Abstract. STA1403 Probability and Statistics for the Biosciences [TCCN: MATH 2442.] (3-0) 3 hours credit. Prerequisite: MAT 1194 or an equivalent. Probability and statistics from a dynamical perspective, using discrete-time dynamical systems and differential equations to model fundamental stochastic processes such as Markov chains and the Poisson processes important in biomedical applications. Specific topics to be covered include probability theory, conditional probability, Poisson processes, random variables, descriptive statistics, covariance and correlations, the binomial distribution, parameter estimation, hypothesis testing and regression. Meets Monday, Wednesday, and Friday, 9:00–9:50am (BB 3.04.062), 11:00–11:50am (MB 0.302), and 1:00–1:50pm (BB 2.01.14).

1. About the Course

1.1. Course Goals.
- Familiarize students with probabilistic and statistical thinking.
- Acquaint students with basic designs for data collection in survey and experimental settings.
- Conduct basic hypothesis tests using appropriate sampling models and sample sizes.
- Develop simple models for structured data using ANOVA and regression.

1.2. Course Objectives. After completing this course, you will be able to
- explain the importance of recognizing and modeling random processes
- demonstrate the use of conditional probability and Bayes’ Theorem
- identify and manipulate the appropriate model for simple random processes
- design simple plans for collecting data through surveys or experiments
- organize sampled data using both graphical and numerical summaries
- apply sampling distributions for large-sample inference
- design and conduct basic hypothesis tests with specified error probabilities
- describe structured data with an appropriate linear model, and determine the suitability of the model
- prepare data summaries and models using an industry-recognized analysis package

1.3. Textbooks. Primary readings are taken from Elston and Johnson’s Basic Biostatistics for Geneticists and Epidemiologists and Ekström and Sörensen’s Introduction to Statistical Data Analysis for the Life Sciences (ISDALS). These books are freely available online from the UTSA Library. Links to the texts are available on the course website.
1.4. **Computer Software.** Most statistical calculations are too extensive to perform manually; they’re done with computers. In this course, we will do some simple (but intensive) calculation using the R programming system. This software is available in the College of Business Statistics Lab (BB 3.01.16), and can also be freely downloaded and installed on your personal computer. The relevant packages are

- the R programming language [http://www.r-project.org/](http://www.r-project.org/)
- the RStudio development environment [http://www.rstudio.com/products/rstudio/#Desk](http://www.rstudio.com/products/rstudio/#Desk) and
- the MiXTeX typesetting program [http://miktex.org/about](http://miktex.org/about) (only available for Windows)

In combination, these packages allow you to perform sophisticated statistical analyses and compile the results into a formatted report document.

1.5. **Web-Based Interactive Software.** Lectures will include "clicker-style" questions for student response, using the Top Hat system. You can register for Top Hat at their website [https://tophat.com](https://tophat.com) for $24. This is the only cost you should incur for this course.

1.6. **Other Course Materials.** All course materials and schedules are available on [UTSA’s BlackBoard site](https://blackboard.utsa.edu).

1.7. **Office Hours.** (Mondays and Fridays, 2:30–5:00pm, in in the Stats Lab, BB 3.02.16, and by appointment) Office hours are held to help you with the material and me with tracking how well I’m teaching it. I’ll gladly give you homework hints and pointers for other courses.

1.8. **Communicating with the Instructor.** If you have a question and can’t make office hours, either set up an appointment with me, or send the question by BlackBoard e-mail. If you have an emergency of some kind that requires my assistance or forbearance, please include the word EMERGENCY in the title of your e-mail, keeping in mind the definition of “emergency” and the fable of the Boy Who Cried Wolf. However, I will not reply to late night e-mails from procrastinators on the night of a case study due date.

1.9. **Things that Help.**

1.9.1. **Calculator.** You will need a scientific calculator for lectures, class exercises, online exercises, and the final exam. It need not be very sophisticated, but it should be able to calculate logs, exponentials, square roots, and factorials.

1.9.2. **Computer Storage Media.** Course materials are provided as PDFs or spreadsheets on the course BlackBoard site. Case studies require simple R programs to analyze data. For all of these, you will need some sort of removable medium, e.g. a flash drive, to save your course work. Don’t make yourself unhappy by saving your files on a university lab computer or “cloud” server; it’s difficult to find it later, and may be inaccessible to the programs you are using.
2. Course Work

*Eighty percent of success is showing up.* –Woody Allen

2.1. Grading. Grades are assigned by point totals.

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<td>class exercises (12)</td>
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<td>in-lecture questions</td>
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<td>online quizzes (5)</td>
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<td>case studies (5)</td>
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You must accumulate at least 650 points to pass this course; the minimum passing grade is a C. Minimum point requirements for grades are C - 650, B - 775, A - 900. Letter grades will be published on the BlackBoard web site after the third week and after the final exam. If you have a failing grade after the third week, this is a clear indication that you are not able to apply sufficient resources to successfully complete the course, and you should drop.

