Course Information

Course Number: GEOG 392/676
Course Title: GIS Programming
Time: Lecture : Dr. Zhe Zhang; M W F 10:20 am -11:10 am ; OMB 112
Office hour: Friday 1:30 pm-2:30 pm online at https://tamu.zoom.us/j/7322949427 (Links to an external site.)Links to an external site.
Location: OMB 112
Credit Hours: 4

Instructor Details

Instructor: Dr. Zhe Zhang, Assistant Professor, Department of Geography, Texas A&M University
Office: CSA 203 C
Phone: (979) 845-6523
E-Mail: zhezhang@tamu.edu
Office Hours: Friday 1:30 pm-2:30 pm online at https://tamu.zoom.us/j/7322949427 Or by appointment.

Teaching Assistant: Mr. Zhenlei Song
Office: CSA 301F
Email: songzl@tamu.edu
Office Hours: Friday 2:00-5:00 pm CSA 301F or by appointment.

Course Description

Programming for geographic information science applications; principles of programming syntax and data structures; development of custom GIS programs; integration of programs into commercial GIS platforms.

This class is an introduction to programming in general and an introduction to programming for Geographic Information Systems (GIS) in particular. This project- and lab-oriented course covers the guiding principles behind programming syntax and data structures, and how to apply these techniques to the development of custom standalone GIS programs and the integration of these into commercial GIS platforms. The course also includes an applied section where the student will identify a real-world “customer” and lead a team of undergraduates to complete a project.

Course Prerequisites

GEOG 390 or equivalent, or approval of instructor; junior or senior classification.

Course Learning Outcomes

This course is designed to introduce students to the basics of programming with modern programming languages in the context of development for and with GIS. Students will learn how to apply this knowledge to develop custom GIS applications and extensions that solve real-world problems. This course will provide students with a solid foundation in fundamental programming techniques and the knowledge to apply these techniques within GIS programming domains.

The course will start with an introduction to fundamental programming structures and techniques and quickly advance to programming issues related to developing for GIS platforms including integration of their code into industry standard GIS platforms to extend the capabilities of these systems. The course will include a lecture component where geographical theoretical issues are covered, and homework and lab-based exercises where students have the opportunity to practice implementing these techniques in the Python programming language.

This course will also include identification of and interaction with a real-world "customer" who needs GIS programming. Students will learn software project management skills while participating in a team led by a graduate student and have the opportunity to interact with a real-world "customer" to experience the identification and translation of customer requirements into application development.

Learning objectives:

- Identify a set of requirements for the development of a software system;
- Implement standalone programming projects in Python to solve GIS problems;
- Integrate custom code into ArcGIS that customizes, automates, and extents its functionality;
- Programmatically access GIS data and use these data in GIS modeling, computation, visualization, and analysis; and
- Familiar with R programming
- Learn basic concept of CyberGIS and big data computing
- Conceptualize, design, plan, implement, and document a custom GIS programming solution to a real-world problem.

Textbook and/or Resource Materials

No required textbooks. Course readings will include online texts, and other videos, resources, and materials provided by the instructor

Optional textbooks

Allen D, 2014. GIS Tutorial for Python Scripting. 1st ed. Redlands, CA, Esri Press.

GIS Fundamentals, 7th Edition, A First Text on Geographic Information Systems. Paul Bolstad and Steven Manson

Grading Policy

Component	Weight	Activity
Lecture	**(600 points)**	
-	200 points	Midterm 1
-	200 points	Midterm 2
-	200 points	Final Exam
Lab	**(700 points)**	
-	100 points/ lab	**Exercises**
Homework (lecture quizzes)	**10% (200 points)**	
-	10 weeks * 20 points/ quiz	**Exercises: Develop three quizzes (Easy, Medium, and Hard) based on this week's lecture.** An example: What are the three major categories of the program language? (EASY) A. Lower, medium, and higher B. Machine language, assembly language, and high-level language (correct) C. Difficult, median, easy
Project	**(450 points)**	
-	100 points	**Project Proposal** - Project team members should submit the PPT - A proposal includes: Introduction, data description, methodology, deliverables, and team member responsibilities.
-	50 points	**Project Update Presentation** All team members must attend, submit the presentation PPT PPT should include: · Title, team members' names, and each team member's responsibilities

