.umd.edu to learn more about the wide range of campus resources available to you. In particular, everyone can use some help sharpen their communication skills (and improving their grade) by visiting ter.ps/writing and schedule an appointment with the campus Writing Center. You should also know there are a wide range of resources to support you with whatever you might need (see go.umd.edu/assistance), and if you just need someone to talk to, visit counseling.umd.edu or one of the many other resources on campus. Most services free because you have already paid for it, and everyone needs help… all you have to do is ask for it.

COVID-19 CARE AND SUPPORT RESOURCES

The University of Maryland Counseling Center cares deeply about the UMD community and we extend our support to the community during this difficult and unprecedented situation caused by the COVID-19 outbreak. As we navigate the outbreak, the counseling center is committed to caring for, supporting, and serving this community through virtual services and resources.

We recognize that in the wake of this crisis, many students may be experiencing significant fear,

not only about their physical health but also about the uncertainty that the outbreak poses. We understand that CDC guidelines on social distancing to protect ourselves and others, has led to severe and uncomfortable changes in our lives with which we must now must cope. Additionally, we acknowledge that the COVID-19 outbreak has greatly impacted certain communities, with unfortunate increases in xenophobic, racist, and anti-Semitic bias; additional stress on medically vulnerable individuals; and significant barriers to resources in lower-income and working-class communities.

In situations like this it is normal to feel anxious, experience stress, feel frustrated, depressed, and lonely. The resources outlined by UMD (counseling.umd.edu/covid19/) may help you cope with these reactions and manage your mental health during this difficult time.

INLCEMENT WEATHER POLICY:

Online classes will continue as normal even if the university is closed due to inclement weather, however the university's operating status is available on the school website (http://www.umd.edu) or by phoning 301-405-SNOW.