GEOG 489: Programming for GIS
Spring, 2022
2:00 – 3:20 PM Tuesday and Thursday
Room 1020, Natural History Building

Instructor Information
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Office Hours
In-person: 3:30 PM - 4:30 PM, Tuesday and Thursday @ Room 1044, Natural History Building, 1301 W Green St, Urbana, IL 61801
Virtual: If the office hour above does not work for you, please reach out to the instructor via email(jparkgeo@illinois.edu) to schedule a meeting over Zoom.

Course overview/description
GEOG 489 (Programming for GIS) is the course of 4 undergraduate hours and 4 graduate hours and introduces Python programming skillsets to customize and extend the capabilities of Geographic Information Science (GIScience). As the importance of programming is highlighted throughout the discipline of geography, not limited to GIScience, the job market and community is actively looking for candidates who can handle data effectively and efficiently. To meet the needs, the topics of this class include programming principles, advanced function and tools coding, visualization, fundamental spatial data structures, and spatial algorithms, but are not limited to. The course is primarily a combination of lecture and hands-on programming workshops so that students will be taught how to customize existing spatial analysis tools to meet their needs with well-known Python packages, such as GeoPandas, Pysal, GDAL, etc. Students are also expected to run projects as a team to experience how to organize Python code with the geospatial libraries for their needs and taste.
Prerequisite: GEOG 379 and GEOG 380 or equivalents, or consent of instructor.

Course-level learning objectives
Successful completion of this course will enable the student to:

- Learn the basics of programming using Python and CyberGISX.
- Programmatically access GIS data and use these data in GIS modeling, computation, visualization, and analysis.
- Conceptualize, design, plan, implement, and document a custom GIS programming solution to a real-world problem.

Course structure
The course will focus on programming in Python. Each week, we will cover background knowledge on Tuesdays and hands-on workshops or labs on Thursdays. The materials for each week will be distributed via https://learn.illinois.edu and https://github.com/jparkgeo/GEOG489 every Monday. For the lab weeks, students will be assigned labs on Thursday and have a week to turn them in. For example, a lab assignment distributed on Feb 3rd should be submitted by Feb 10th at midnight (before Feb 11th).

Computational Resources
Students will have access to and are recommended to use the CyberGISX platform (https://cybergisxhub.cigi.illinois.edu/) using their university account throughout the course. The instruction of getting access will be provided during the first week.

Textbooks (No needs to purchase, both are accessible online through the library website)

- Garrard. (2016). *Geoprocessing With Python* (1st edition). Manning Publications. ISBN 1-61729-214-1
- Toms, van Rees, E., & Crickard, P. (2018). *Mastering Geospatial Analysis with Python* (1st edition). Packt Publishing. ISBN 1-78829-333-9

Grading
Grade assignments will be made by converting your points earned to a percentage and compared to the following grading scale:

A	93.33% -100.0%
A-	90.00% -93.32%
B+	86.67% -89.99%
B	83.33% -86.66%
B-	80.00% -83.32%
C+	76.67% -79.99%
C	73.33% -76.66%
C-	70.00% -73.32%
D+	66.67% -69.99%
D	60.00% -66.66%
F	60%

Grade Breakdown and Guideline

- Class participation (10%)
  One absence without notice is allowed. However, more than that will take off 1 point from the maximum of 10 points. In other words, 11 absences will cause no credits from the class participation.
- Labs (40%; 5 points * 8 labs)
  Students will have a week to finish. Late submission will take out a point per day.
- Research Project (30%; Detailed rubric will be announced during the class)
  - 15 points from the instructor
    - (5 points for a Jupyter Notebook & 10 points for two presentations)
  - 10 points from classmates (Inter-team review)
  - 5 points from teammates (Intra-team review)

- Midterm (20%)
  Students will only have a midterm and will have two hours to take it.

Communication Protocols
The instructor will attempt to respond to emails during the weekdays within 24 hours of receiving them. Therefore, please do not expect an immediate response and plan accordingly, although the instructor will respond as soon as possible. If you send an email over the weekend, please do not expect any response until Monday or Tuesday morning.

Academic Integrity
Each student is expected to be familiar with the UIUC definitions and policies on academic integrity: https://studentcode.illinois.edu/article1/part4/1-401/, and adhere to the student code of conduct. Cheating on the exams or assignments will be reported to the university with a default sanction of getting a zero (0) on any assignments or exams the student has cheated on. Note that while you may discuss the laboratory assignments with your classmates, you must turn in your own work, written in your own words. Turning in identical assignments as another student is considered cheating.

Course Schedule (The instructor has the right to change the syllabus as needed to make the course more informative.)

Weeks	Lecture Topics	Reading	Projects	Lab
Week 1 (Jan 17 – 21)	Course orientation Introduction to Python environment			
Week 2 (Jan 24 – 28)	Python basics	Geoprocessing ~ Chapter 2		
Week 3 (Jan 31 – Feb 4)	Aspatial data manipulation		Project Proposal Pitch	Y
Week 4 (Feb 7 – 11)	Spatial data manipulation: Vector	Mastering ~ Chapter 4 & 5.	Project Team Matching	Y
Week 5 (Feb 14 – 18)	Spatial data manipulation: Raster	Geoprocessing ~ Chapter 9-10		Y
Week 6 (Feb 21 – 25)	Geospatial data visualization	Geoprocessing ~ Chapter 13		Y
Week 7 (Feb 28 – Mar 4)	Basic spatial analysis with Python			Y
Week 8 (Mar 7 – 11)	Review session & Proposal Presentation (Mar 8th) Midterm (Mar 10th)			
Spring Break (Mar 14 – 18)				
Week 9 (Mar 21 – 25)	Setting up a collaboration environment Data acquisition with Python			
Week 10 (Mar 28 – Apr 1)	Advanced spatial analysis: Network analysis and accessibility measurements	To be announced		Y
Week 11 (Apr 4 – 8)	Advanced spatial analysis: Map algebra and resampling	To be announced	Status report	Y
Week 12 (Apr 11 – 15)	Spatial statistics with Python: Correlation, regression, and spatial autocorrelation	To be announced		Y
Week 13 (Apr 18 – 22)	Customizing python code for spatial analysis	To be announced		
Week 14 (Apr 25 – 29)	Final presentations (Apr 26th and 28th)			
Week 15 (May 4)	Project product due			