
CP 6581-C: Programming for GIS¹

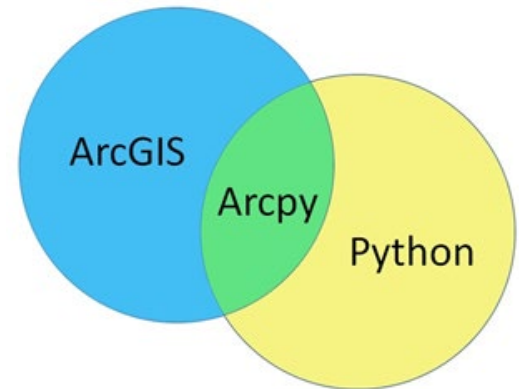
(With courtesy of Pr. Bill Drummond)

Fall 2024

Course Syllabus

Monday/Wednesday 5:00 - 6:15 pm

Arch W 358



Instructor

Gervais W Tabopda, PhD
Lecturer
College of Design
School of City and Regional Planning

Email

gervais.tabopda@design.gatech.edu

Office hours

Wed 1 pm-3 pm (or by appointment)
Part-time Faculty Office – Suite 204 O

Course description

The purpose of CP 6581 is to provide graduate students with the specialized programming skills needed to conduct advanced spatial data analysis. It focuses on Python programming, with significant emphasis on the ArcPy library, the primary programming interface for the ArcGIS environment. It also covers basic online GIS and JavaScript programming, enabling the embedding of GIS functionality in Web pages. The course has a prerequisite of CP 4510 or CP 6514, "Introduction to GIS."

There are several significant advantages to writing Python scripts to automate spatial analysis tasks. First, scripting allows us to build custom tools rather than relying on a sequence of point-and-click operations.

¹ Note that this syllabus is subject to change. The most up-to-date version will always be posted on Canvas, and revisions will be announced in class and/or by e-mail

Once those tools are built, making parameter changes (increasing a buffer distance from ¼ mile to ½ mile) or other minor modifications (changing a table name involved in a spatial join) will be trivial. Second, Python scripting enables the automation of repetitive tasks. In graduate school, we usually have one-off course projects. However, in professional practice, we may need to conduct the same weekly, monthly, or annual analysis sequence. Third, scripting generates an automatic audit trail showing exactly how we achieved our analysis results. This is important for professional practice and graduate students writing dissertations, theses, or capstone projects. Lastly, Python scripts enable us to integrate spatial analysis with other software environments, such as statistical software and design software. Python is the default scripting language for many commercial and open-source software packages.

Learning objectives

By the end of the course, students will be able to

- Write basic Python programs
- Apply Python skills to standard GIS tasks with the ArcPy geoprocessing library
- Utilize the Google Maps API
- Process vector and raster data structures through direct programming
- Create basic Web-based GIS functionality

Course readings

The course has two required textbooks. Students may wish to purchase both textbooks. However, after logging into the GT library, students can read the Zandbergen book online and download about 1/3 of the book as individual chapter PDF files. The datasets for homework assignments from the Zandbergen book will be posted on the Q drive and Canvas site.

Students can also download the entire Tateosian book as a PDF from the GT library. The Tateosian sections can be initially skimmed, but they cover essential aspects of Python syntax that cannot be addressed in class. Here are the details for both books:

[Python Scripting for ArcGIS Pro-Esri Press \(2020\) \(1\)](#)

by Paul A. Zandbergen ISBN-13: 978-1589484993

[Python Scripting for ArcGIS \(2013\)](#) by

Paul A. Zandbergen ISBN: 978-1589483712

Python for ArcGIS (2015) by
 Laura Tateosian ISBN: 978-
 3319183978

Additional readings may be posted online at the course's Canvas site and in the CP 6581 folder on the College of Design Q drive.

Course grading

The Georgia Tech Honor Code is in effect throughout this course. You should review it to ensure you understand your responsibilities. If you have any questions, do not hesitate to contact the instructor.

The course subject matter requires a disciplined, steady, consistent effort throughout the semester. The course grading structure will include multiple components to encourage that type of effort.

1. Homework assignment sheets will be distributed in most Wednesday classes and will be due at the following Monday classes. Students will receive three points for homework sheets returned in class on Monday, two points if the sheet is returned on Wednesday, and one point if it is returned on the Monday after it is initially due.
2. Brief programming quizzes will be given in six semi-random classes. The lowest two grades of the six will be used to compute each student's quiz average.
3. The midterm and final exams will occur during the designated midterm class and the GT-defined final exam period. They will be allowed to use open books, open notes, and open computers.

Students' final grades will be based on the weighted average of these components:

Component	Percentage of Final Grade
Homework	10%
Quizzes	15%
Draft prospectus	5%
Midterm exam	20%
Final exam	30%
Course project report	20%

Course project

The assignment for this course is to develop a GIS project utilizing the programming skills learned throughout the semester. Your project can be in any area of interest, such as transportation, environment, land use, economic development, real estate, or any other substantive area. You may combine this project with work for another class if you wish. However, you must obtain **prior approval** from both instructors and submit all your final products for both classes to both instructors, so the effort made for each course can be individually assessed.

