Syllabus

MARS 5470/4470

Introduction to Scientific Computing for Earth, Environmental and Marine Science

Instructor: Dr. Cheryl Harrison cheryl.harrison@utrgv.edu 956-882-8456
T/Th 1:50-4:30 BMAIN #63 1.312
Office hours after class (4:30-5:30 MW in LHSB 1.816), or by appointment
Note that most of the week I am on the Port Isabel campus in 1.400

Mission Statement

Data analytics and scientific programming are critical, marketable research skills in science and industry. In this class we will be developing proficiency in scientific programming in the python programming language from the basics up, empowering you as a researcher to make the tools you need. Students will learn how to write programs, modify others' programs, analyze and visualize data. By the end of the semester, students will complete a research project relevant to their research or field of study.

Learning Goals

- develop proficiency writing code in python for scientific applications using scripts and notebooks
- python packages and how to get them
- logical controls: for, while and do loops
- data types, data files, input/output including netcdf files
- visualization: scientific plotting, movies, maps
- data analysis: statistics, integrals...
- other subjects as dictated by student interest
- develop expertise related to the students' research culminating in a research project

Grading

Letter grades will be assigned based on the following:
20% Attendance
20% Assignments
10% Feedback on course pedagogy and curriculum design
50% Final research project, broken down:
  15% proposal
  20% report
  15% presentation

Graduate students are expected to engage in more challenging research projects, use more sophisticated programming techniques, and write more professional proposals and final reports.

Pedagogical Style

The basic format is a period of lecture/demonstrations (~50 min), followed by a 15 min break, followed by lab time where we will hack away together. Attendance for this class is critical and will be 20% of the grade. The expectation is that you will help one another, steal code from the internet, and generally hack things together until they work. Code commenting is strongly recommended.

This is a new class. The goal is that we will explore together the best way to develop proficiency and have fun learning scientific python. Student feedback and co-creation of the course are critical, and is 10% of the final grade (see below); there will be a feedback rubric due each week. Deviations from the class schedule are to be expected, and all suggestions and requests for material to be covered will be considered. We will push ourselves but we will enjoy the process and the rewards.

Assignments (20% of grade) are largely evidence of effort in learning python, a notebook of your coding progress during each week. It is expected that students will make progress at different rates based on their background and abilities, and this does not determine grading. However, effort, showing up and putting time in will be graded heavily, as will reaching certain benchmarks throughout the term, covered in the next section.

There is no textbook for this course (see resources below). All materials are free and online. You are welcome and encouraged to use your own computer, or you can use the campus computers and save all of your work in the cloud.

Final Research Project (50% of grade)

Scientific data analysis and plotting of the student's interest. Proposal (15%), report (20%) and presentation to the class required (15%).

Research project proposal (due Sunday 10/27/19 at 11:59 PM CT):
Write a short (2-3 page) research proposal, including: abstract, background, why it's important, what your hypothesis is, what analysis you plan to do, what the broader impacts are, and a timeline for completion. (Broader impacts: How can this information be used? Why do we care? Impact for society...) At least one figure and three references are required. You will also give a short class presentation to get feedback.

Research report (due Wednesday 12/11/19 at 11:59 PM CT)
5-10 pages. Should take the form of a scientific article with the following sections: Abstract, Introduction, Methods, Results, Discussion, Bibliography. 2-5 figures or tables and bibliography are required.

Final presentation (12/3-5 during class time) using powerpoint or your favorite presentation software.

Proposals and reports are required to be written in Overleaf (LaTeX) using a Zotero bibliography database. These will be introduced in class. You can start writing in your favorite editor before if desired.

Resources

AN – Anaconda python/R platform
https://www.anaconda.com/distribution/

SL - Scipy lecture notes
http://scipy-lectures.org/

RJ - Robert Johansson's scientific python lectures:
https://github.com/jrjohansson/scientific-python-lectures

B - Basemap:
https://matplotlib.org/basemap/

C – Cartopy
https://scitools.org.uk/cartopy/docs/latest/

P – PANDAS (Python Data Analysis Library)
https://pandas.pydata.org/

XR - XARRAY
http://xarray.pydata.org/en/stable/

U - UNIX/Linux/MacOSX
https://ryanstutorials.net/linuxtutorial/commandline.php#welcome
X-terminal for PCs:
https://sourceforge.net/projects/xming/

Python documentation (more advanced)
https://www.scipy.org/docs.html

On Scientific Writing:
http://www-star.st-and.ac.uk/~pw31/CompAstro/ScientificWriting.pdf

O - Overleaf
https://www.overleaf.com/
Introduction to LaTeX:
https://www.overleaf.com/learn/latex/Learn_LaTeX_in_30_minutes

Z - Zotero
https://www.zotero.org/

Tentative Class Schedule

Week	Dates	Topic	Resources (defined above)	Assignments (due Sunday 11:59 PM CT)
1	8/27,29	Introductions: class, python	AN, SL 1.2.1-2, RJ Lec 0-1	CV
2	9/3,5	Introduction to python continued, Introduction to LaTeX and Zotero	SL 1.2.3, RJ Lec 1, O, Z	
3	9/10,12	logical control, numpy	RJ Lec 1-2	
4	9/17,19	Plotting, I/O: excel and netcdf files, xarray	B, C, XR	
5	10/1,3	Putting it all together: scientific analysis and plotting		
6	10/8,10	Putting it all together: scientific analysis and plotting		
7	10/15,17	More excel importing, pandas		
8	10/22,24	Research projects, research topics presentations		Research topics due
9	10/29,31	Predator Prey Modeling, Line fitting		
10	11/5,7	Student choice topics		Research project proposals due
11	11/12,14	Research projects		Weekly research notebook
12	11/19,21	Research projects		Weekly research notebook
13	11/26	Research projects		Weekly research notebook
14	12/3, 5	Research presentations		
15	12/11			Final paper due (Wed 11:59 PM)

