

GEOGRAPHY FINAL COURSE OUTLINE: FALL 2023

GEOGRAPHY 567 INTRODUCTION TO PROGRAMMING IN GEOGRAPHIC INFORMATION SYSTEMS

GFC Hours 3-2, CLASS NUMBER 74240

Section	Days	Time	Location
LEC 01	TR	11:00 - 12:15	ES407
B01	M	14:00 - 15:50	ES407

Instructor: Dr. Darren Bender	Office: ES 338
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Official Course Description

Introduction to computer programming for customizing and automating a GIS. Topics include object-oriented programming techniques, advanced geoprocessing, scripting, and automation using a programming language such as Python or Visual Basic.

Course Objectives

Students will learn fundamental programming skills that are transferable to any object-oriented programming language and apply these skills to performing GIS-related tasks, such as geoprocessing or automation of repetitive tasks. Students will evaluate and design effective programming solutions to a variety of tasks relevant to GIS or geospatial software. Emphasis will be placed on analyzing problems and designing structured solutions, particularly using Python scripts and customized tools in ArcGIS Desktop applications. Programming concepts and coding skills will be presented from a fundamental/conceptual perspective and practiced in technically oriented assignments.

Course Overview

This course provides an introduction to programming and is intended for students with no previous programming experience. It focuses on fundamental programming skills using the Python programming language, with particular application to GIS-related tasks within the ArcGIS software environment. Approximately one-half of the course will be spent learning general and transferable programming skills, and the second half will cover GIS-specific applications, including basic scripting, batch processing and automation of repetitive tasks, and designing complex geoprocessing tasks.

Course Format

GEOG 567 will be delivered using a teaching approach that is often referred to as the “flipped classroom” approach. Each week a new programming topic will be undertaken through a combination of: (1) online learning materials that students are required to complete (using the Microsoft Teams for Education learning platform), (2) a weekly lab period and lab assignment that puts the learning materials into practice, and (3) instructor-led, interactive sessions in the Tuesday and Thursday lecture periods that will be used to review key concepts/skills/techniques from the online materials and lab sessions. The weekly interactive lecture sessions will be held in the GIS lab so that students can put their knowledge into practice with guidance from the instructor.

Learning Resources

The first text below is strongly recommended for this course, and the second is entirely optional (both are available online in digital format via the University of Calgary Library):

- Zandenberg, Paul A. 2020. *Python Scripting for ArcGIS Pro*. Esri Press, Redlands, CA. 420 pp.
- Zandenberg, Paul A. 2020. *Advanced Python Scripting for ArcGIS Pro*. Esri Press, Redlands, CA. 400 pp.

Readings from other sources may be assigned. Notifications of these will be posted on D2L. They will not require purchase.

Course Learning Outcomes

The Department of Geography is committed to student knowledge and skill development. The table below lists the key learning outcomes for this course, the program-learning outcomes to which they contribute, and the expected level of achievement.

Course Learning Outcomes	PLO(s)	Level(s)
Recognize and describe the differences between low- and high-level programming languages and distinguish between compiled and interpreted code.	6	1
Describe data types and structures, decision structures and functions, and implement them in effective computer code to perform/automate GIS tasks.	6	2
Explain the principles of object-oriented programming (OOP) and modularization of code and implement OOP techniques in effective code.	5	2
Explain the value of the program development cycle for problem-solving and developing code solutions and implement the approach in assigned programming exercises.	4	3
Apply effective programming techniques to problem-solve geoprocessing and map automation tasks in a GIS framework.	3,4,6	3
Demonstrate the ability to analyze coding problems and demonstrate active learning to develop original solutions using reference material and code examples.	3	2
Create stand-alone solutions (e.g., ArcGIS script tools) that enhance or expand the built-in functionality of a GIS software system using OOP code.	3,4,6,7	2

**PLOs = Program Learning Outcomes: 1 = reflect and communicate diverse human-environment perspectives, 2 = identify and explain human-environment processes, 3 = implement sampling, data collection, analyses and communication methods, 4 = analyze spatial and temporal aspects of human-environment systems, 5 = employ knowledge, arguments, and methodologies for solving human-environment problems, 6 = evaluate geospatial data and manipulate it to create cartographic products, 7 = communicate geographic concepts using oral, written, graphic, and cartographic modes, and 8 = demonstrate literacy skills.*

***Levels: 1 = Introductory, 2 = Intermediate, and 3 = Advanced.*

Prerequisites: 3 units from GEOG 357 or 482.

This course assumes no prior knowledge of programming. However, students are expected to understand fundamental GIS concepts. Experience using the ArcGIS Pro desktop application is essential.