		· Data description · Methodology (or programming components used in the project) · What has been done? · What will be done next? · Expected results
-	50 points	**Project Final Presentation** · All team members must attend, submit the presentation PPT · Title, team members' names, and each team member's responsibilities · Data description · Methodology (or programming components used in the project) · What has been done? · Results
-	250 points	**Final Project Deliverables** · Code: 80 points · Demo video: 80 points · Final report: 75 points include (Introduction; data description, methodology, results, discussion, conclusion) · Team evaluation: 15 points
Participation	**(280 points)**	
-	40 points * 4 times random attendance check CyberTraining webinar	Class Participation If you miss 3 times participation check, you will be invited to meet Dr. Zhang to explain the reasons for missing the classes and possibly reduce your final grade by 200 points.

	40*3=120	
Total		2230 Points

Grading Scale

The typical grading scheme for this course has the following cutoffs:

%	**Grade**
≥90%	A
80-89%	B
70-79%	C
60-69%	D
<60%	F

An average performance in the class will earn a satisfactory grade.

Late Work Policy

Late assignments receive a 10% deduction for each day they are late unless covered by a University excused absence. The maximum deduction will be 50% if you submit before the hard deadline. **The hard deadline for Fall 2024 is at 11: 59pm, December 5, 2024**. Late submissions (penalty or not) are not accepted after the hard deadline. It is your responsibility for keeping up with assignments. You should talk to your TA and or the instructor **BEFORE** late assignments become a problem.

Course Schedule

Module	**Topic 1 (Monday)**	**Topic 2 (Wednesday)**	**Topic 3 (Friday)**	**Lab & Homework**
01 (8/19-8/25)	Introduction to the class	Programming Development Environment Set Up	Introduction to Git	Lecture Quiz 1
02 (8/26-9/1)	Containers	Operators and Condition Statement	Loops	Lecture Quiz 2 Lab1
03 (9/2-9/8)	Labor Day (no class)	Iterator and Regular Expression	Python Function	Lecture Quiz 3
04 (9/9-9/15)	CyberTraining Webinar	Advanced Python Function Lambada	Object-oriented programming	Lecture Quiz 4 Lab2

		(submit project proposal)		
05 (9/16-9/22)	Numbers and Calculator	Errors and Exceptions	Read and Write files using Python Exam Review	Lecture Quiz 5
06 (9/23-9/29)	Introduction to Geographical Theories	Exam 1	Basic ArcPy	Lecture Quiz 6
07 (9/30-10/6)	Intro to Geopandas and PySAL	ArcPy Continued	CyberTraining Webinar	Lecture Quiz 7
08 (10/7-10/13)	Fall Break No Class	Project Update Student Presentation Groups 1-5	Project Update Student Presentation Groups 6-10	Lab3
09 (10/14-10/20)	Project Update Student Presentation Groups 11-14	Develop an ArcPy tool	Python toolbox	Lecture Quiz 8
10 (10/21-10/27)	Search Cursor Modules	Map creation Exam Review	ArcPy messaging	Lecture Quiz 9 Lab4
11 (10/28-11/3)	Exam 2	Advanced Tool Data format	Working with Raster1 Working with Raster2	Lab5
12 (11/4-11/10)	CyberTraining Webinar	REST Video	Working with Numbers: Introduction to R and Geostatistics	Lecture Quiz 10 Lab6

13 (11/11-11/17)	GIS Day (no class)	GIS Day (no class)	GIS Day (no class)	
14 (11/18-11/24)	Working with Numbers: NumPy Exam Review	CyberTraining Webinar	Exam Review Final Presentation Group 11-14	Lab7
15 (11/25-12/1)	Final Project Presentation Group 6-10	Reading Day No Class	Thanksgiving	
16(12/2- 12/8)	Final Project Presentation Group 1-5	Reading day No class	Final Exam	Hard deadline for everything (labs, homework, group project) at 11: 59pm, December 5th, 2024

Optional Course Information Items

Learning Resources

Practice Python using Codecademy: https://www.codecademy.com/

The https://studyhub.tamu.edu/ lists many on-campus learning resources to support students in achieving academic excellence.

