Programming for Biologists (BSC 4456C / 5937C)

Department of Biology, College of Sciences

3 Credit Hours

Instructor Information

- Instructor: Dr. Matthew Tye
- Office Location: 201B
- Office Hours:
  - In person (Bio 201B): Thursday and Friday 10:30-12:30
  - Virtual (Zoom): MTW 10:30-12:30
- Digital Contact: matthew.tye@ucf.edu

Course Information

- Term: Fall 2023
- Course Number & Section: BSC 4456C / 5937C
- Course Name: Programming for Biologists
- Credit Hours: 3 Credit Hours
- Class Meeting Days: Tuesdays and Thursdays
- Class Meeting Time: 3:30 PM – 4:45 PM
- Class Location: Biological Sciences 305
- Course Modality: In Person

Recommended Course Prerequisites

Recommended prerequisites (or permission of instructor):

- An introductory statistics and/or calculus course (STA 2023, MAC 2311C)
- Biology II (BSC 2011C)
- An introductory course in genetics (PCB 3063), ecology (PCB 3044), or evolutionary biology (PDB 4683)

Course Description

Basic concepts in biological software applications and will cover multiple computer languages and biological topics.

Course Purpose

This course covers foundational programming skills, data visualization, git-based version control, and principles of data science as they relate to biological research. We'll primarily be using R. Each graduate student will design and implement an independent project that is relevant

to their thesis and falls under the scope of the class (e.g., designing a software package, developing a research pipeline, implementing advanced analytical methods, etc).

Course Materials and Resources

Required Materials/Resources

- Personal computer
    - Must install R, RStudio, and git

Student Learning Outcomes

By the end of the course, students should know how to

- program in base R and the tidyverse
- make publication-quality figures using ggplot2
- collaborate on projects using git/GitHub
- make high-quality markdown-based publications, including how to author
    - reproducible examples for getting help on forums (e.g. StackOverflow)
    - personal research website
    - open-source books
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Methods of Evaluation and Grading Methods

Grades will be assigned on the following scale without rounding or the use of plus/minus grades:

A: 90-100%   B: 80-89%   C: 70-79%   D: 60-69%   F<60%

Assignment categories include:

- **3 Take Home Exams (50%, 25% each exam, lowest exam dropped)**
- **Final project (50%)**. Details will be provided throughout the semester. **<u>Graduate students will have additional requirements.</u>**

Unless otherwise indicated, all assignments can be completed **individually or in groups and** are **open book**, **open notes**, and **open internet**. Make sure to comprehensively reference/cite any outside material used.

Disclaimer for working in groups: Since all assignments can be completed individually, all students working in groups will receive the same grade with no exceptions. Any issues arising from working in groups is on you to resolve.

Attendance, Participation

Attendance is expected. You will **not** be penalized for missing class, but you are responsible for making up any work.

Make-up Assignments

Per university policy, you are allowed to submit make-up work (or an equivalent, alternate assignment) for authorized university-sponsored activities, religious observances, or legal obligations (such as jury duty). If this participation conflicts with your course assignments, I will offer a reasonable opportunity for you to complete missed assignments and/or exams. The make-up assignment and grading scale will be equivalent to the missed assignment and its grading scale. In the case of an authorized university activity, it is your responsibility to show me a signed copy of the Program Verification Form for which you will be absent, prior to the class in which the absence occurs. In any of these cases, please contact me ahead of time to notify me of upcoming needs.

Course Schedule

Week	Topic
1	Introduction to R and RStudio
2	Objects in R
3	GitHub / Reproducible Workflow
4	Data Visualization
5	Data Wrangling
6	Data Tidying
7	Data Importing and Recoding
8	Communicating Results Effectively
9	Writing Functions
10	Conditional Statements
11	Loops
12	Modelling Data
13	Classification and Model Building
14	Ethics in data science
15	Model validation and uncertainty quantification

University Services and Resources

Academic Services and Resources

A list of available academic support and learning services is available at [UCF Student Services](). Click on "Academic Support and Learning Services" on the right-hand side to filter.

Non-Academic Services and Resources

A list of non-academic support and services is also available at [UCF Student Services](). Click on "Support" on the right-hand side to filter.

If you are a UCF Online student, please consult the [UCF Online Student Guidelines]() for more information about your access to non-academic services.

Policy Statements

Academic Integrity

Students should familiarize themselves with [UCF's Rules of Conduct](). According to Section 1, "Academic Misconduct," students are prohibited from engaging in:

- *Unauthorized assistance*: Using or attempting to use unauthorized materials, information or study aids in any academic exercise unless specifically authorized by the instructor of record. The unauthorized possession of examination or course-related material also constitutes cheating.
- *Communication to another through written, visual, electronic, or oral means*: The presentation of material which has not been studied or learned, but rather was obtained through someone else's efforts and used as part of an examination, course assignment, or project.
- *Commercial Use of Academic Material*: Selling of course material to another person, student, and/or uploading course material to a third-party vendor without authorization or without the express written permission of the university and the instructor. Course materials include but are not limited to class notes, Instructor's PowerPoints, course syllabi, tests, quizzes, labs, instruction sheets, homework, study guides, handouts, etc.
- *Falsifying or misrepresenting* the student's own academic work.
- *Plagiarism*: Using or appropriating another's work without any indication of the source, thereby attempting to convey the impression that such work is the student's own.
- *Multiple Submissions*: Submitting the same academic work for credit more than once without the express written permission of the instructor.
- *Helping another violate* academic behavior standards.