Learning Technologies and Requirements

To successfully engage in their learning experiences at the University of Calgary, students taking online, remote, and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security and malware updates
- A current and updated web browser
- Broadband internet connection

Assessment Methods

Students will be evaluated in two areas: (1) their knowledge of the course materials and (2) weekly lab assignments. Two open-book, in-class tests will be scheduled, and they will evaluate the students' knowledge of the conceptual issues of programming and script development in Python and ArcGIS. Each test is expected to be completed in approximately 60 minutes, and tests will be timed (limited to 75

minutes completion time). Weekly programming assignments will be assigned to evaluate the student's application of knowledge and their programming skills (see online materials for schedule).

The overall grade for the course is distributed between two components: Knowledge Tests and Lab Assignments.

Knowledge Tests:

- In-class quizzes via TopHat (weekly during Tuesday or Thursday lecture) 10%
- Midterm test #1: covers materials for weeks 1 – 6 Date: 19 October 15%
- Midterm test #2: covers materials for weeks 7 – 12 Date: 5 December 15%
- Take-home final exam: programming assignment Due: 19 December 20%

Lab Assignments:

- Ten (10) weekly assignments, each worth 4% Due: Mondays @ 11:59 PM 40%
- One optional assignment (replaces lowest lab grade) Due: 6 December

An overall passing grade must be achieved in the Knowledge Tests component to pass the course. Unless exempted by the instructor, students must complete all the required weekly lab assignments and achieve an overall passing grade for the lab assignments to pass the course.

Grading System

96-100	A+	76-80	B	59-61	C-
90-95	A	71-75	B-	55-58	D+
86-89	A-	65-70	C+	50-54	D
81-85	B+	62-64	C	0-49	F

Late Assignments and Missed Evaluations

Late assignments will be assessed a penalty of **2% per hour** or portion thereof past the assigned deadline unless prior accommodations have been made with the instructor. If you anticipate that you will not meet a deadline for an assignment, contact your instructor at least one full business day prior the deadline to discuss whether an accommodation can be granted. ***No accommodations can be provided if the deadline has passed.***

It is mandatory that students complete the two midterm tests on the scheduled date and time. Missed tests will automatically receive a grade of zero (0). Students will also receive a grade of zero for missed quizzes unless the student has arranged accommodations with the instructor for missing lectures prior to the missed class.

Documentation for Absences or Missed Course Assessments

In the event that a student misses a midterm, quiz, or any other coursework due to illness or other extenuating circumstances, supporting documentation such as a statutory declaration may be requested (see the university policy at <https://www.ucalgary.ca/pubs/calendar/current/m-1.html>, and refer to <https://www.ucalgary.ca/registrar/registration/appeals/student-faq> for frequently asked questions concerning the provision of a statutory declaration). If approved by your instructor, missed lab assignments, quizzes and tests may be reweighted with the remaining assessments. However, missed labs will still need to be satisfactorily completed to pass the course (see Assessment Methods above for details).

Note: A physician's note will never be requested by your instructor, so please do not visit your doctor for documentation of illness for this course.

Exams & Deferrals

The deadline for the take-home final exam is firm and cannot be extended by your instructor. Please refer to the official University of Calgary policies at: <https://www.ucalgary.ca/registrar/exams> regarding deferrals for the take-home final exam.

Supplementary Fees

Not applicable.

Other Course Administrative Policies and Procedures

1. All materials presented in this course are examinable, including online course materials, information presented orally by the instructor during the lecture periods, assigned readings, materials presented in the weekly lab assignments, etc.
2. You will be required to complete several lab assignments during this course. Each assignment will be given a specific deadline online, but typically it will be due the following Monday at 11:59 pm. Late submissions will be penalized (see Late Assignments and Missed Evaluations above).
3. All assignments must be submitted online using the Microsoft Teams platform. Other forms of submissions (e.g., email submissions) cannot be accepted.
4. Students are welcome to work together with other students to discuss and brainstorm solutions, but all student submissions must be independent and unique. Strong similarities in student solutions may be considered **plagiarism, which is a serious academic offence that will be vigilantly monitored and reported in this course**. Essentially, plagiarism can arise whenever a student submits material for evaluation that was not entirely their own work (e.g., copied from another student, “borrowed” from another source without proper citation, based on ideas that were not your own) and the source of that work was not appropriately acknowledged. All students in this course are required to review and become familiar with university policies and regulations regarding plagiarism and academic misconduct in the University Calendar.

Use of internet and electronic devices in class

Students will use Windows-based computers heavily during the lecture periods in this course, especially the Python and ArcGIS Pro software packages. Students are also welcome to bring personal laptops and other electronic devices into the classroom, provided they do not disturb or distract other students or the instructor (e.g., please remember to turn off cell phone ringers/notifications while in class).

Use of AI Tools, such as ChatGPT

Artificial intelligence tools, such as ChatGPT, may have the capability of interpreting course assignments and generating workable code solutions and documentation. As such, it may be tempting to use these tools to circumvent the learning process and preparation of assignments in this course. Students are permitted to use AI technologies in this course, but they are strongly encouraged to independently learn the materials for themselves and not rely on AI technologies.

