

STAT 5412 - Biostatistical Analysis Theory Course Syllabus - Fall 2022

Instructor

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Office Hours: Mon, Wed, Fri | 3:00-4:30 | RAS 113 (and virtual)
Tue, Thu | 10:00-11:30 and 2:00-4:30 | FH 204 (and virtual)
Appointments (face-to-face or virtual) can always be made via e-mail or text.
I also have "Open Door Office Hours". Feel free to come in anytime you see me in my office.

Teaching Assistant

Name: Brooke Bowman
Office: RAS 118
Office Hours: Mon, Wed | 12:00-2:30 (Brooke can also do appointments, and has "open door office hours" as well)
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Course Description

An introduction to statistical concepts and models applied to agricultural and biological systems. The course introduces the scientific method, inferential theory, data types, experiment design, descriptive statistics, the normal distribution, and null hypothesis significance testing (NHST) for these scenarios: one-sample, two-independent-sample, two paired sample, multi-sample 1-way (ANOVA), multiple comparisons, factorial and nested ANOVA, multivariate ANOVA, data transformations, linear regression and correlation, multiple regression and correlation, polynomial regression, goodness of fit, contingency tables, and testing for randomness. Emphasis is on theory and hand-calculations.

Enhanced Course Description

H. G. Wells argued that "statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write." Due to its importance to the everyday person, some (e.g. Arthur Benjamin) are currently advocating for courses in statistics to replace algebra courses in high school.

Statistical proficiency is even more important to the scientist, as good science employs statistical knowledge in *every* step of the scientific method. Statistics is *the* tool used to discern truth from fiction, and science is all about finding the truth. Statistics is so fundamental to sound science, that Karl Pearson described statistics as the "grammar of science." Whether you go on to be a technician, a researcher, a manager, or a professor, the knowledge you gain in this course will be critical to your success.

In the short term, statistical knowledge will inform most decisions you make in each stage of your graduate research, and will in large part affect the success of your research. Then you will be going to job interviews, where a chief complaint from hiring managers of new hires concerns their lack of statistical ability. So please take this course very seriously. Your graduate committee and future employers *will* want to know if you know your statistics!

Let's be frank. Statistics can be an intimidating subject. My promise is to *walk with you every step of the way*. I have been teaching graduate statistics and helping students with their research at Sul Ross since 2015. Prior to coming to Sul Ross, I had 20-years of experience applying statistical principles as an aerospace engineer at NASA for our nation's human spaceflight programs. Life then brought me to West Texas, and I could not be happier. I LOVE teaching statistics, and plan to help each of you become statistically competent by the end of this semester.

Now, let's go delve in and tackle some statistics!

Objectives and Outline

Course Objectives

This course addresses Program Learning Outcome 1 for the M.S. and 1 for the M.Ag. programs, which states that students should be able to apply statistical concepts and procedures to natural resource data. Specific student outcomes will include the following:

1. Knowledge of various data types and the appropriate analysis for each type.
2. Ability to use sample data to estimate population parameters.
3. Ability to calculate measures of central tendency, dispersion, and variability.
4. Ability to calculate probabilities including permutations and combinations.
5. Knowledge of normal distributions, how to assess normality in data, and which statistical methods to use for normal and non-normal data.
6. Knowledge of the scientific method and how to apply it to research.
7. Ability to use parametric and non-parametric methods for hypothesis testing of these scenarios: one-sample, two-independent-sample, two paired sample, multi-sample 1-way (ANOVA), multiple comparisons, factorial and nested ANOVA, multivariate ANOVA, data transformations, linear regression and correlation, multiple regression and correlation, polynomial regression, goodness of fit, contingency tables, and testing for randomness.

Course Outline (Numbers given are the associated chapters in the textbook)

- | | |
|---------------------------------------------------------|-----------------------------------------------------|
| 1. Data: Types and Presentation | 15. <Skipped> |
| 2. Populations and Samples | 16. <Skipped> |
| 3. Measures of Central Tendency | 17. Simple Linear Regression |
| 4. Measures of Variability and Dispersion | 18. <Skipped> |
| 5. Probabilities | 19. Simple Linear Correlation |
| 6. The Normal Distribution | 20. Multiple Regression and Correlation |
| 7. One-Sample Hypotheses | 21. Polynomial Regression |
| 8. Two-Sample Hypotheses | 22. Testing for Goodness of Fit |
| 9. Paired-Sample Hypotheses | 23. Contingency Tables |
| 10. Multisample Hypotheses and the Analysis of Variance | 24. Dichotomous Variables* |
| 11. Multiple Comparisons | 25. Testing for Randomness* |
| 12. Two-Factor Analysis of Variance | 26. Circular Distributions: Descriptive Statistics* |
| 13. Data Transformations | 27. Circular Distributions: Hypothesis Testing* |
| 14. <Skipped> | • Information Theoretic Approaches (AIC) |

Student Learning Objectives for the M.Agr. in Range and Wildlife Management

The graduating student will demonstrate that he/she is able to:

1. Apply statistical concepts and procedures to natural resource data
2. Evaluate literature and references as they apply to the natural resource field
3. Demonstrate their knowledge of the fundamentals and advanced concepts of range and wildlife management.