University Policies

This section outlines the university level policies. The TAMU Faculty Senate established the wording of these policies.

***NOTE**: Faculty members should not change the written statements. A faculty member may add separate paragraphs if additional information is needed.*

Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to Student Rule 7 in its entirety for information about excused absences, including definitions, and related documentation and timelines.

Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to Student Rule 7 in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" **(**Student Rule 7, Section 7.4.1**).**

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" **(**Student Rule 7, Section 7.4.2).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. **(**See Student Rule 24**).**

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" (Section 20.1.2.3, Student Rule 20).

Texas A&M at College Station

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact Disability Resources office on your campus (resources listed below). Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

Texas A&M at College Station

Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit https://disability.tamu.edu/.

Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions **(**see University Rule 08.01.01.M1):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University's goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

Texas A&M at College Station

Students wishing to discuss concerns related to mental and/or physical health in a confidential setting are encouraged to make an appointment with University Health Services or download the TELUS Health Student Support app for 24/7 access to professional counseling in multiple languages. Walk-in services for urgent, non-emergency needs are available during normal business hours at University Health Services locations; call 979.458.4584 for details.

Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University's Title IX webpage.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors influencing a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care practices by utilizing the resources and services available through University Health Services. Students needing a listening ear can call the Texas A&M Helpline (979.845.2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends for mental health peer support while classes are in session. The TELUS Health Student Support app provides access to professional counseling in multiple languages anytime, anywhere by phone or chat, and the 988 Suicide & Crisis Lifeline offers 24-hour emergency support at 988 or 988lifeline.org.

Texas A&M College Station

Students needing a listening ear can contact University Health Services (979.458.4584) or call the Texas A&M Helpline (979.845.2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends while classes are in session. 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at 988lifeline.org.

Campus-Specific Policies

Classroom Access and Inclusion Statement

Texas A&M University is committed to engaged student participation in all of its programs and courses and provides an accessible academic environment for all students. This means that our classrooms, our virtual spaces, our practices and our interactions are as inclusive as possible and we work to provide a welcoming instructional climate and equal learning opportunities for everyone. If you have an instructional need, please notify me as soon as possible.

The Aggie Core values of respect, excellence, leadership, loyalty, integrity and selfless service in addition to civility, and the ability to listen and to observe others are the foundation of a welcoming instructional climate. Active, thoughtful and respectful participation in all aspects of

the course supports a more inclusive classroom environment as well as our mutual responsibilities to the campus community.

The following statements below are optional. Leave as is to include, or delete if preferred. Either way, delete this note.

Statement on the Family Educational Rights and Privacy Act (FERPA)

FERPA is a federal law designed to protect the privacy of educational records by limiting access to these records, to establish the right of students to inspect and review their educational records and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings. Currently enrolled students wishing to withhold any or all directory information items may do so by going to howdy.tamu.edu and clicking on the "Directory Hold Information" link in the Student Records channel on the MyRecord tab. The complete FERPA Notice to Students and the student records policy is available on the Office of the Registrar webpage.

Items that can never be identified as public information are a student's social security number, citizenship, gender, grades, GPR or class schedule. All efforts will be made in this class to protect your privacy and to ensure confidential treatment of information associated with or generated by your participation in the class.

Directory items include name, UIN, local address, permanent address, email address, local telephone number, permanent telephone number, dates of attendance, program of study (college, major, campus), classification, previous institutions attended, degrees honors and awards received, participation in officially recognized activities and sports, medical residence location and medical residence specialization.

College and Department Policies

College and departmental units may establish their own policies and minimum syllabus requirements. As long as these policies and requirements do not contradict the university level requirements, colleges and departments can add them in this section. ***Please remove this section if not needed.***

Click ***here*** for more information on Texas A&M University's syllabus requirements.