

BIOS 4401 Syllabus

Experimental Design & Statistical Methods

Tue / Thur 12:30 - 1:45pm

Boggs B9

Instructor Information

Instructor

Annalise Paaby, PhD

Teaching Assistants

Claudia Ortega

Cheng Zhang

Sudeep Gorla

R Workshop Instructor

Avery Davis Bell, PhD

Communications

For questions relating to course content or logistics, please post to our class Piazza page (details below). For personal questions, check our Canvas page for the correct contact person.

General Information

This is an introductory course on probability distributions and statistical testing, using techniques commonly applied in biology research. In-class activities will be split between lectures, which will introduce general concepts and outline formal steps for solving statistical problems, and exercises, where you will implement these ideas on your own or working in small groups.

Homework assignments will demonstrate concepts learned in class using the statistical programming language R. No prior experience with R is required. Please note: although this course may introduce students to R for the first time, it is *not* a “How to use R” class itself. However, new this year, this course will offer an optional R workshop mid semester!

Required resources

- **Learning Catalytics** account (\$12/six months)
 - Please use only *one* LC account for the semester
 - Please ensure you are using a *student* (not instructor) account, otherwise your points are not recorded!
- **Piazza** account (free)
- **Computer** - For attending class, a computer with decent internet speed is highly recommended. It may be possible to use a tablet if it is capable displaying multiple apps at once. To complete homework in R, you will need a computer. If you don't have access to this technology, please contact us ASAP.
- **R statistical computing software** via RStudio (free)
 - You may download and install RStudio locally or use GT-supported web access
 - Instructions for accessing and getting started in RStudio will be provided
- **Calculator** - A cheapie, hand-held calculator (no advanced functions or memory storage)
- **Textbook** - There is no required textbook for this course.

Course websites / accounts

Canvas

The course main page on Canvas is the virtual home for our course. **Go here first for everything!** All documents will be available for download here, and all announcements will be archived here. Make sure your account is set to send you an email for each announcement. <https://gatech.instructure.com/>

Learning Catalytics

We will use Learning Catalytics extensively. Accounts cost \$12 for six months. If you don't already have one, please follow the directions on the “Get your Learning Catalytics account” document (available on Canvas), or go here to purchase an account: <https://learningcatalytics.com/>.

Piazza

We will use the interactive Piazza forum as the primary support for this class. **All questions should be posted to Piazza!** If you email us a question, we will ask you to post it on Piazza. You are welcome to post anonymously, though your identity will be visible to instructors. Students are encouraged to respond to each other's posts—helpful responses *will be noted* and can potentially boost your grade. Posts on Piazza will never hurt your grade. Set up your free account and join our class page by going to piazza.com/gatech/fall2022/bios4401.

PACE instructional cluster (ICE) for RStudio

If you do not wish to download and install RStudio locally on your computer, you may use Georgia Tech's Partnership for an Advanced Computing Environment (PACE) to access a web version of RStudio. Instructions for accessing RStudio via the PACE ICE cluster will be provided.

Grading

Component	Weight
In class exercises	30%
Tests	50%
R homework assignments	20%

Grading Scale

Points $\geq 90\%$ of the total possible points are guaranteed an A, $\geq 80\%$ a B, $\geq 70\%$ a C, etc.

Grading Philosophy

This course covers a lot of material, but the lecture and in-class exercises are designed to prepare you completely for the tests. There will be no surprises. This is *not* a class where tests will ask you to think beyond what you have already practiced in class.

My goal is for every student to earn a good grade in the course. I believe this is possible!

If at any point you are concerned about your performance, especially if you are concerned about failing, please make an appointment to speak with me. I will be happy to strategize with you about how to improve things.

Grade Dispute Policies and Procedures

If you identify a mistake in the grading, please bring it to our attention immediately. Errors identified more than a week after the document is returned (or test is over) may not be reconsidered.

Grading Components

In Class Exercises

Exercises will be delivered during class time through Learning Catalytics. These exercises will reinforce the concepts taught in lecture, and often represent the type of questions that you will see later on the tests. All in class exercises are open book, and working with other students is encouraged. *There will be no make-up opportunities for missed exercises* (see below). If you earn 85% of the total available points, you will automatically get 100% of the points for this component of your final grade.