Student Learning Objectives for the M.S. in Range and Wildlife Management

The graduating student will demonstrate that he/she is able to:

1. Apply statistical concepts and procedures to natural resource data.
2. Evaluate literature and references to substantiate an applied research project.
3. Examine, select, and utilize appropriate resources, materials, and data collection instruments to implement research projects.
4. Justify and defend the research questions and design.

Range and Wildlife Management Marketable Skills, MS

Students will acquire these marketable skills:

1. Students will be able to communicate scientific research results to a wide variety of audiences.
2. Students will be able to analyze a data set with a wide variety of statistics.
3. Students will be able to demonstrate competence in scientific writing – also includes appropriate literature review.

Logistics / Materials / Grading Information / Course Policies

Class Meeting Time/Location

Lecture: MWF 10:00 am -10:50 am
Lab: MWF 11:00 am -11:50 am
Location: RAS 128

Text and Supplies

1. Zar, J. H. 2009. *Biostatistical Analysis*. Fifth edition. Prentice Hall, Inc. Upper Saddle River, NJ. ISBN-13: 978-0131008465. **(Required)**
 - Note that this is an older edition of the book and may be out of print. I do not recommend buying the newer 6th edition.
2. Statistics-capable calculator **(Required)**.
 - **The TI-84 Plus shown on the online SR Bookstore** is listed as "Optional", but it is **HIGHLY RECOMMENDED** as the calculator you use, because the materials we will be using specifically have instructions for the TI-84 family of calculators (TI-84, TI-84 Plus, or TI-84 CE). Color (CE) and silver editions (more memory, more tools) are great but definitely not necessary and not needed for this course.
 - These can be expensive to buy new, so *the NRM department has available a limited supply of TI-84 Plus calculators that students can borrow for the semester, on a first-come-first-served basis*. Students must come in-person to the NRM department to check out a calculator, then return it at the end of the semester. **Failure to return a borrowed calculator will result in a Hold being placed on your SRSU account** until the calculator is returned, or the student has paid SRSU the cost of replacement for a new calculator.
 - If you cannot borrow a calculator from NRM, then many students choose to buy used, which is a great option. It's also possible to rent a calculator (if you go online and google "calculator rental" you'll see several rental options).
 - If you use something other than a TI-84, you may be on your own as far as learning to use it. If you use a TI-83, the instructions in this course will mostly work; you will encounter a few situations where the TI-83 is limited, and I (the instructor) can help you with those issues if the TI-83 is truly your best option.
 - FYI, we will only use this calculator for one semester; next semester for Biostatistical Analysis Applications, we will use computer software instead.

Course Grade

Exam I	20%
Exam II	20%
Exam III	20%
Exam IV (Final Exam)	20%
Homework	20%

Grade Assignment

<60 = F, 60-69 = D, 70-79 = C, 80-89 =B, 90-100 = A.

Readings

The course and its material are organized by chapter. Each chapter has a reading assignment that explains the material. ***The assigned readings are essential; completing 100% of the assigned readings is expected.***

Homework

Late assignments will be accepted at the instructor's discretion, with a **10% penalty per day late** (i.e. 10% for 0-24 hours late, 20% for 24-48 hours late, etc.) Late assignments are not accepted after 7 days.

Exams

Exams are not cumulative in the sense that Exam II does not test the material tested on Exam I, and Exam III does not test material tested on Exams I and II, etc.; however, concepts from throughout in the course will always be needed to complete every exam. **No make-up exams will be given for an unexcused absence. Use of internet-capable devices (e.g. smartphones) is not allowed for exams.**

Participation

- I expect a high level of engagement to enhance everyone's learning. This includes interacting with the instructor and other students, asking questions during class, posting in the Blackboard discussion forums, writing entries in Blackboard journals, attending office hours (in-person and/or online), completing outside of class assignments and readings, and being prepared to participate in class discussions.
- Online participation: Any time you attend class online (via Blackboard Collaborate Ultra), you are required to be properly dressed, avoid video distractions, and keep your microphone muted except to ask questions or request clarification. **Anyone causing distractions may be muted, have their video shut off, and/or removed from the session without warning, at the instructor's discretion.**