Note that while AI tools are allowed in this course, the midterm tests will be written in person using paper exams, and it will be impractical or impossible to use AI tools to complete the tests. Therefore, students must be proficient with the knowledge and skills taught in this course to pass the tests.

For additional detailed course information posted by the instructor, visit the course Desire2Learn page online at <https://d2l.ucalgary.ca/d2l/home>.

SUPPLEMENTAL INFORMATION

Principles of Conduct

The University Calendar includes a statement on the principles of conduct expected of all members of the university community (including students, faculty, administrators, any category of staff, practicum supervisors, and volunteers), whether on or off university property. This statement applies in all situations where members of the university community are acting in their university capacities. All members of the university community have a responsibility to familiarize themselves with the principles of conduct statement, which is available at: www.ucalgary.ca/pubs/calendar/current/k.html.

Plagiarism, Cheating, and Student Misconduct

The University of Calgary is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect.

Academic dishonesty is not an acceptable activity at the University of Calgary, and students are **strongly advised** to read the Student Misconduct section in the University Calendar at: www.ucalgary.ca/pubs/calendar/current/k-3.html. Often, students are unaware of what constitutes academic dishonesty or plagiarism. The most common are (1) presenting another student's work as your own, (2) presenting an author's work or ideas as your own without adequate citation, and (3) using work completed for another course. Such activities will not be tolerated in this course, and students suspected of academic misconduct will be dealt with according to the procedures outlined in the calendar at: <https://www.ucalgary.ca/legal-services/university-policies-procedures/student-academic-misconduct-procedure>.

For students wishing to know more about what constitutes plagiarism and how to properly cite the work of others, the Department of Geography recommends that they attend Academic Integrity workshops offered through the Student Success Centre: <https://www.ucalgary.ca/student-services/student-success/learning/academic-integrity>

Instructor Intellectual Property

Information on Instructor Intellectual Property can be found at <https://ucalgary.ca/legal-services/university-policies-procedures/intellectual-property-policy>

Freedom of Information and Protection of Privacy

Freedom of Information and Protection of Privacy (FOIP) legislation in Alberta disallows the practice of having students retrieve assignments from a public place, such as outside an instructor's office, the department office, etc. Term assignments will be returned to students individually, during class or during the instructor's office hours; if students are unable to pick up their assignments from the instructor, they must provide the instructor with a stamped, self-addressed envelope to be used for the return of the assignment.

Human subjects

Students will not participate as subjects or researchers on human subjects in this course.

Posting of Grades and Picking-up of Assignments

Graded assignments will be returned by the instructor or teaching assistant personally during scheduled lecture or laboratory periods, unless they are made available electronically through the course D2L webpage. Grades and assignments will not be available at the Department of Geography's main office.

Academic Accommodations

It is the student's responsibility to request academic accommodations, according to the university policies and procedures listed in the University Calendar.

The student accommodation policy can be found at: <https://ucalgary.ca/legal-services/university-policies-procedures/student-accommodation-policy>

Students needing an accommodation because of a disability or medical condition should communicate this need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities:

<https://ucalgary.ca/legal-services/university-policies-procedures/accommodation-students-disabilities-procedure>

Students needing an accommodation based on a protected ground other than disability should communicate this need, preferably in writing to their instructor or the Department Head (freeman@ucalgary.ca).

Copyright Legislation

All students are required to read the University of Calgary policy on Acceptable Use of Material Protected by Copyright <https://ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-material-protected-copyright-policy> and requirements of the copyright act at (<https://laws-lois.justice.gc.ca/eng/acts/C-42/index.html>) to ensure they are aware of the consequences of unauthorised sharing of course materials (including instructor notes, electronic versions of textbooks etc.). Students who use material protected by copyright in violation of this policy may be disciplined under the Non-Academic Misconduct Act.

Wellness and Mental Health Resources

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness, and academic success and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support, or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, <https://www.ucalgary.ca/wellnesscentre/services/mental-health-services>) and the Campus Mental Health Strategy website (<https://www.ucalgary.ca/mentalhealth/>).

Contact Information for Student and Faculty Representation

- Student Union VP Academic 403-220-3911, suvpaca@ucalgary.ca
- Students Union Representatives for the Faculty of Arts – 403-220-3913, arts1@su.ucalgary.ca, arts2@su.ucalgary.ca, arts3@su.ucalgary.ca, arts4@su.ucalgary.ca
- Student Ombuds Office information can be found at: www.ucalgary.ca/ombuds/

Campus Safewalk

Campus Security, in partnership with the Students' Union, provides the Safewalk service, 24 hours a day, to any location on Campus, including the LRT station, parking lots, bus zones, and university residences. Contact Campus Security at 220-5333 or use a help phone, and Safewalkers or a Campus Security officer will accompany you to your campus destination.