This is a demonstration project whose primary purpose is to demonstrate the application of programming skills in GIS spatial analysis. You may use real, hypothetical, or a combination of the two. If you use hypothetical data, ensure it is realistic so that the demonstration is convincing. Do not plan to use a dataset any larger than that needed for a successful demonstration. Most class projects can be adequately completed with datasets that are small to moderate in size.

Course projects will typically consist of an automated version of a traditional spatial analysis process and a custom user interface that enables the execution of the project. Project grading will be based upon equal weighting of these three elements:

- Complexity of the range of operations automated in the spatial analysis process
- Usability of the custom user interface
- Clarity of the code and documentation

You will turn in a short project prospectus on the due date listed in the syllabus. It should include:

- A single sentence describing the goal of spatial analysis
- A single sentence explaining the benefit of automating the process
- A single ½ page paragraph explaining why the topic is important and what you hope to demonstrate, learn, and accomplish.
- A listing of the required GIS datasets and their sources (Census Bureau, Z drive, etc.)

Your written report course project is due on the date listed in the course schedule. It should include (excluding code) approximately 2,400 to 3,000 words (8-10 pages) of project report text, a set of well-formatted maps integrated with the project text, and a complete, fully documented, and commented program listing as an appendix. Your project report should include (at a minimum) the following:

- A brief description of the spatial analysis problem
- List of data sources and spatial analysis techniques utilized
- Analysis results with printed maps
- Self-evaluation of your code and user interface
- Documented and commented on programming code

- Screen captures of the user interface
- A self-contained zip file with your working code and a small demonstration dataset

Students with disabilities

Students with disabilities requiring academic accommodations should provide documentation to the Accessible Disabled Assistance Program for Tech Students (<http://www.adapts.gatech.edu/>) and bring an ADAPTS accommodation letter to their instructor, indicating the required accommodations. This should be done within the first week of class or as soon as possible after a new disability condition arises. All efforts will be made to provide reasonable accommodations.

College of Design Faculty Statement on Diversity, Equity, and Inclusion

“The College of Design (COD) community of faculty, staff, and students aspires to create and nurture an environment that supports all backgrounds where different views and ideas are respected and encouraged. In all our pursuits, we are committed to justice, diversity, equity, and inclusion, encompassing race, national origin, language, age, sexual orientation, gender, religion, and ability. Moreover, we will encourage intellectual inquiry and respectful exchange that cements our dedication to these principles.”

Course Topics and Schedule (Version 1.0, updated 08/13/2025)

The following table outlines the course schedule, including labs (yellow), due dates (red), final project (green), readings, and other important events. This schedule is subject to change; the most current version can always be found in Canvas.

Day	Topic	Readings and assignments due
8/18	Course overview and critical perspective	
8/20	Introduction to Programming	Zandbergen chap. 1; Tateosian chap. 1, 2
8/25	Python data structure basics	Zandbergen chap. 4.1 to 4.8; Tateosian chap. 3-4
8/25	Review and Lab	
9/1	OFFICIAL SCHOOL HOLIDAY – NO CLASS	
9/3	Python lists, dictionaries, and data frames	Zandbergen chap. 4.9 to 4.15; Tateosian chap. 18
	Review and Lab	
9/8	Python essential user input and flow of control	Zandbergen chap. 4.16 to 4.21; Tateosian chap. 7, 9, 10, 22
9/10	Review and Lab	
9/15	ArcPy Basics	Zandbergen chap. 5; Tateosian chap. 5
9/17	Review and Lab	
9/22	ArcPy Attributes	Zandbergen chap. 6; Tateosian chap. 3, 4, 17
9/24	Review and Lab	
9/26	Draft project prospectus due September 30	
9/29	ArcPy Geometry	Zandbergen chap. 7 and 8
10/1	Review and Lab	
10/6	FALL BREAK – NO CLASS	

10/8	ArcPy Spatial Analysis (1)	Tateosian chap. 6.1-6.4
	Review and Lab	
10/13	MIDTERM EXAM: OCTOBER 21	
10/20	ArcPy Spatial Analysis (2)	Tateosian chap. 6.5-6.8
10/22	Review and Lab	
10/23	ArcPy Spatial Analysis (3)	Tateosian chap. 6.9-6.11
	Review and Lab	
10/27	ArcPy Classes and Functions	Zandbergen chap. 11 and 12; Tateosian chap. 15, 21
10/29	Review and Lab	
11/3	ArcPy custom tools and toolboxes	Zandbergen chap. 13 and 14; Tateosian chap. 23
11/5	Review and Lab	
11/10	ArcPy Raster Processing	Zandbergen chap. 9
11/12	Review and Lab	
11/17	Internet GIS (1)	Tateosian chap. 11
11/19	Review and Lab	
11/24	Internet GIS (2)	Tateosian chap. 19
	Review and Lab	
11/26	STUDENT RECESS	
12/1	Course Review	
12/3	Course Overview	
12/10	Final exam: Wednesday, December 14, 8:00 AM – 10:50 AM Project due December 15 at 8:30 PM	
12/11	END OF TERM	

Contacting Instructor

The most effective way to communicate is via email. Please label your emails regarding this class with [CP6581-FALL25]. The email addresses are below:

Gervais: gwt3@gatech.edu

If you need to reach me by phone, please call 770-771-4117

Other means of contacting: Gmail - gervaistabopda@gmail.com