**Principles and techniques of reproducible science**

**PLPA 5820/6820 ENTM 5820/6820 APBT 5820**

**Spring 2023**

**Prerequisites:**  **Come with data, and a laptop/computer**

**Meeting time:** 4:00 – 4:50 pm Rouse 114

**Instructor:** Dr. Zachary Noel

**Credit hours:** 2

**Office hours**: By appointment

**Textbook: No textbook required. All materials will be provided. There are so many resources free online for learning R. However, the following text resources can be helpful:**

# [**The Book of R: A First Course in Programming and Statistics**](file:///The%20Book%20of%20R/%20A%20First%20Course%20in%20Programming%20and%20Statistics)

### [R in Action](https://geni.us/HqCBwv)

**Course Description**

Reproducibility is fundamental to science. Yet there is a reproducibility crisis in science. This course will introduce students to the concepts of reproducibility, scientific integrity, accessibility, and data management. Students are often exposed to R for the first time in graduate school in a statistics curriculum. However, R is not just for statistics, but a tool for improved communication, reproducibility, and accessibility in science – especially when integrated with version control repositories like GitHub. Students will gain hands on knowledge on principles and techniques handling data reproducibly. Students **will not learn statistics** but may encounter statistics in course examples and assignments. Graduate students in the course will develop a reproducible workflow using their own data that they can publish with manuscripts.

**Course objectives**

1. Students will understand the fundamentals of the reproducibility and accessibility in science
2. Students will apply the use of computer languages to solve challenges in reproducibility and accessibility in science
3. Students will create reproducible workflows for their own data

**Tentative Course Schedule**

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**Assignments**

* 6 written assignments (50 points each) = 300 points
* 6 In class exercises/assignments/paper reviews (10 points each) = 60 points
* Reproducible workflow project = 150 pts (grad students only).

**Written assignments** – 6 written assignments. These written assignments will apply student's knowledge from class lectures and allow them to write code that can be used to create projects.

Each written assignment will be a list of 5-9 (5-9 pts each) questions where students must demonstrate knowledge of the previous week's topic using computer code and written responses. 5 pts will be given for demonstration of use of version control repository for each submission.

**In class exercises/assignments** – These assignments will be in class and allow students to discuss topics related to lecture materials and learn and relate to reproducibility in science.

Points will be awarded based or written summaries of paper discussions and exercises.

Both written and in class assignments will prepare students to critically think about reproducibility, accessibility, and efficiency in science and prepare them for exams.

**Reproducible workflow project** - 150 pts (grad students only). This assignment is a semester long project for graduate students to produce a reproducible workflow to publish along with manuscripts.

**Points for the reproducible workflow will be awarded for the following:**

* History of evidence of integration with version control - 10 points
* Creation of figures that are manuscript ready - 50 points
* Use of reproducible and efficient coding techniques like functions, self-checks, R markdown, loops, and data simulation. - 50 points
* Must have a README file - 5 points
* Must have a file tree - 5 points
* Must be in an R project - 5 points
* I must be able to download your project. run the code, and have it make sense and reproduce it! - 25 points

**Exams**

Test 1 - 100 pts

Test 2 (Final) - 100 pts

**Exam format**

The exam will be given in two parts a written exam, and an oral exam.

* **Written**: The written exam will consist of an open book take home exam on R coding and or short answer questions that you will have to back up with relevant literature. I may give you a dataset and will expect you to write code you have learned in class. However, notice I said ***open book***. This does not mean open with your classmates. You do need to know how the code you are writing works, and you need to interpret the code, not copy it from other people.
* **Oral**: The oral portion will be a one-on-one style exam with the professor, and will be more focused on verbal reasoning on core concepts in the course. This type of exam is designed to help work out any misunderstandings, and has demonstrated better comprehension and retention of knowledge ([Luckie et al. 2013](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3763018/); [Theobold 2021](https://www.tandfonline.com/doi/full/10.1080/26939169.2021.1914527)).

Total possible points graduate students - 760 pts

Total possible points undergraduate students – 650 pts

**Grading System**

Letter grades will be based on percentages.

                                    A =      90% - 100%

                                    B =      80% - 89%

                                    C =      70% - 79%

                                    D =      60% - 69%

                                    F =       0       - 59%

**Late assignments and missing class policy**

Attendance is required. If an exam or assignment is missed, a written excuse should be presented or emailed to the instructor within 24 hours of the absence. **Exams**: The missed exam must be taken with in 5 days of the exam due date. It is the responsibility of the learner to schedule make up exams. **Assignments**: In general, I really do not like grading assignments way later than they are due, but I also understand that there are times when life gets in the way or you are forgetful. It happens. Please turn in assignments when they are due, but I will allow one late assignment to be turned in during the semester with no consequences. Otherwise, you will lose 10 points per day on late assignments.

