**GEOG276 Syllabus**

**Principles of Python Programming and Geocomputing**

**Course Details:**

Session: Fall 2024

Lecture classroom: LEF 1158

Lab classroom: LEF 1136 and 1138

Lecture Times: MW 11:00am – 11:50am

Lab Times: W 4:00pm – 5:50pm

Instructor: Xin Tao (xtao@umd.edu)

Office: LEF 1167

Office hours: Monday 12:00pm – 1:00 pm and by appointment

Teaching assistant: Ushashi Podder (ushaship@umd.edu)

Office: 4600 River Road

Office hours: By appointment

**Course Objectives**:

Introduces conceptual and practical aspects of scientific computing using the Python programming language. The main focus is on developing proficiency for the basic elements of the development environment, foundational syntax including variables, logical operators, looping, conditional statements, nesting, and common programming patterns for mathematical and textual computing. In addition, essential data structures and functionality for scientific computing, such as arrays, data frames, and data visualization will be introduced. Throughout the course, students will develop a proficiency in applying these basic programming principles to manipulating spatial data sources within the context of Geographic Information Systems (GIS).

The format of this course will consist of lectures, homework, lab assignments, and readings. All lectures involve the interaction between students and the instructor in real time. The readings and lab assignments will also be posted in a timely manner.

**Learning Outcomes**

After successfully completing this course, you will:

* Understand the principles of computing and the role of the individual elements of the computing environment for developing code and deploying a program.
* Become proficient in the fundamentals of Python syntax and programming patterns for automating tasks for numerical and textual computation.
* Gain exposure to basic pillars of scientific computing using Python, such as creating and manipulating arrays, plotting data, and organizing data tables.
* Be able to deploy Python to develop workflows to read, process, and disseminate social and environmental geographic data.

**Prerequisites**

Students are expected to have backgrounds in elementary statistics and introductory GIS.

**Course Outline:**

Variables and Strings……………….………...……………. 2 weeks

Lists and dictionaries ………………………………………. 2 weeks

Loops and conditionals………………………………....... 2 weeks

Functions and modules……………………...……………… 1 week

NumPy………………………………………………................. 1 week

Pandas…………………………………………………………….… 1 week

GeoPandas ………………………….……………………………. 3 weeks

Raster handling…………………………………………………. 2 weeks

Advanced topics………….….…......……………………...…. 1 week

**References**

*Learning to Python* by Mark Lutz

*Learning Geospatial Analysis with Python* by Joel Lawhead

Python Tutorial, https://www.w3schools.com/python/default.asp

**Grading**:

It is strongly encouraged to attend each lecture and actively participate in the online discussion board as well as in class. Students are required to post a reply on the forums posted by the instructor. Lab assignments will be given weekly to help students gain practical experience in developing websites.

There will be 5 homework and 8 labs. The lab score is worth 48% of the final grade. The homework will be worth 40% of the final grade. 12% will be based on attendance and participation.

**Grade Policy**:

* Homework, in-class activities, and labs:

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| --- | --- | --- |
|  | % of total grade | Due date |
| Homework | 40% | 9/9 (Homework 1), 9/16 (Homework 2), 9/30 (Homework 3), 10/7 (Homework 4), 10/14 (Homework 5) |
| In-class activities | 12% | 9/4 (ICA 1), 9/25 (ICA 2), 10/23 (ICA 3), 11/13 (ICA 4), 12/4 (ICA 5), 12/6 (ICA 6) |
| Labs | 48% (6% × 8 labs) | 9/9 (Lab 1), 9/16 (Lab 2), 9/30 (Lab 3), 10/7 (Lab 4), 10/21 (Lab 5), 10/28 (Lab 6), 11/4 (Lab 7), 11/25 (Lab 8) |

Letter Grade Distribution:

The plus/minus grading system will be used to assign student grades. Minor adjustments to this scale might be made based on the performance of the class as a whole.

97-100.0 = A+

94-96.99 = A

90-93.99 = A-

87-89.99 = B+

84-86.99 = B

80-83.99 = B-

77-79.99 = C+

74-76.99 = C

70-73.99 = C-

67-69.99 = D+

64-66.99 = D

60-63.99 = D-

<60 = F

All students must have a UMD email account for communication. All assignments should be submitted through email or on ELMS. Details about the ELMS will be provided in the class.

**Academic Honesty**: The University of Maryland, College Park, has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student, you are responsible for upholding these standards for this course. You need to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism.

Within our class, students may work together to review class notes and home assignments. However, assignments must be done individually. Each student must turn in his or her own work, from his or her personal computer. Any discussion or problem solution must be his or her alone, without assistance from any other person.

**Accessibility Resources**: Any student with a disability is encouraged to meet with the instructor privately during the first week of class to discuss accommodations. I will make every effort to accommodate students who are registered with the Disability Support Services (DSS) Office and provide a DSS accommodation form. Please refer to the Online Undergraduate Catalog Policy on Religious Observance.

**Email**: Both the TA and the instructor will always be available by email. The professor may not always reply to emails after 6pm or on weekends. Normally, an email would be replied within 24 hours. Emails sent over weekend may not be replied until next work day. E-mails should be respectful and professional.

**Course schedule**

The weekly coverage is subject to change as it depends on the progress of the class. However, you must keep up with the reading assignments.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Week | Date | Topics | Readings | Assignments  |
| 1 | 8/268/28 | Overview & toolsDatatypes, variables & operators | Python Variables |  |
| 2 | 9/29/4 | No class (Labor Day)Strings, ICA 1 | Python Strings | Homework 1 Lab 1 out |
| 3 | 9/99/11 | PracticeLists | Python Lists | Homework 1 Lab 1 dueHomework 2 Lab 2 out |
| 4 | 9/169/18 | Dictionaries Tuples | Python Dictionaries | Homework 2 Lab 2 dueHomework 3 Lab 3 out |
| 5 | 9/239/25 | Flow controlLoops, ICA 2 | Python While and For Loops |  |
| 6 | 9/3010/2 | Flow controlConditionals | Python If…Else | Homework 3 Lab 3 dueHomework 4 Lab 4 out |
| 7 | 10/710/9 | Functions Modules | Python Functions | Homework 4 Lab 4 dueHomework 5 out |
| 8 | 10/1410/16 | Intro to NumPyData arrays | NumPy Tutorial | Homework 5 dueLab 5 out |
| 9 | 10/2110/23 | Intro to pandasICA 3 | Pandas Tutorial | Lab 5 dueLab 6 out |
| 10 | 10/2810/30 | Intro to GeoPandas Geometries | GeoPandas | Lab 6 dueLab 7 out |
| 11 | 11/411/6 | MappingGeometric operations | GeoPandas | Lab 7 due |
| 12 | 11/1111/13 | Automating GIS workflowsICA 4 |  | Lab 8 out |
| 13 | 11/1811/20 | Basic raster handlingPractice |  |  |
| 14 | 11/2511/27 | More rasterNo class (Thanksgiving) |  | Lab 8 due |
| 15 | 12/212/4 | Advanced topicsICA 5 |  |  |
| 16 | 12/9 | ICA 6 |  |  |

Homework:

1. Constants and variables
2. Strings
3. List and dictionaries
4. Loops and conditionals
5. Word frequency

Lab:

1. Variables, datatypes, & operators
2. String manipulation
3. List, tuples, & dictionaries
4. Loops, conditionals, & flow control
5. Functions, modules, & more
6. Pandas and csv
7. Pandas series and data frames
8. GeoPandas