

BAT/BE/RNR/EIS 413/513 Applied Biostatistics

(3 credits, live online)

Description of Course

The main aim of this course is to develop a conceptual and practical understanding of introductory statistics through a series of methods, specifically addressed to students specializing in the life sciences. Its primary aims are (1) to show students how statistical reasoning is used in biological, medical, and agricultural research; (2) to enable students to confidently carry out statistical analyses and to interpret the results; and (3) to raise students' awareness of basic statistical issues and provide them necessary statistical training for their research.

Course Prerequisites or Co-requisites

An introductory course on Statistics that covers basic probability distributions and hypothesis testing, e.g., MATH 163 or 263.

Instructor and Contact Information

Dr. Lingling An

E-mail: anling@email.arizona.edu

Lecture meeting: 9:30-10:45am (TT):

<https://arizona.zoom.us/j/86255646509?pwd=VW55QUUpZQVg1cTgwblVROVFKTkxZz09>

Office Hours: 11am – 12pm (Tue) or by appointment via Zoom meeting:

<https://arizona.zoom.us/s/4711375891>

Course website: D2L

Course Objectives and Expected Learning Outcomes

Focus on understanding how design choices drive choice of the appropriate statistical methods for analysis and inference; explore the principles and pitfalls of estimation and hypothesis testing.

Through this course the students will

- learn a fairly large array of statistical tools that will be useful for a wide range of problems
- improve their understanding of statistical reasoning and of measures of uncertainty
- identify appropriate statistical tools to address specific types of scientific questions
- use visualization techniques to explore data
- perform data analysis using R programming
- learn how to translate mountains of computer output into short summary statements
- learn how to present the statistical analysis to a diversely trained audience (**for graduate students only**)
- know the language, the general tools, and the spirit of statistical data analysis, which will make communication with statisticians more effective and beneficial.

Textbook

The statistical sleuth: A course in methods of data analysis, 2nd edition (2002), by Ramsey and Schafer

Recommended Reading

Statistics for the Life Sciences, 5th edition (2016), by Samuels, Witmer, and Schaffner

Introduction to the Practice of Statistics, 9th edition (2017), by Moore, McCabe, and Craig

Software

A free software Rstudio: downloaded from <https://rstudio.com/>

This class is scheduled to be taught in the LIVE ONLINE modality.

- **Meeting Times:** The class will meet TT at 9:30-10:45am via Zoom. Our synchronous meetings will give us the opportunity to communicate efficiently, e.g., your questions can be answered immediately during the lecture time.
- **Class attendance:** Participating in the course and attending lectures are vital to the learning process. Quizzes will be given during the class time.
- **Class Recordings:**
 - Course recordings are being made, please email the instructor in the first week of the class if you do not wish to be identified by name.
- For lecture recordings, which are used at the discretion of the instructor, students must access content in D2L only. Students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulations. Therefore, students accessing unauthorized recordings or using them in a manner inconsistent with UArizona values and educational policies are subject to suspension or civil action.
- If you feel sick, or may have been in contact with someone who is infectious:
 - stay home. Except for seeking medical care, avoid contact with others and do not travel.
 - notify your instructors if you will be missing live online lecture(s).
 - Campus Health is testing for COVID-19. Please call (520) 621-9202 before you visit in person.
 - visit the UArizona COVID-19 page for regular updates.
 - to request a disability-related accommodation, please contact the Disability Resource Center at (520) 621-3268 or drc-info@email.arizona.edu.
- **Academic advising:** If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the Advising Resource Center can guide you toward university resources to help you succeed.
- **Life challenges:** If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at 520-621-2057 or DOS-deanofstudents@email.arizona.edu.
- **Physical and mental-health challenges:** If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520-621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

Makeup Policy for Students Who Register Late

After the first two weeks only one missed assignment and one missed quiz can be made up. The due date is one week after registration.

Assignments, Quizzes, and Examinations

- There will be 8 homework assignments. Permission for late submissions should be obtained from the instructor in advance.
- Quizzes will be given in the beginning of each lecture.
- One midterm exam (in mid of October) and one final exam (in Dec). Both exams will be via zoom meeting.
- One project (**for graduate students only**). Graduate students are required to do a group project. Each group consists of 3 students. They need to perform a comprehensive analysis on ecological, biological, or biomedical data, write a project report, and present their work to the class via zoom meeting. The reports will be due the last day of class and presentations will be on the last week of class. Details will

be posted after the midterm exam.

Grading Scale and Policies

Both the graduate and undergraduate students need to do all homework assignments, take the quizzes, midterm exam and the final exam. The class project is required for graduate students only. Therefore - the distribution of the weight of each component in the final grade for **undergraduate students**:

Quiz: 10%
Homework: 40%
Midterm exam: 25%
Final exam: 25%.

The distribution of the weight of each component in the final grade for **graduate students**:

Quiz: 10%
Homework: 30%
Midterm exam: 25%
Final exam: 25%.
Project: 10%

All students will be evaluated at the grading scale:

A: 90 - 100
B: 80 - 89
C: 70 - 79
D: 60 - 69
E: 0 - 59

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Honors Credit

Students wishing to contract this course for Honors Credit should email me to set up an appointment to discuss the terms of the contract. Information on Honors Contracts can be found at <https://www.honors.arizona.edu/honors-contracts>.

Scheduled Topics/Activities

We will cover most of the topics from chapters 1~ 19 in the textbook.

Week	Topics	Homework due
Week 1	Chapter 1: review basic statistical concepts; introduction to Rstudio	
Week 2	Chapter 2: two-group comparisons using t-tests	
		Hw1
Week 3	Chapter 3: a closer look at assumptions	
Week 4	Chapter 4: non-parametric 2-group comparisons	
		Hw2
Week 5	Chapter 5: comparison among several samples: ANOVA	
Week 6	Chapter 6: linear combinations and multiple comparisons of means	
		Hw3
Week 7	Chapter 7: simple linear regression (SLR)	
Week 8	Chapter 8: closer look at assumptions for SLR	
		Hw 4

Week 9	review; midterm exam	
Week 10	Chapter 9-10: multiple regression (MR)	
		Hw5
Week 11	Chapter 11: model checking and refinement for MR	
Week 12	Chapter 12: strategies for variable selection	
		Hw6
Week 13	Chapter 13: two-way ANOVA	
Week 14	Chapter 18-19: comparisons of proportions or odds; table of counts	
		Hw7
Week 15	Chapter 20-21: logistic regression	
		Hw8
Week 16	Project presentation	
	review & final exam	

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, making phone calls, web surfing, etc.).

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations. For additional information on Disability Resources and reasonable accommodations, please visit <http://drc.arizona.edu/instructors/syllabus-statement>.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for

those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.