

## Syllabus—GEOG 9021 GIS Programming with Python

Spring 2024 Friday and Saturday, March 8-9, 9:00 am – 6:00 pm - Online Synchronous Format, but students can attend in the lab HSS 290, and use the computers there.

Programming methods allow the GIScience professional to accomplish two main goals: (1) automating repetitive tasks, and (2) extending the capabilities of the GIS and remote sensing tools to perform analyses that are not possible using the software tools provided. Much introductory GIScience work involves interacting with the data to create maps and simple analyses; GIScience professionals quickly discover that they need to use logic and automation to complete more advanced analyses, or even mundane repetitive tasks. Class Format: Approximately 50% lecture, 50% exercises.

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Students can either work in the lab (HSS 290) or on their own computer, but in that case should install the version of ArcGIS Pro installed in the lab. Installation instructions for ArcGIS Pro can be found at <https://gis.sfsu.edu/arcgis-pro-installation-instructions>

### Course Objectives

Introduce Python for ArcGIS to conduct efficient geoprocessing analysis:

- Introduction to the syntax of the Python programming language.
- Understand the introductory and basic concepts of Python programming for GIS, within a Jupyter Notebook environment within ArcGIS Pro; this environment is also used in the ArcGIS Online API.
- How to use **arcpy**, the Python programming library for the ArcGIS Desktop suite, in addition to numpy, matplotlib and pandas modules.

We will use Esri's ArcGIS Pro (Version 3.1.2) but will be focusing on the Python aspects of geoprocessing within the software package, using a Jupyter Notebook environment within ArcGIS Pro.

**GIS Licensing Policy:** San Francisco State University has excellent educational discounts for ArcGIS software and we are fortunate to be able to provide our students with the installation and licensing files needed to install the software up on a home computer. Please remember that when you use ArcGIS Online or install ArcGIS software on your computer, you are agreeing to only use the software only for your own teaching and learning purposes. You should not use or permit others to use ESRI education products for consulting or any other form of commercial or profit-generating activities with your license. Please review our full site license agreement in the link below for a more comprehensive understanding of this policy. <https://sfsu.box.com/s/7i3319kej7f8qlxuhnnbk0pxuw959s6q>

### Grading

This course is graded Credit/Non-Credit. To receive a Credit grade, students must demonstrate completion of each section by turning in assignments. All forum participation must be finished, and assignments must be submitted by EOD Sunday, 2024.

### Recommended Reading:

- Zandbergen, P (2020). Python Scripting for ArcGIS Pro. ESRI Press
- Toms S, O'Beirne D (2017). ArcPy and ArcGIS, 2nd edition. Packt Publishing

### Course Sections

Lectures	Labs	Date
Introduction to the Python Language <ul style="list-style-type: none"><li>• Jupyter notebook environment: code and markdown</li><li>• object types (numbers, strings, Boolean) and conversions</li><li>• lists, tuples, dictionaries</li><li>• mathematical and logical operations</li></ul>	1	Friday
Working with modules, flow control, and input/output <ul style="list-style-type: none"><li>• modules (math, random, numpy, etc.)</li><li>• flow control: if, while, for, def</li><li>• input/output</li></ul>	2	Friday
Introduction to <b>pandas</b> for working with data frames <ul style="list-style-type: none"><li>• Pandas data structures: series, dataframe</li><li>• Vectorizing ndarrays and series</li><li>• Bringing in JSON files</li><li>• Setting the index</li><li>• Data selection, columns or rows</li><li>• Descriptive statistics</li></ul>	3	Friday
Introduction to Python Geoprocessing with arcpy <ul style="list-style-type: none"><li>• Intro ArcPy</li><li>• ArcPy list methods</li><li>• Syntax of geoprocessing tools</li></ul>	4	Saturday
Geoprocessing methods <ul style="list-style-type: none"><li>• Describe</li><li>• Exists</li><li>• Messages</li></ul>	5	Saturday
Data management, Cursors for Processing Records <ul style="list-style-type: none"><li>• Data management tools</li><li>• Cursors: Search, Insert, Update</li></ul>	6	Saturday

**Disclosures of Sexual Violence (Title IX):** SF State fosters a campus free of sexual violence including sexual harassment, domestic violence, dating violence, stalking, and/or any form of sex or gender discrimination. If you disclose a personal experience as an SF State student, the course instructor is required to notify the Dean of Students. To disclose any such violence confidentially, contact: The SAFE Place – (415) 338-2208; [psyservs.sfsu.edu/content/safe-place](https://psyservs.sfsu.edu/content/safe-place) Counseling and Psychological Services Center – (415) 338- 2208; [psyservs.sfsu.edu](https://psyservs.sfsu.edu)

**Disability Access:** Students with disabilities who need reasonable accommodations are encouraged to contact the instructor. The Disability Programs and Resource Center (DPRC) is available to facilitate the reasonable accommodations process. The DPRC is in the Student Service Building and can be reached by telephone (voice/TTY 415-338-2472) or by email to [dprc@sfsu.edu](mailto:dprc@sfsu.edu).