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Course title and number      Introduction to Python for Geosciences (469/669)

Term      Fall 2019

Meeting times and location      O&M 303 (College Station) TR 9:35 – 10:50am

### **Instructor Information**

Dr. Kristen Thyng  
kthyng@tamu.edu – 979-845-0791 – O&M 607  
Office hours by appointment.

### **Course Description and Prerequisites**

This course provides an introduction to data analysis and graphical representation of geoscience data using the Python programming language. Topics include how to read and write data using standard formats; modern programming techniques including object oriented programming and the model-view-controller paradigm; plotting geophysical data using various projections, and best practices in plotting.

Prerequisites: None, but previous programming experience will be very helpful.

This class is being offered in person in College Station and over Google Hangouts for Galveston students.

### **Learning Outcomes or Course Objectives**

Students will understand the basic concepts of programming. In particular, they will understand basic Python programming as typically used in the geosciences, that is, for one- and two-dimensional geospatial analysis for scientific applications. Students will be able to read in data files, perform analysis, and plot results in multiple formats with strong basic design principles.

### **Textbook and/or Resource Material**

No required text. In-class laptop required.

Online course materials: <https://github.com/kthyng/python4geosciences>.

### **Grading Policies**

Homework will be assigned approximately every week, and in-class work is integral to the class and is graded accordingly. There will be a final project for all students.

The grading scale is 90-100% = A, 80-89% = B, 70-79% = C, etc.

For all students, homework will account for 50% of the grade, class participation 25%, and the final project 25%. Homework will be submitted online and graded automatically when possible. This means that your code needs to run to get points — you will not receive points for code that does not run. Homework is due at 11:59pm every Friday night. If you submit homework by the following Thursday night, your grade will be reduced by 10%, and if you submit by the second Friday night after, your grade will be reduced by 20%; after that it will be worth zero points. Undergraduate students will have access to the homework questions assigned to graduate students, and these problems can be completed for extra credit, though this is not required.

### **Academic Integrity**

For additional information please visit: <http://aggiehonor.tamu.edu>

Students are encouraged to work together both in and out of class, but absolutely need to complete their own work and understand what they turn in. “An Aggie does not lie, cheat, or steal, or tolerate those who do.”

**Course Topics, Calendar of Activities, Major Assignment Dates (subject to change)**  
**Homework is typically due every Friday night at midnight**  
**This is superseded by schedule at <https://github.com/kthyng/python4geosciences>**

Week 0–2 (Aug 27/29, Sep 3/5/10/12): Course intro; Python basics — Core language

*Homework 00 due Aug 30, hw01 due Sep 6, hw02 due Sep 13*

Using Jupyter notebooks and JupyterHub. Overview of the standard Python programming language, standard data containers (lists, tuples, dictionaries, etc), importing packages, for/while loops, functions, and object oriented programming (objects as containers for data and associated functions).

Week 3–4 (Sep 17/19/24/26): Numerical Python

*hw03 due Sep 20, hw04 due Sep 27*

Numpy, vector operations, data types, and array broadcasting.

Week 5 (Oct 1): Review

*hw05 due Oct 4*

Review core language and numpy.

Week 5–7 (Oct 3/8/10/15): Basic plotting in Python with matplotlib

*hw06 due Oct 11, hw07 due Oct 18, Email project plan by Oct 18*

Overview of the matplotlib plotting package: 1D (line plots, histograms), 2D (contours, pcolor).

Week 7–9 (Oct 17/22/24/29): 1D time series analysis

*hw08 due Oct 25, hw09 due Nov 1*

pandas, indexing, averaging.

Week 9–10 (Oct 31, Nov 5): Review

*hw10 due Nov 8*

Review core, numpy, matplotlib, and pandas.

Week 10-12 (Nov 7/12/14/19): 2D geospatial plotting

*hw11 due Nov 15*

Cartopy mapping package and shapefiles. xarray: reading and writing NetCDF files locally and over the internet.

Week 12-13 (Nov 21/26, No class Nov 28): Python beyond the notebook

Anaconda package installer, iPython for terminal window, writing scripts, Jupyterlab; debugging, unit testing.

Week 14 (Dec 3): Share projects in groups

*hw12/project due Dec 3 (undergrads and grads)*

Share projects in groups and get feedback. Attendance is required.

### **Attendance and Make-up Policies**

Attendance is highly recommended and part of your grade is based on in-class participation. If you will miss class, be sure to contact me ahead of time.

### **Americans with Disabilities Act (ADA)**

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call [979-845-1637](tel:979-845-1637). For additional information, visit <http://disability.tamu.edu>.