Due Dates/Times/Extensions

All graded work, including exams, are expected to be on-time. **No due dates for ANY graded work, including exams, will be extended without PRIOR e-mail arrangements** initiated by the student, and only for valid reasons. **Before an accommodation (e.g. extended due date) can be granted for a COVID-related reason, students are required to first submit the SR COVID-19 Self Report form found at <https://srinfo.sulross.edu/covid-19/self-report/>.**

Academic Integrity

Academic dishonesty hurts everyone and reduces the value of college degrees. Doing someone else's work, presenting the ideas and work of others as your own, submitting the same paper for multiple classes, and/or failing to cite your sources when you utilize the ideas of others, are all examples of academic dishonesty. It is your responsibility to read and understand the university's policy on academic dishonesty in the SRSU Student Handbook, as all violations will be taken seriously and handled through the appropriate university process. The Student Handbook can be found at: <https://www.sulross.edu/wp-content/uploads/2020/09/student-handbook-2019-2020-revision-12.7.2020.pdf> (Academic Honesty is on page 88-89). In addition, please note that plagiarism detection software will be used in this class for written assignments, as well as monitoring software for any online exams. **Any student shown to violate academic integrity will receive no credit (0) for work done and/or may be penalized in accordance with published University Rules.**

Communication

You are required to check your **Sul Ross e-mail and Blackboard announcements several times per week**. I do not use the personal or preferred e-mail addresses that you may have on record with the university.

Attendance

- Students are expected to attend every class. If class must be missed, the student is expected to find out what was missed, and it is advised you obtain any hand-taken notes from a classmate. As much information as possible from lectures (PowerPoints, announcements, etc.) will be posted in Blackboard but it is not guaranteed that everything will make it to Blackboard.
- Roll WILL be taken every lecture for the face-to-face students, attendance will be automatically recorded for those joining live lecture online, and viewing of recorded lectures will also be automatically recorded by Blackboard.
- It is policy of this class to **drop a student with a grade of ``F'' if 9 hours or more of class are missed**. Any time class is missed, for any reason, it will be recorded as an absence. Any time class is missed, for any reason, it will be recorded as an absence, unless an absence can be shown to be due to a college-related event.
- Students are expected to arrive to class on time. If a student is perpetually late, they will be asked to not attend class unless they can arrive on time. If tardiness becomes a problem for the class as a whole, people who arrive late will not be permitted to enter the class. If this stricter policy becomes necessary, there will be an announcement made in class.

General Expectations

Statistics can be a very intimidating subject. However, you cannot survive in the biological sciences without knowing statistics. To maximize learning in this course, we should have some expectations of each other.

I expect from you:

- ASK whenever something is unclear. Preferably in class, as it is likely that others have the same question. **THIS IS YOUR MOST IMPORTANT JOB!**
- ATTEND lecture; be on time as a courtesy to others.
- PARTICIPATE in class.
- READ the required sections from the text. If you come to me with a question and it is clear that you haven't read the book or the lecture notes, I will direct you to the reading first.
- DO all assignments, do them in a timely manner, and ensure I can read them! Parts of assignments that I can't read will not be graded. If you are late with assignments, it prevents me from returning others' assignments until I have yours in-hand.
- BE HONEST in all of your work.

What you can expect from me:

- GIVE 100% effort in teaching you the best I can.
- Make myself AVAILABLE to help outside of class.
- ANSWER all of your questions to the best of my knowledge, and if I don't know the answer I will find out.
- Be FAIR in all grading.
- Provide you with timely, constructive FEEDBACK regarding your work.

Electronics in the Classroom

The use of personal laptops, cell phones, iPads, and other electronic devices can create distractions for learning, both for yourself and others. However, such devices can also be great tools to aid learning. Therefore, using electronic devices for class purposes (e.g. taking notes, working out problems, searching the internet) is allowed in silent mode. If you choose to use electronic devices in class, do so in a professional manner that does not impede others' learning. **The use of internet-capable devices (e.g. smartphones) is not allowed for exams. Headphones will not be allowed in class for any reason.**

Learning Environment and Life

I aim to create a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality, religion, ability, socioeconomic class, age, nationality, etc.). I also understand that the crisis of COVID, economic disparity, and health concerns, or even unexpected life events could impact the conditions necessary for you to succeed. My commitment is to be there for you and help you meet the learning objectives of this course. I do this to demonstrate my commitment to you and to the mission of Sul Ross State University to create an inclusive environment and care for the whole student as part of the Sul Ross Familia. If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you.