Tests

This course will have several tests spaced throughout the semester, designed to assess your proficiency on the problem types taught in that section. *Please note that the Test dates indicated on this copy of the syllabus are tentative.*

R Homework Assignments

Homework assignments will require the use of the R statistical computing platform. You are welcome to collaborate with other students to complete these assignments, but all work must be your own. (This means you must perform the work yourself; copying is plagiarism.) If you work with one or more other students, you will be asked to acknowledge your collaboration when you submit the assignment.

Final Exam

There will be no comprehensive final exam for this course, but the last test will take place during our scheduled final exam period.

Missed or Late Assessments

In Class Exercises

There will be no make-up opportunities for in class exercises, but very occasional absences are built into the grading scheme. If you are unable to complete an exercise due to medical (or other critical) reasons, you may be excused from that exercise with a note from the Dean of Students.

Tests

All tests will be announced in advance (*note dates listed on this copy of the syllabus are tentative*). If you have an unavoidable conflict scheduled and will be unable to complete a test in the announced time frame, please get in touch with us as soon as possible and we will work something out. If you miss a test, you will only be able to do a make-up test with an excused absence from the Dean of Students.

Homework Assignments

Late assignments that are turned in before the rest are graded will receive a 50% penalty. Late assignments turned in after the rest are graded will not be accepted.

Office of the Dean of Students: <http://studentlife.gatech.edu/content/services>

Attendance

We will not take attendance in this course.

Collaboration & Group Work

I encourage students to work together at every point in this course, including the in class exercises, homework assignments and study sessions. Three important points:

1. By all means study together, but tests are strictly individual.
2. All assignments are to be completed individually. This means you may collaborate with another student and even compare and change answers. However, each student must complete their own assignment. Copying without collaboration is a form of plagiarism and will be referred to the Office of Student Integrity. All assignments will be graded individually.
3. Homework assignments completed in collaboration with other students must list the names of those collaborators when submitted. You'll be prompted to note your collaborators on these assignments.

Course Expectations & Guidelines

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/>. Any student suspected of plagiarizing will be reported to the Office of Student Integrity.

Accommodations for Individuals with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (often referred to as ADAPTS) at (404) 894-2563 or <http://disabilityservices.gatech.edu/>, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter.

Students requiring extra time on tests will take their tests at the Testing Center and are responsible for scheduling those events in advance. If you don't schedule it in time, we cannot guarantee that we will be able to proctor an extended-time test for you.

Student-Faculty Expectations

At Georgia Tech we believe that it is important to continually strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See <http://www.catalog.gatech.edu/rules/22/> for an articulation of some basic expectations—that you can have of me, and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech, while in this class.

Course Schedule

Date	Anticipated topic *
Tue Aug 23	Introduction to the course
Thu Aug 25	Descriptive statistics
Tue Aug 30	Combinations, permutations, and probability
Thu Sep 1	Introduction to probability distributions
Tue Sep 6	Binomial and poisson distributions
Thu Sep 8	Solving probability statements and introduction to the normal distribution
Tue Sep 13	Normal distribution
Thu Sep 15	Test
Tue Sep 20	Standard normal (z) distribution
Thu Sep 22	Sampling distributions
Tue Sep 27	The central limit theorem
Thu Sep 29	Applications of sampling distributions
Tue Oct 4	Applications of sampling distributions cont'd
Thu Oct 6	Test
Tue Oct 11	Hypothesis testing
Thu Oct 13	Type I and type II errors
Tue Oct 18	Fall break
Thu Oct 20	Hypothesis testing cont'd
Tue Oct 25	The sign test
Thu Oct 27	Wilcoxon signed-rank test
Tue Nov 1	Rank sum test
Thu Nov 3	Other non-parametric tests
Tue Nov 8	Chi-squared extrinsic goodness of fit test
Thu Nov 10	Chi-squared contingency table test
Tue Nov 15	Chi-squared contingency table test cont'd
Thu Nov 17	Test
Tue Nov 22	Unique tests!
Thu Nov 24	Thanksgiving
Tue Nov 29	Introduction to analysis of variance (ANOVA)
Thu Dec 1	ANOVA continued
Tue Dec 6	Linear regression (if we get to it!)
Thu Dec 15	Test **

* Topics are loosely interpreted and are likely to shift over the course of the semester.

** The last test of the semester will not be cumulative. It will take place during our final exam period, Thu Dec 15, 11:20am - 2:10pm. It will be the length of a regular test (so the exam period will give extra time).