

Course Number and Title

Zoo4926/6927: Computational Tools for Research

Catalog Description

Information technology has dramatically transformed how research across many disciplines is conducted. How researchers are able to leverage new tools and resources changes the types of questions asked, and the feasible scale and level of integration across multiple fields. Increasingly, knowledge of scripting, database management, and advanced computing skills are critical for academic researchers. This course will survey areas where high performance computing, large-scale data access and integration, informatics tools and software, and multi-disciplinary collaboration have had high impact on research as a foundation for computationally-enabled research.

Topics will address a gap in how research has advanced—and become increasingly computational—while student training in the use of computational tools has lagged. The course will cover basic concepts that will provide the ability for students to apply new technologies to a wide array of research questions. A foundation in information management concepts opens doors for well-trained scientists and allows them to work in multidisciplinary research domains that are becoming increasingly essential.

The course will meet three hours each week.

The course is roughly divided into three sections:

Section 1: Linux command line, Bash scripting, version control and using high-performance computing resources

Section 2: Python scripting

Section 3: SQL database introduction and integration with Python

Credit Hours

3 credit (3 hours per week)

Pre-requisites and Co-requisites

None

Course Objectives

By the end of the course, the student will:

- Understand how technology infrastructure can improve research and open new avenues of investigation.
- Competently navigate the Unix/Linux command line interfaces.
- Effectively and efficiently manipulate text files, performing complex regular expression replacements, reformatting and merging files in various ways.
- Raise and address current issues through class participation and discussion.

- Use High Performance Computing resources such as the UF Research Computing for cluster-based analyses. Including batch scripting and running multi-processor applications (threaded and MPI).
- Understand the basic anatomy of computer scripts/programs, with particular focus on Python scripting.
- Construct analytical pipelines to accomplish complex tasks.
- Understand basic database design, creation and manipulation. Perform scripted database operations for information discovery, data exploration and research data curation.
- Have a basic understanding of research graphics formats, preparation and manipulation

Instructor Information

Name:	Matt Gitzendanner	TA: TBD
Office location:	Dickinson 301c	
Telephone:	273-1960	
E-mail address:	magitz@ufl.edu	
Office hours:	Tuesdays, 10-11	

Course Meeting Time(s)

MWF 2nd Period

Course Meeting Location(s): Rogers 110.

Course Website

Course materials and related information will be posted on the course E-Learning (Canvas) website at <http://lss.at.ufl.edu>. You are responsible for all announcements made in class and/or posted on the course website for this course.

Fees

None

Required Materials

Software and hardware

Participants will be required to have a laptop with ability to connect to the internet. As access to power during course time may be limited, students should ensure their laptop is charged and able to function for the 50 minute class period.

Several free/open source software packages will be used throughout the course, and students will be required to install some of these.

Students will be required to apply for a (free) Research Computing account to access HiPerGator for course work.

Course Outline

Week	Date	Topic
1	8/22/18 8/24/18	Introduction and course objectives. UF Research Computing Intro & getting started
2	8/27/18 8/29/18 8/31/18	Linux Basics: Text files, regular expressions Linux Basics: Command line Linux Basics: Pipes and Redirects
3	9/3/18 9/5/18 9/7/18	Labor Day Holiday—No Class Shell Scripts Shell Scripts, Version Control: git and GitHub
4	9/10/18 9/12/18 9/14/18	Version Control: git and GitHub Using UF Research Computing resources Running batch jobs, Compiling source code
5	9/17/18 9/19/18 9/21/18	Singularity/Docker Data Management/Data Curation Wrap-up
6	9/24/18 9/26/18 9/28/18	Introduction to Python Python data types Working in Python, File I/O
7	10/1/18 10/3/18 10/5/18	Working in Python, Loops, Conditional Statements Working in Python: try/except, RegEx, imports SciPy, NumPy, Pandas
8	10/8/18 10/10/18 10/12/18	Class project, begin Scripting data acquisition UF Homecoming—No Class
9	10/15/18 10/17/18 10/19/18	Python modules and libraries Working with dictionaries Class project, continue
10	10/22/18 10/24/18 10/26/18	Writing functions Class project, complete Matplotlib and data visualization
11	10/29/18 10/31/18 11/2/18	Overview of databases Database design MySQL
12	11/5/18 11/7/18 11/9/18	Setting up a database SQL Queries, joins, etc. SQL Queries
13	11/12/18 11/14/18 11/16/18	Veteran's Day Holiday—No class Python scripting of database actions Uses of databases
14	11/19/18 11/21/18	Class projects begin Thanksgiving break—No class

