

Syllabus: GEOG656 - Programming and Scripting for GIS - Winter 2017

Instructor

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Office Hours: On-campus: Mondays, 3 to 5 pm (Also available most days by appointment)

Location: 1137 LeFrak Hall

Teaching Assistant

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Office Hours: Online after Lab Sessions

About the Course

Time: 5:30 to 8 pm Mondays (Lectures); 5:30 to 7:30 pm Tuesdays (Labs)

Location: Online: <http://elms.umd.edu>; Campus Location: 1166 LeFrak Hall (Lectures)

Description

This course teaches programming and scripting for GIS users. The concepts of scripting and object-oriented programming using the Python programming language are reviewed. This course teaches students to design clearly structured programs and introduces ArcPy, a library providing access to ArcGIS geoprocessing tools. ArcPy includes a series of modules such as data access, mapping, spatial analysis, and network analysis. Students will develop geoprocessing programs to edit, query, manipulate, and analyze spatial data (both vector and raster data) with Python, ArcPy, and other modules like NumPy.

The format of this course will consist of lectures, quizzes, and lab assignments. The lectures will be presented online via the Live Classroom on the Enterprise Learning Management System (ELMS). All lectures involve the interaction between students and instructor in real-time. Lectures will be archived into videos which will be made available on ELMS. Please note that video archives are intended for occasional or backup use in case students have to miss lectures due to personal, business, or medical reasons. Real-time, online participation is strongly recommended. The reading and lab assignments will also be posted on ELMS.

Prerequisites

The material in this course is crucial for anyone who works with geographic information systems and wants to customize GIS geoprocessing for particular applications. Students taking this course are expected to have basic understandings and skills in GIS. Some programming experience is strongly recommended. This course is required for the MPS in GIS and the Graduate Certificate in GIS.

Textbooks

Recommended (only if you are new to programming and need a reference)

- Gries, P., Campbell, J., and Montojo, J. (2013) Practical Programming: An Introduction to Computer Science Using Python, Pragmatic Programmers.

Suggested

- Lutz, M. and Ascher, D. (1999) Learning Python, O'Reilly Media.
- Zelle, J. M. (2003) Python Programming: An Introduction to Computer Science, Franklin Beedle.
- Tucker (2004) Writing Geoprocessing Scripts in ArcGIS, ESRI Press (available online).

Online References

Python Homepage - <http://www.python.org/>; Python 2 Documentation - <https://docs.python.org/2/>

Official Python 2 Tutorial - <https://docs.python.org/2.7/tutorial/>

A Byte of Python (An Online Wikibook) - <https://python.swaroopch.com/>

Additional Python Tutorials - <https://www.learnpython.org/>; <https://www.codecademy.com/learn/python>;
<https://www.tutorialspoint.com/python/>

ArcGIS Desktop Help - <http://desktop.arcgis.com/en/arcmap/10.3/analyze/python/what-is-python-.htm>
ArcGIS Resources and Communities (Python) - <http://resources.arcgis.com/en/communities/python/>
ArcGIS Analytics (Python) - <http://desktop.arcgis.com/en/analytics/python/>

Grading

Students are encouraged to attend each lecture and actively participate in online discussion board as well as in class. Students are required to post a reply on the issues or questions posted by the instructor. Lab assignments will be given on a weekly basis to help students gain practical experience in developing programs with Python and ArcPy. Lab assignments will give students the directions to code sample programs and then ask students to modify programs for solving the given questions. Final grades will be determined by the following items:

Quizzes = 5%

Discussions and Participation = 5%

Lab Assignments = 90%

Optional Final Project = 0%*

The plus/minus grading system will be used to assign student grades. Minor adjustments to this scale might be made based on the performance of the class as a whole.

* Note: The final project for this class involves designing an ArcGIS Python Tool for the application of your choice. It is **optional** and not counted toward your final grade. More details will be announced later.

Lab Assignments

There are a total of nine (9) lab assignments and each account for 10% of the final grade. The due date will be specified in the lab document. Late submission of lab reports will result in a possible deduction of points. However, in some situations (e.g. medical or family emergency), extension is possible if you contact the instructor before the due date. All labs must be completed by the end of the quarter.

Software

You can use either a PC or Mac to access ELMS. Whichever you choose, it should be equipped with headphones and microphone.

The following software will be utilized during this course:

- ESRI ArcGIS 10.X (With ArcPy) (If you need a digital copy let me know)
- Python 2 (Installed automatically with ArcGIS) (<https://www.python.org/downloads/>)
- IDE (Integrated Development Environment) such as IDLE or Notepad++

The software required for this class is available in the open lab (located in 1136 and 1138 LeFrak Hall) or remotely through VMware (<https://geog.umd.edu/graduate/mps-student-resources>).

