

CP 6581: Programming for GIS
William J. Drummond
Fall 2020

Course Syllabus
Version 2

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204 East Architecture

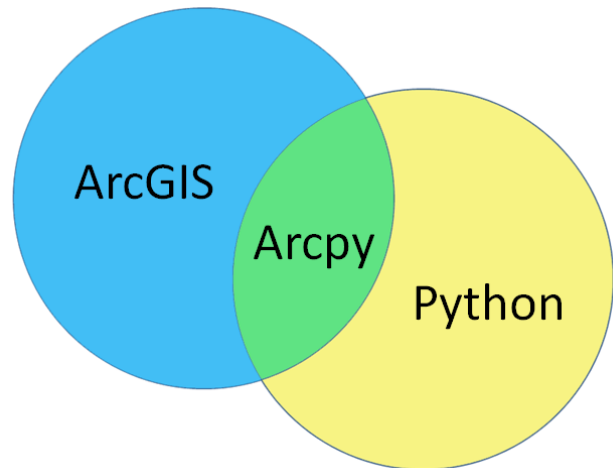
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Webex office hours:

Appointments are available on Wednesday 10:00-12:00.

See the syllabus below to reserve office hour time slots.



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 major attention on the Arcpy library, which is the main programming interface for the ArcGIS environment. It also addresses basic online GIS and Javascript programming to embed GIS functionality in Web pages. The course has a pre-requisite of CP 4510 or CP 6514, "Introduction to GIS."

The class sessions for this course will all be held in remote synchronous mode using Webex software. Students are expected to "attend" every class during the designated class periods although class attendance is not a direct component of student grades. Biweekly quizzes, the midterm exam, and the final exam will all take place during the class (and final exam) periods designated in the syllabus. The course's Canvas calendar contains URL links to the Webex class meetings.

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 do cover important aspects of Python syntax that cannot be addressed in class. Here are details for both books:

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/or 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 this code and make sure you understand your responsibilities. If you have any questions, please contact the instructor.

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

1. Homework assignment sheets will be distributed in Wednesday classes and will be due at the following Monday classes. Students will receive three points for homework sheets posted to Canvas by Monday classes, two points if the sheet is posted by the next Wednesday classes and one point if it is posted the week after it is initially due.
2. Brief online quizzes will be given every second week. In computing each student's quiz average the lowest two of seven grades will be dropped.
3. The midterm and final exam will take place during the designated midterm class and the GT-defined final exam period. They will be open book, open note, and open computer.

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

Component	Percentage of final grade
Homework	10%
Quizzes	15%
Midterm exam	20%
Final exam	25%
Course project report	30%

Assignment, quiz, and exam grading will utilize the Canvas anonymous grading and question-by-question options to ensure fair and unbiased grading. If students have any concerns regarding grading and would prefer not to speak to the instructor, Professor Subhro Guhathakurta, the Chair of the School of City and Regional Planning, has volunteered to discuss those issues with anyone in the course.

Course project

The assignment for this course is to produce a GIS project based upon the programming skills we have been learning 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. If you wish, you may combine this project with work for another class. However, you must obtain **prior approval** from both instructors and turn in 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 basic purpose is to show the application of programming skills for GIS geoprocessing and presentation. You may use real data, hypothetical data, or a combination of the two. If you use any hypothetical data, the data should be 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 small to moderate datasets.

Course projects will ordinarily consist of an automated version of a traditional spatial analysis process and a custom user interface that can execute the project and view the results. 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

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

- A single sentence describing the goal of the 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 explain, learn, and/or accomplish?
- A listing of the required GIS datasets and their sources (Census Bureau, Z drive, etc.)

Your written report course project is due at the date listed in the course schedule. It should include (not counting code) about 2,400 to 3,000 words (8-10 pages) of project report text, 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 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 needing academic accommodation should provide documentation to the Access Disabled Assistance Program for Tech Students (<http://www.adapts.gatech.edu/>) and bring an ADAPTS accommodation letter to the instructor indicating the nature of accommodations required. 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.