	11/23/18	Thanksgiving break—No class
15	11/26/18 11/28/18 11/30/18	Security and data management Class projects, continue Graphics (Ch. 17 of text)
16	12/3/18 12/5/18	Class projects, complete Wrap-up—Last day of classes.

Attendance Policy

Attendance is not required, but a significant portion of grading is based on class participation. Penalties for absence or tardiness will be handled on a case-by-case basis.

Conduct in Class

- Please be courteous and do not talk during lecture. This can be distracting to other students and the instructor.
- Only approved electronic devices may be used in class. Approved electronic devices are laptop computers (when used to take notes or otherwise participate in classroom activities) and voice recording devices. Unapproved electronic devices include cell phones, video recorders, digital cameras and MP3 players.

Grading

- Quizzes: 5 @ 20 points each (33% of final grade)
- Problem sets: 5 @ 20 points each per module (33% of final grade)
- Class projects: 2 @ 40 points each (27%)
- Class Participation: 20 points (6% of final grade)
- **Additional Graduate student requirements:** There will be 1-2 extra questions on each quiz and problem set that will be required only for graduate students. Additionally graduate students will be expected to take a leadership role in the class projects.

Grading Scale

Point Range (%)	Letter Grade	GPA equivalent
≥ 90.00	A	4.0
86.7 – 89.9	A-	3.67
83.3 – 86.6	B+	3.33
80.0 – 83.2	B	3.0
76.7 – 79.9	B-	2.67
73.3 – 76.6	C+	2.33
70.0 – 73.2	C	2.0
66.7 – 69.9	C-	1.67
63.3 – 66.6	D+	1.33
60.0 – 56.7	D	1.0
56.7 – 53.3	D-	0.67
< 53.3	E	0

Note that a “C-” will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit:

<http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html>

Grade Curve Policy

The instructor may use a curve to adjust grades, if necessary.

UF Counseling Services

- Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
 - UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
 - Career Resource Center, Reitz Union, 392-1601, career and job search services.
- Many students experience test anxiety and other stress related problems. “A Self Help Guide for Students” is available through the Counseling Center (301 Peabody Hall, 392-1575) and at their web site: <http://www.counsel.ufl.edu/>.

Honesty Policy

- All students registered at the University of Florida have agreed to comply with the following statement: “I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University.”

- In addition, on all work submitted for credit the following pledge is either required or implied: *“On my honor I have neither given nor received unauthorized aid in doing this assignment.”*
- If you witness any instances of academic dishonesty in this class, please notify the instructor or contact the Student Honor Court (392-1631) or Cheating Hotline (392-6999). For additional information on Academic Honesty, please refer to the University of Florida Academic Honesty Guidelines at: <http://www.dso.ufl.edu/judicial/procedures/academicguide.html>.

Accommodation for Students with Disabilities

- Students who will require a classroom accommodation for a disability must contact the Dean of Students Office of Disability Resources, in Peabody 202 (phone: 352-392-1261). Please see the University of Florida Disability Resources website for more information at: <http://www.dso.ufl.edu/drp/services/>.
- It is the policy of the University of Florida that the student, not the instructor, is responsible for arranging accommodations when needed. Once notification is complete, the Dean of Students Office of Disability Resources will work with the instructor to accommodate the student.

Software Use

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.