STUDENTS WITH DISABILITIES:
Students with a documented disability (physical, psychological, learning, or other disability which affects academic performance) who would like to receive academic accommodations should contact **Student Accessibility Services (SAS)** as soon as possible to schedule an appointment to initiate services. Accommodations can be arranged through SAS at any time, but are not retroactive. Students who suffer a broken bone, severe injury or undergo surgery during the semester are eligible for temporary services.

Pregnancy, Pregnancy-related, and Parenting Accommodations
Title IX of the Education Amendments of 1972 prohibits sex discrimination, which includes discrimination based on pregnancy, marital status, or parental status. Students seeking accommodations related to pregnancy, pregnancy-related condition, or parenting (reasonably immediate postpartum period) are encouraged to contact Student Accessibility Services for additional information and to request accommodations.

Student Accessibility Services:
Brownsville Campus: Student Accessibility Services is located in Cortez Hall Room 129 and can be contacted by phone at (956) 882-7374 (Voice) or via email at ability@utrgv.edu. **Edinburg Campus:** Student Accessibility Services is located in 108 University Center and can be contacted by phone at (956) 665-7005 (Voice), (956) 665-3840 (Fax), or via email at ability@utrgv.edu.

MANDATORY COURSE EVALUATION PERIOD:
Students are required to complete an ONLINE evaluation of this course, accessed through your UTRGV account (http://my.utrgv.edu); you will be contacted through email with further instructions. Students who complete their evaluations will have priority access to their grades.

ATTENDANCE:
Students are expected to attend all scheduled classes and may be dropped from the course for excessive absences. UTRGV's attendance policy excuses students from attending class if they are participating in officially sponsored university activities, such as athletics; for observance of religious holy days; or for military service. Students should contact the instructor in advance of the excused absence and arrange to make up missed work or examinations.

SCHOLASTIC INTEGRITY:
As members of a community dedicated to Honesty, Integrity and Respect, students are reminded that those who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and expulsion from the University. Scholastic dishonesty includes but is not limited to: cheating, plagiarism (including self-plagiarism), and collusion; submission for credit of any work or materials that are attributable in whole or in part to another person; taking an examination for another person; any act designed to give unfair advantage to a student; or the attempt to commit such acts. Since scholastic dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced (Board of Regents Rules and Regulations and UTRGV Academic Integrity Guidelines). All scholastic dishonesty incidents will be reported to the Dean of Students.

SEXUAL HARASSMENT, DISCRIMINATION, and VIOLENCE:
In accordance with UT System regulations, your instructor is a "Responsible Employee" for reporting purposes under Title IX regulations and so must report any instance, occurring during a student's time in college, of sexual assault, stalking, dating violence, domestic violence, or sexual harassment about which

she/he becomes aware during this course through writing, discussion, or personal disclosure. More information can be found at www.utrgv.edu/equity, including confidential resources available on campus. The faculty and staff of UTRGV actively strive to provide a learning, working, and living environment that promotes personal integrity, civility, and mutual respect that is free from sexual misconduct and discrimination. If students, faculty, or staff would like confidential assistance, or have questions, they can contact OVAVP (Office for Victim Advocacy & Violence Prevention) at 665-8287, 882-8282, or OVAVP@utrgv.edu.

COURSE DROPS:
According to UTRGV policy, students may drop any class without penalty earning a grade of DR until the official drop date. Following that date, students must be assigned a letter grade and can no longer drop the class. Students considering dropping the class should be aware of the "3-peat rule" and the "6-drop" rule so they can recognize how dropped classes may affect their academic success. The 6-drop rule refers to Texas law that dictates that undergraduate students may not drop more than six courses during their undergraduate career. Courses dropped at other Texas public higher education institutions will count toward the six-course drop limit. The 3-peat rule refers to additional fees charged to students who take the same class for the third time.

STUDENT SERVICES:
Students who demonstrate financial need have a variety of options when it comes to paying for college costs, such as scholarships, grants, loans and work-study. Students should visit the Students Services Center (U Central) for additional information. U Central is located in BMAIN 1.100 (Brownsville) or ESSBL 1.145 (Edinburg) or can be reached by email (ucentral@utrgv.edu) or telephone: (888) 882-4026. In addition to financial aid, U Central can assist students with registration and admissions.

Students seeking academic help in their studies can use university resources in addition to an instructor's office hours. University Resources include the Learning Center, Writing Center, Advising Center and Career Center. The centers provide services such as tutoring, writing help, critical thinking, study skills, degree planning, and student employment. Locations are:

- Learning center: BSTUN 2.10 (Brownsville) or ELCTR 100 (Edinburg)
- Writing center: BLIBR 3.206 (Brownsville) or ESTAC 3.119 (Edinburg)
- Advising center: BMAIN 1.400 (Brownsville) or ESWKH 101 (Edinburg)
- Career center: BCRTZ 129 (Brownsville) or ESSBL 2.101 (Edinburg)