**Face Coverings**:

The university permits individual faculty members to require face coverings in their classrooms

and instructional laboratories. At the current time face coverings are not required; however

should the number of COVID infections significantly increase all students enrolled in this

course are required to properly wear a face covering at the faculty’s decision. Face coverings must cover the nose and mouth while inside the classroom or office. Failure to comply with this requirement represents a potential Code of Student Conduct violation and may be reported as a non-academic violation. Please consult the Classroom Behavior Policy for additional details.

**COVID-19 Related Issues**:

For COVID-19 related issues, students are to abide by the guidelines set forth at the university

COVID-19 Resource Center (http://auburn.edu/covid-resource-center/). If exposed to the virus

or test positive, please stay away from class and fill out a report (http://auburn.edu/covid-

resource-center/reporting/) and let the instructors know. We will make alternative arrangements

as necessary.

**University Policies**

There are important university policies that you should be aware of, such as the add/drop policy; cheating and plagiarism policy, grade appeal procedures, accommodations for students with disabilities and degree requirements. See Academic Policies

http://bulletin.auburn.edu/undergraduate/generalintroduction/academicpolicies/.

**Dropping and Adding**

Students are responsible for understanding the policies and procedures about add/drops, course loads/overloads, etc. The Academic Policies page

http://www.auburn.edu/cosam/departments/student-services/academic-policies.htm has

information regarding these.

**Campus Policy on Disability Access for Students**

If you are a student with a disability, and think you may need academic accommodations, please contact the Office of Accessibility, located in Haley Center, Room 1228, Phone: (344) 844-2096, as early as possible in order to avoid a delay in receiving accommodation services. Use of OA services, including testing accommodations, requires prior authorization by the Office of Accessibility. For more help see Steps to Receive Accommodations

https://cws.auburn.edu/Accessibility/cm/prospective.

**Emergency Evacuation**

If you are a student with a disability and you think you may require assistance evacuating a

building in the event of a disaster, you should inform your instructor about the type of assistance you may require. You and your instructor should discuss your specific needs and the type of precautions that should be made in advance of such an event (i.e. assigning a buddy to guide you down the stairway). We encourage you to take advantage of these preventative measures as soon as possible and contact the Office of Accessibility if other classroom accommodations are needed.

**Academic Integrity**

Students should be familiar with the university’s Academic Honesty Code

https://sites.auburn.edu/admin/universitypolicies/Policies/AcademicHonestyCode.pdf. Your own commitment to learning, as evidenced by your enrollment at Auburn University and the

university’s policy, require you to be honest in all your academic course work. Instances of

academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person’s ideas without giving proper credit) will result in a failing grade and sanctions by the university. For this class, all assignments are to be completed by the individual student unless otherwise specified.

**Additional Resources**

Library Research Guides and Subject Librarians You should be able to complete this course without making a trip to the library. Be advised that the Auburn University Library can help you find information and conduct research. If you would like help pursuing a topic that we touched on, you can make an appointment with a librarian, or get help online. The specialist for Biology is Patricia Hartman (pjh0011@auburn.edu).

**Miller Writing Center**

The Miller Writing Center helps Auburn University students become better writers and produce better written documents. The MWC has multiple locations: RBD Library, SADC, Multicultural

Center, Forestry & Wildlife Building, and Auburn Global. The knowledgeable and friendly

tutors can help you with a wide array of concerns, from generating good ideas and organizing

papers more clearly to learning citation formats and using semi-colons correctly. Visit the

Writing Center website http://wp.auburn.edu/writing/writing-center/ for more information on

how to schedule time with a tutor.

**General Student Computing**

Review the information posted at OIT Computing Lab Locations http://www.auburn.edu/oit/labs/. There you will find computer use guidelines and a list of

available computer labs.

**Canvas**

Canvas is Auburn University's official Learning Management System (LMS). Canvas is the

place where you will find the course syllabus, read posted announcements, submit your

assignments online and view the materials for this course. To access Canvas use your AU user

ID and password to log into Auburn’s Canvas homepage https://auburn.instructure.com/login/ldap. When you log in, you will be directed to your

dashboard. Click on the link for this course (classes are listed by course name and number). Note that the Login link is also conveniently located in AU Access www.auaccess.auburn.edu and many other university pages.

**Canvas Help**

Contact the OIT Help desk https://oit.auburn.edu/helpdesk if you need assistance with Canvas or other information about computing and information technology at Auburn. Three ways to contact the OIT Help Desk are:

* Call: 334-844-4944
* Email: helpdesk@auburn.edu
* Visit Location: RBD Library, 2nd and 3rd floors

**Student Counseling Services (SCS)**

SCS is a unit of the Auburn University Medical Clinic. SCS offers confidential counseling to

students experiencing personal problems that interfere with their academic progress, career or

well being. The SCS website http://wp.auburn.edu/scs/ provides information only. If you would

like to talk with someone or make an appointment, please call (344) 844-5123 during business

hours, or (344) 501-3100 after hours or on weekends.