For more information about Academic Integrity, students may consult [The Center for Academic Integrity]().

For more information about plagiarism and misuse of sources, see "[Defining and Avoiding Plagiarism: The WPA Statement on Best Practices]()".

Responses to Academic Dishonesty, Plagiarism, or Cheating

Students should also familiarize themselves with the procedures for academic misconduct in UCF's student handbook, The Golden Rule. UCF faculty members have a responsibility for students' education and the value of a UCF degree, and so seek to prevent unethical behavior and when necessary respond to academic misconduct. Penalties can include a failing grade in an assignment or in the course, suspension or expulsion from the university, and/or a "Z Designation" on a student's official transcript indicating academic dishonesty, where the final grade for this course will be preceded by the letter Z. For more information about the Z Designation, see http://goldenrule.sdes.ucf.edu/zgrade.

Course Accessibility Statement

The University of Central Florida is committed to providing access and inclusion for all persons with disabilities. Students with disabilities who need disability-related access in this course should contact the professor as soon as possible. Students should also connect with Student Accessibility Services (Ferrell Commons 185, sas@ucf.edu, phone (407) 823-2371). Through Student Accessibility Services, a Course Accessibility Letter may be created and sent to professors, which informs faculty of potential access and accommodations that might be reasonable.Determining reasonable access and accommodations requires consideration of the course design, course learning objectives and the individual academic and course barriers experienced by the student.

Campus Safety Statement

Though most emergency situations are primarily relevant to courses that meet in person, such incidents can also impact online students, either when they are on or near campus to participate in other courses or activities or when their course work is affected by off-campus emergencies. The following policies apply to courses in online modalities.

- To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to https://my.ucf.edu and logging in. Click on "Student Self Service" located on the left side of the screen in the toolbar, scroll down to the blue "Personal Information" heading on the Student Center screen, click on "UCF Alert", fill out the information, including e-mail address, cell phone number, and cell phone provider, click "Apply" to save the changes, and then click "OK."
- Students with special needs related to emergency situations should speak with their instructors outside of class.

Emergencies on campus are rare, but if one should arise during class, everyone needs to work together. Students should be aware of their surroundings and familiar with some basic safety and security concepts.

- In case of an emergency, dial 911 for assistance.
- Every UCF classroom contains an emergency procedure guide posted on a wall near the door. Students should make a note of the guide's physical location and review the online version at http://emergency.ucf.edu/emergency_guide.html.
- Students should know the evacuation routes from each of their classrooms and have a plan for finding safety in case of an emergency.
- If there is a medical emergency during class, students may need to access a first-aid kit or AED (Automated External Defibrillator). To learn where those are located, see the AED Locations Page.
- To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to https://my.ucf.edu and logging in. Click on "Student Self Service" located on the left side of the screen in the toolbar, scroll down to the blue "Personal Information" heading on the Student Center screen, click on "UCF Alert", fill out the

information, including e-mail address, cell phone number, and cell phone provider, click "Apply" to save the changes, and then click "OK."
- Students with special needs related to emergency situations should speak with their instructors outside of class.
- To learn about how to manage an active-shooter situation on campus or elsewhere, consider viewing this video [You CAN Survive an Active Shooter](#)

Deployed Active Duty Military Students

Students who are deployed active duty military and/or National Guard personnel and require accommodation should contact their instructors as soon as possible after the semester begins and/or after they receive notification of deployment to make related arrangements.

Copyright

This course may contain copyright protected materials such as audio or video clips, images, text materials, etc. These items are being used with regard to the Fair Use doctrine in order to enhance the learning environment. Please do not copy, duplicate, download or distribute these items. The use of these materials is strictly reserved for this online classroom environment and your use only. All copyright materials are credited to the copyright holder.

Third-Party Software and FERPA

During this course you might have the opportunity to use public online services and/or software applications sometimes called third-party software such as a blog or wiki. While some of these could be required assignments, you need not make any personally identifying information on a public site. Do not post or provide any private information about yourself or your classmates. Where appropriate you may use a pseudonym or nickname. Some written assignments posted publicly may require personal reflection/comments, but the assignments will not require you to disclose any personally identity-sensitive information. If you have any concerns about this, please contact your instructor.

Third-Party Accessibility and Privacy Statements

This course uses third-party tools that integrate with Webcourses:

GitHub ([Privacy Statement](#))