Office hour appointments

Students are encouraged to meet with Bill Drummond as individuals or groups in office hour appointments from 10:00 to 12:00 on Wednesdays. Students should reserve one or more 15-minute time slots through Canvas with the following procedure. **Note:** for some mysterious reason Canvas appointment slots are not visible on the regular course calendar. You must go through this process to see and reserve appointment slots:

1. In Canvas select CP 6581
2. Click on "**View Course Calendar**" (upper-right section of screen and the middle box of three boxes)
3. Click on "**Find Appointment**" on middle-right of screen
4. Click on Programming for GIS - CP 6581
5. Click on an available appointment slot or slots
6. Add Comments to specify topic
7. Click on "**Reserve**" at bottom of screen
8. Note your time slot. At the start of your appointment connect to the course Office Hours Webex meeting using the Canvas course calendar link named "Office Hours Webex Link."

Course schedule

Classes	Topics, Tests, Quizes, Deliverables	Readings
Week 1: August 17 - August 19	Introduction to programming	Zandbergen chap. 1; Tateosian chap. 1, 2
Week 2: August 24 - August 26	Python data structure basics <u>Quiz 1: August 26</u>	Zandbergen chap. 4.1 to 4.8; Tateosian chap. 3-4
Week 3: August 31 - September 2	Python lists, dictionaries, dataframes <u>Homework 1 due: August 31</u>	Zandbergen chap. 4.9 to 4.15; Tateosian chap. 18
Week 4: September 9	Python basic user input and flow of control <u>Quiz 2: September 9</u>	Zandbergen chap. 4.16 to 4.21; Tateosian chap. 7, 9, 10, 22
Week 5: September 14 - September 16	Arcpy basics <u>Homework 2 due: September 14</u> <u>Draft prospectus due: September 16</u>	Zandbergen chap. 5; Tateosian chap. 5-6
Week 6: September 21 - September 23	Arcpy attributes <u>Quiz 3: September 23</u>	Zandbergen chap. 6; Tateosian chap. 3, 4, 17
Week 7: September 28 - September 30	Arcpy geometry <u>Homework 3 due: September 28</u>	Zandbergen chap. 7 and 8
Week 8: October 5 - October 7	Mapping with Arcpy <u>Quiz 4: October 7</u>	Zandbergen chap. 10; Tateosian chap. 24
Week 9: October 12 - October 14	Arcpy classes and functions <u>Homework 4 due: October 12</u> <u>Midterm exam: October 14</u>	Zandbergen chap. 11 and 12; Tateosian chap. 15, 21
Week 10: October 19 - October 21	Arcpy custom tools and toolboxes <u>Quiz 5: October 21</u>	Zandbergen chap. 13 and 14; Tateosian chap. 23
Week 11: October 26 - October 28	Arcpy raster processing <u>Homework 5 due: October 26</u>	Zandbergen chap. 9
Week 12: November 2 - November 4	Internet GIS basics <u>Quiz 6: November 4</u>	Tateosian chap. 11
Week 13: November 9 - November 11	Internet GIS advanced <u>Homework 6 due: November 9</u>	Tateosian chap. 19
Week 14: November 16 - November 18	Markup languages for spatial data <u>Quiz 7: November 18</u>	Tateosian chap 13
Week 15: November 23	Google's KML <u>Homework 7 due: November 23</u>	Tateosian chap. 16
Week 16: Exam week	<u>Project due December 2 at 12:00 noon</u> <u>Final exam: Monday, Dec 7, 2:40 PM - 5:30 PM</u>	

Additional Information for Fall 2020 GT Classes

The fall semester 2020 is especially challenging due to the Covid-19 pandemic and a growing awareness of racial inequities. The following information relates to specific services and guidelines for courses during this semester. The most up-to-date information on Covid-19 is on the [TECH Moving Forward](#) website and in the [Academic Restart Frequently Asked Questions](#).

