Special Topics in Python for Geosciences
3 credits

Instructor: Robert Hetland
Office: O&M Building Room 618d Phone: 458-0096
E-mail: hetland@tamu.edu

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

Prerequisites: Graduate: None; Undergraduate: U3 or U4 status.

Learning outcomes:
Students will compile and run parallel codes for use on distributed memory supercomuters, use batch scheduling of computer programs, and identify and fix problems in standard supercomputer management software. Students will create programs that use multiple processors using the Message Passing Interface. Students will analyze large data sets. Students will collaborate on a class project using standard tools such as Version Control Systems for maintaining collaborative software projects. Students will create scripts in the Python programming language to solve research problems.

Course Outline:

Week 1-2: Core language

Overview of the standard python programming language, standard data containers (lists, tuples, dictionaries, etc), importing packages, for/while loops, and functions.

Week 3-4: Numerical python

Using numpy and scipy, vector operations, and best practices for large numerical datasets.

Week 5: Basic plotting in python

Overview of the matplotlib plotting package.

Week 6-7: Plotting on the earth

The Basemap package, the proj3 library, and other geospatial applications.

Week 8: NetCDF

Reading and writing NetCDF files locally and over the internet.

Week 9-10: Object Oriented programming and data structures

Object oriented programing (OOP) techniques, and good programming practices. OOP as a surrogate for data structures.

Week 11: Wrapping FORTRAN code

Wrapping FORTRAN code using f2py, and other numerical performance code techniques.

Week 12: Creating and distributing large projects

How to create and distrubute a large python package using standard techniques, like distutils and github.

Week 13-14: Group project presentations.

Prerequisites:

None, however, basic understanding of some programming language is strongly recommended.

Grading:

Homework will be assigned approximately every other week. Students will be expected to bring unique problems to the class, so that the homework can involve real applications. There will be no exams.
Undergraduate grading: Homework will account for 75% of the grade, class participation 25%. Undergraduate students are welcome to participate in the group projects, but it is not required.
Graduate grading: Graduate students will be expected to also work on a group project, with results presented in class in the final weeks of the course, and code distributed publicly; homework will account for 50% of the grade, class participation 25%, and the group project 25%.
The grading scale for all students is 90-100% = A, 80-89% = B, 70-79% = C, etc.

Text:

There will be no text for this class. Online resources will be sufficient.

Attendances:

Please inform me before any planned absences, and I will try to be accommodating. University excused absences are always accepted.

The ADA Statement For additional information see http://disability.tamu.edu/
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with dis- abilities. 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 the Department of Student Life, Services for Students with Disabilities in Room B118 of Cain Hall. The phone number is 845-1637.

The Copyright Policy Statement
All materials used in this class are copyrighted. These materials include but are not limited to syllabi, quizzes, exams, lab problems, in-class materials, review sheets, and additional problem sets. Because these materials are copyrighted, you do not have the right to copy the handouts, unless permission is expressly granted.

Academic Integrity Statement and Policy See http://aggiehonor.tamu.edu
An Aggie does not lie, cheat, or steal, or tolerate those who do.