Resources and Assistance

SRSU Online Bookstore

The Sul Ross State University Online Bookstore, powered by TextbookX, operates completely online and can be visited at <http://sulross.textbookx.com>. Created in partnership with Akademos, Inc. and powered by TextbookX, Sul Ross' Online Bookstore simplifies the textbook process for students while providing them with a variety of course materials, and physical and digital textbook formats. Students log into the bookstore using their LoboID login, select their materials, checkout, and their materials will be delivered to them via email or shipped via USPS, Fed Ex, or UPS. Information about the on-campus bookstore can be found at <https://www.sulrossbookstore.com/home>.

SRSU Library Services

The Bryan Wildenthal Memorial Library in Alpine offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library's website, <https://library.sulross.edu/>. Off-campus access requires logging in with your LoboID and password. Librarians are a tremendous resource for coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).

Tutoring

SRSU tutoring will be available shortly after the semester starts. Contact Anita Banegas (432-837-8992, abanegas@sulross.edu) or Mabel Garcia (432-837-8629, mag15bf@sulross.edu) to get information or to request an appointment.

Blackboard's Support Desk

If you have any technical issues with Blackboard itself, e.g. if you are having issues submitting a document, getting videos to play, or you are dealing with a technical error in the course, then the Blackboard Support Desk is ready to help you. The support desk is open 24 hours a day, 7 days a week. You can reach the support desk by calling **888-837-6055**, emailing blackboardsupport@sulross.edu, using resources from the Technology Support tab within Blackboard, or clicking the Support Desk graphic on the course homepage. As always, academic questions about course assignments, due dates, and general course questions should be directed to your instructor.

SRSU Disability Services

Sul Ross State University (SRSU) is committed to equal access in compliance with Americans with Disabilities Act of 1973. It is SRSU policy to provide reasonable accommodations to students with documented disabilities. **It is the student's responsibility to initiate a request each semester for each class.** Students seeking accessibility / accommodations services must contact Mary Schwartze Grisham, M.Ed., LPC, SRSU's Accessibility Services Coordinator at 432-837-8203 (please leave a message and they will get back to you as soon as they can during working hours), or e-mail mschwartz@sulross.edu. The office is located on the first floor of Ferguson Hall (Suite 112), and the mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas, 79832.

Tentative Course Schedule (Subject to Change)

Week	Dates	Topic(s)
1	08/22-08/26	Course Introduction Ch 1. Data: Types and Presentation Ch 2. Populations and Samples
2	08/29-09/02	Ch 3. Measures of Central Tendency Ch 4. Measures of Variability and Dispersion Ch 5. Probabilities
3	09/05-09/09	Ch 6. The Normal Distribution
4	09/12-09/16	Ch 6. The Normal Distribution Ch 7. One-Sample Hypotheses
5	09/19-09/23	Ch 7. One-Sample Hypotheses Ch 8. Two-Sample Hypotheses
6	09/26-09/30	Ch 8. Two-Sample Hypotheses EXAM 1 (Ch 1-7)
7	10/03-10/07	Ch 9. Paired-Sample Hypotheses Ch 22. Testing for Goodness of Fit Ch 23. Contingency Tables Ch 10. Multi-sample Hypotheses and the Analysis of Variance
8	10/10-10/14	Ch 10. Multi-sample Hypotheses and the Analysis of Variance EXAM 2 (Ch 8-9, 22-23)
9	10/17-10/21	Ch 11. Multiple Comparisons
10	10/24-10/28	Ch 11. Multiple Comparisons Ch 13. Data Transformations Ch 17. Simple Linear Regression
11	10/31-11/04	Ch 17. Simple Linear Regression Ch 19. Simple Linear Correlation Ch 20. Multiple Regression and Correlation EXAM 3(Ch 10-13)
12	11/07-11/11	Ch 20. Multiple Regression and Correlation Ch 21. Polynomial Regression
13	11/14-11/18	Information Theoretic Approaches (AIC)
14	11/21-11/25	Information Theoretic Approaches (AIC)
15	11/28-12/02	Ch 12. Two-Factor Analysis of Variance EXAM 4 (Ch 12, 17, 19-21, AIC)

Holidays

Labor Day (no classes)

Monday, September 05

Veteran's Day (no classes)

Friday, November 11

Thanksgiving

Wednesday-Friday, November 23-25

Exam Schedule

Exam I (Chapters 1-7)

Monday, September 26 (tentative)

Exam II (Chapters 8-9, 22-23)

Friday, October 14 (tentative)

Exam III (Chapters 10-12)

Wednesday, November 02 (tentative)

Final Exam (Chapters 17-21, AIC)

Friday, December 02 (10:15 a.m. – 12:15 p.m.)