Expectations and Guidelines

Each of us has a responsibility to ourselves and our fellow Yellow Jackets to be mindful of our shared commitment.

We are all required to wear a face covering while inside any campus facilities/buildings, including during in-person classes, and to adhere to social distancing of at least 6 feet. If an individual forgets to bring a face covering to class or into any indoor space, there will be a clearly marked supply of these in each building. If a student fails to follow Georgia Tech's policies on social distancing and face coverings, they will initially be reminded of the policy and if necessary, asked to leave the class, meeting, or space. If they still fail to follow the policy, they may be referred to the Office of the Dean of Students. Here is [Information on the Institute's policy on face coverings](#).

Students are expected to sit in assigned seats and to come to class only on days that are assigned to them.

Papers, projects, tests, homework, and other assignments will only be accepted in electronic form unless the assignment is a physical artifact.

Additional information is available in the [Student Guidebook](#).

Instructor Illness or Exposure to Covid-19

During the fall 2020 semester, some faculty members may be required to quarantine due to exposure or isolate due to a Covid-19 diagnosis. Some disruption to classes or services is inevitable, but Georgia Tech is making every effort to ensure continuity of operations. As is the case in any semester, faculty may cancel a class if they have an illness or emergency situation and cover any missed material at their own discretion. If instructors need to cancel a class, they should notify students as early as possible.

Student Illness or Exposure to Covid-19

During the semester, students may be required to quarantine or self-isolate to avoid the risk of infection to others. Quarantine is the separation of those who have been exposed to someone with Covid-19 but who are not ill; isolation is the separation of those who have tested positive for Covid-19 or been diagnosed with Covid-19 by symptoms.

If you have not tested positive but are ill or have been exposed to someone who is ill, please follow the [Covid-19 Exposure Decision Tree](#) for reporting your illness.

During the quarantine or isolation period you may feel completely well and able to work as usual, or too ill to work until you recover. Unless you are too ill to work, you should be able to complete your remote work while in quarantine or isolation.

GT has asked all faculty to be lenient and understanding when setting work deadlines or expecting students to finish work, and so you should be able to catch up with any work that you miss while in quarantine or isolation. Your instructor may make available any video recordings of classes or slides that have been used while you are absent, and may prepare some complementary asynchronous assignments that compensate for your inability to participate in class sessions. Ask your instructor for the details.

CARE Center, Counseling Center, Stamps Health Services, and the Student Center

These uncertain times can be difficult, and many students may need help in dealing with stress and mental health. The [CARE Center](#) and the [Counseling Center](#), and [Stamps Health Services](#) will offer both in-person and virtual appointments. Face-to-face appointments will require wearing a face covering and social distancing, with exceptions for medical examinations. Student Center services and operations are available on the [Student Center](#) website. For more information on these and other student services, contact the Vice President and Dean of Students or the [Division of Student Life](#).

Accommodations for Students at Higher Risk for Severe Illness with Covid-19

Students may request an accommodation through the Office of Disability Services (ODS) due to 1) presence of a condition as defined by the Americans with Disabilities Act (ADA), or 2) identification as an individual of higher risk for Covid-19, as defined by the Centers for Disease Control (CDC). Registering with ODS is a 3-step process that includes completing an application, uploading documentation related to the accommodation request, and scheduling an appointment for an

“intake meeting” (either in person or via phone or video conference) with a disability coordinator.

If you have been approved by ODS for an accommodation, I will work closely with you to understand your needs and make a good faith effort to investigate whether or not requested accommodations are possible for this course. If the accommodation request results in a fundamental alteration of the stated learning outcome of this course, ODS, academic advisors, and the school offering the course will work with you to find a suitable alternative that as far as possible preserves your progress toward graduation.