Communication

Email

Both the TA and the instructor will always be available by email. Use the email link in the sidebar to send us an email at any time. We will try to answer within 24 hours and usually sooner.

Online / Chatroom Office Hours

If needed, I can provide online office hours if you are unable to meet on campus. To do so, simply send me an e-mail to request a time to meet online.

Offline / On-campus Office Hours

I will be available to meet on campus for face-to-face office hours at specified times. You can also email either the TA or the instructor to set up individual office hours by appointment.

Discussion Board

The discussion board is a place on the ELMS site for you to visit your classmates. This is an open forum for discussion about course material and for casual conversation. We encourage any general questions about the course material or lab assignments to be posted here so that students can help learn from each other. We will try to help answer any course-related questions that are posted here. In addition, there will be study rooms set up for you to form study groups. We will not be monitoring these rooms. Remember that the University Code of Academic Integrity specifies that you are free to work together and to discuss the assignments, but that you must produce your own original and independent work.

Class Attendance and Environment

You are strongly recommended to attend every lecture in real time at the online site or on campus at the physical classroom. We will meet online at the announced time for a live audio/video lecture. During this time you can follow along with the lecture and ask any questions that you may have. The lecture will be archived for anyone who absolutely must miss a class, but I encourage you to join the class online at the appointed time so that you can ask questions and keep up with the course schedule.

In this class, students will meet in a virtual space online which will be treated as a classroom. Our class will meet within the Enterprise Learning Management System (ELMS), the university's online learning system. Go to <http://elms.umd.edu> to access the course. After login, the course will be listed in the right column under "My Courses".

It is important to recognize that the classroom is an environment that requires respect for all participants. Therefore, students are expected to conduct themselves in a considerate manner.

Disabilities and Religion

Any student with a disability is encouraged to meet with the instructor privately during the first week of class to discuss accommodations. I will make every effort to accommodate students who are registered with the Disability Support Services (DSS) Office and provide a DSS accommodation form.

Please refer to the Online Undergraduate Catalog Policy on Religious Observance.

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 the 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://www.shc.umd.edu>.

Within our class, students may work together to review class notes and lab assignments. However, labs must be done individually. Students must turn in their own work without assistance from another student.

Course Schedule

This is a tentative schedule and may be adjusted. Changes will be announced and posted on ELMS.

Week	Date	Lecture Topics	Assignments
1	Nov. 27	Course Introduction Variables and Numerical Data Types Conditionals, Loops, Functions	Lab 1 Out
2	Dec. 4	String Data Types Modules and Methods Lists and Data Structures	Lab 1 Due Lab 2 Out
3	Dec. 11	File Processing - Reading and Writing Files Operating System Commands Debugging Computer Code; Modular Programming	Lab 2 Due Lab 3 Out
4	Dec. 18	Object-oriented Programming - Classes and Objects Program Flow Control; Exception Handling (Part 1)	Lab 3 Due Lab 4 Out
	Dec. 25	No Lecture - Winter Break	
5	Jan. 2*	Python Scripting for ArcGIS - ArcPy Module Creating Custom Tools in ArcGIS GIS Workflows - ArcPy and Model Builder	Lab 4 Due Lab 5 Out Project Out
6	Jan. 8	ArcPy Classes and Objects ArcPy Geoprocessing Tools and Functions ArcPy Messages; Exception Handling (Part 2)	Lab 5 Due Lab 6 Out
7	Jan. 16*	Managing Tabular Data and Cursor Objects Geoprocessing Outputs and Result Objects Listing GIS Data	Lab 6 Due Lab 7 Out
8	Jan. 22	Working with Geometry Objects Getting Information with Describe Objects	Lab 7 Due Lab 8 Out
9	Jan. 29	Spatial Analyst and Raster Objects Computer Algorithms Creating Custom Tools in ArcGIS	Lab 8 Due Lab 9 Out
10	Feb. 5	Map Document Objects; Network Analyst Third-party Python Modules; PySal Integrating ArcPy with NumPy	Lab 9 Due
	Feb. 12	No Lecture - Work on Optional Final Project	Optional Project Due

* Lecture for Week 6 and Week 8 will meet on Tuesday to honor New Year's and MLK Day on Monday. Final grades must be submitted to the university by **Feb. 18**. All work must be submitted by **Feb. 16**.

Lab Assignment Topics

Lab 1 - Introduction to Python Scripting

Lab 2 - Modules and Data Structures

Lab 3 - File Processing

Lab 4 - Object-oriented Programming

Lab 5 - Introduction to the ArcPy Module

Lab 6 - Geoprocessing Tools in Python

Lab 7 - Cursor Objects

Lab 8 - Geometry Objects

Lab 9 - Raster Objects