UNIVERSITY OF
CALGARY

GEOG 567 LEC01 Introduction to Programming in Geographic Information Systems
GFC Hours 3-2
Fall 2022 classes: September 6th – December 7th, 2022

Section	Days	Time	Location
LEC 01	TR	11:00 - 12:15 PM	ES415
B01	M	8:00 - 9:50 AM	ES415

Instructor: Dr. Darren Bender	Office: ES 338
Telephone: 403.220.6398	Email: dbender@ucalgary.ca
Email communication will be through your UCalgary email address.	Office hours: Via MS Teams, on demand

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.

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.

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 with 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 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.

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:
- Midterm test #1: covers materials for weeks 1 – 6   Date: 20 October   15%
- Midterm test #2: covers materials for weeks 7 – 12   Date: 6 December   15%
- Take-home final exam: programming assignment   Due: 20 December   20%

Lab Assignments:
- Ten (10) weekly assignments, each worth 5%   Due: Mondays @ 11:59PM   50%
- 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 to pass the course.

Grading System

96-100	A+	77-80	B	59-61	C-
90-95	A	71-76	B-	55-58	D+
86-89	A-	65-70	C+	50-54	D
81-85	B+	62-64	C	0-49	F

Flexible Grade Option (CG Grade)
https://www.ucalgary.ca/pubs/calendar/current/f-1-3.html

Late Assignments and Missed Evaluations
Late assignments will be assessed a penalty of 1% 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 24 hours prior the deadline to discuss whether an accommodation can be granted. No accommodations will be provided if the deadline has passed.

It is mandatory that students complete the two midterm tests on the scheduled date and time. Missed term tests will automatically receive a grade of zero (0).

Additional Course Information
In the event that a student misses a midterm or any course work due to illness, a statutory declaration or other form of supporting documentation may be requested (see: https://www.ucalgary.ca/pubs/calendar/current/m-1.html). Please refer to https://www.ucalgary.ca/registrar/registration/appeals/student-faq for frequently asked questions concerning the provision of a statutory declaration.

Exams & Deferrals
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.

Referencing Standard
In written work presented in this class, the accepted method for referencing the work of others will be the Chicago Manual of Style: https://www.chicagomanualofstyle.org/home.html

Other 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) will not be accepted.

4. **Plagiarism 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 Python and ArcGIS Pro software. 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).

Important Dates

The last day to drop this course and receive a tuition fee refund is **Thursday, September 15th, 2022**. The last day to add or swap a course for Fall 2022 is **Friday, September 16th, 2022**. The last day to withdraw from this course is **Wednesday, December 7th, 2022**. Please note that the University is closed on Friday, September 30th; Monday, October 10th; and Friday, November 11th, 2022.

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

Supplementary Information

Resources and Writing support

Please note writing support resources provided by the Student Success Centre https://ucalgary.ca/ssc/resources/writing-support and the library https://libguides.ucalgary.ca/guides/

University of Calgary Academic Integrity Policy

Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. 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://www.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.

Posting of Grades and Picking-up of Assignments
Graded midterm tests will be returned by the instructor personally during scheduled lecture periods, and graded lab assignments will be returned electronically through the Microsoft Teams platform. 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://www.ucalgary.ca/pubs/calendar/current/b-6-1.html.

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://www.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 (email: freeman@ucalgary.ca).

Course evaluations and student feedback
Student feedback will be sought at the end of the course through the standard University Student Ratings of Instruction (USRI) and Faculty course evaluation forms.

Accessibility
Course materials, lecture periods, and lab periods will present both visual and oral information that is required to understand the content of this course. Lecture and lab sessions will not be recorded.

Copyright Legislation
All students are required to read the University of Calgary policy on *Acceptable Use of Material Protected by Copyright* https://www.ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-material-protected-copyright-policy and requirements of the copyright act (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 disciplines 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 (http://www.ucalgary.ca/mentalhealth/).

Students requiring assistance are encouraged to email the **Student at Risk line** if they or others appear to need wellness assistance: sar@ucalgary.ca For more immediate response, please call: 403-210-9355 and select option #2.

Sexual Violence Policy

The University recognizes that all members of the University Community should be able to learn, work, teach and live in an environment where they are free from harassment, discrimination, and violence. Please see the policy available at https://www.ucalgary.ca/legal-services/university-policies-procedures/sexual-and-gender-based-violence-policy

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/

Emergency Evacuation/Assembly Points

Assembly points for emergencies have been identified across campus. Assembly points are designed to establish a location for information updates from the emergency responders to the evacuees and from the evacuated population to the emergency responders. For more information, see the University of Calgary's Emergency Management website: https://www.ucalgary.ca/risk/emergency-management.

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.

*The **Department of Geography** condemns the longstanding and continued injustices against those marginalized by racism, sexism, homophobia, transphobia, classism, xenophobia, able-bodied normativity, mental health profiling, and other forms of prejudice. We are pained by the fact that injustices are unevenly borne.* https://arts.ucalgary.ca/news/anti-racism-statement

Territorial Acknowledgement

The Department of Geography would also like to acknowledge the traditional territories of the people of the Treaty 7 region in southern Alberta. The City of Calgary is also home to Métis Nation of Alberta, Region III. https://www.ucalgary.ca/indigenous/cultural-protocol.