*A man wandering in downtown Manhattan stops a fellow carrying a clarinet case and asks him, “Excuse me, how can I get to Carnegie Hall?”*

“Practice!” replies the musician.

2.2. Classroom Exercises (**Not at home** work). During some class meetings you will work in small groups to solve a set of problems suggested by the lectures. You should discuss and attempt to resolve any technical questions about problem-solving within your group before asking me for help. Each group will mark their solutions on the answer form provided. If you miss a class exercise, an online version of the same exercise will be available to you via BlackBoard. You have two from the exercise date to complete it online.

2.3. Online Exercises. Each topic area has a companion online exercise on BlackBoard. Each exercise is a set of computational or multiple-choice questions drawn at random from a larger test bank. You may attempt each exercise an unlimited number of times; your highest score will be recorded as the exercise grade. Careful! Each attempt gets a new set of questions.

2.4. Case Studies. Case studies are analysis problems from the textbook and readings, intended to apply the basic computational and inference skills you are learning in this course and its prerequisite. These are due by midnight on Fridays (see the schedule). Late submissions may be made until midnight Saturdays, after which time submissions will be closed.

2.4.1. Format. Case studies write-ups should form a **coherent narrative**, with explanatory comments for calculations. The report should have this basic organization:

**Title:** case study name, your name, date of report

**Abstract:** a brief problem description (in your words, not mine), and a summary of your analysis and findings
Data: a meaningful data summary, either numeric or graphical, with comments on any interesting features of the data

Analysis: a brief explanation of each technique used to address the research problem, and the detailed outcome of its use

Results: a detailed description, including appropriate graphics or tables, of your analysis outcomes.

References: a short bibliography of any outside sources used to provide data or analysis methods

Edit your report just as you would an essay or term paper; there should be no sentence fragments, unlabeled graphs, misaligned tables, or meandering blather.

2.4.2. Submission. Submit your report via BlackBoard through the page containing the case study. Be sure to include your name in the document, but DO NOT include your student identification or Social Security account number. Each report should be a concise document contained in a single PDF, HTML, or DOC format file. Usually you will generate these documents using the rMarkdown tool. Do not submit your write-up in source code, graphics file, or ZIP format; I will return it to you with a grade of 1 point. I will attempt to grade early submissions as they arrive, so you can resubmit the assignment with corrections. However, I will only accept 3 submissions of any assignment, so get it right.

2.4.3. Solutions. Sample solutions will be posted to the course web site on the day after late submissions close, usually on Mondays.

2.5. Exams. Exams have problems similar to those in the classroom exercises. You will need pencils, and eraser, a calculator, and a large-format bluebook. You may bring a single 3 × 5” formula card to the exam. Exam results will be posted to BlackBoard two days after the exam date.

2.6. Extra Credit. There will be several opportunities throughout the semester to earn extra credit. You can earn up to 10 points for attending a statistics or computational biology colloquium and writing a brief report on it. Other extra-credit opportunities will be announced in class. Extra credit write-ups are due no later than the Friday of the week following the assignment or event, and should be submitted via BlackBoard in the Extra Credit discussions.
3. Class Policies

3.1. Attendance. Class attendance is important, since this is where the difficult material will be explained. However, attendance is not graded. A sign-in roster will be passed around at the beginning of each class; be sure to initial it. This roster tells me (a) if you’ve been attending class, (b) when you stopped attending if you drop out, and (c) whether you’re present in the event of an emergency. If I am more than 5 minutes late to the lecture, you should assume I have been unavoidably detained, and the lecture is cancelled.

3.2. Tardiness. You are not always the master of your own schedule. If you must arrive late, or depart early, from class, please do so in an orderly and unobtrusive manner; you won’t hurt my feelings. If coming in late, pick up any handouts for the day from the stack by the door.

3.3. Behavior. Your class behavior should be courteous, relaxed, and participative. You are expected to assist in maintaining an environment that is conducive to learning. To assure everyone has an opportunity to gain from time in class, do not engage in any form of distraction. Should you feel compelled to engage with the internet or social media instead of the lecture, please sit in one of the back two rows of the classroom, where you may be safely ignored. If you behave inappropriately, you will be, at a minimum, asked to leave class. You are encouraged to ask any and all questions about the material, including fishing for hints about the case studies. If a proof or calculation in lecture is unclear or has an error, sing out! If you have question about outside material that is relevant, feel free to ask that as well.

3.4. Enrollment. Enrollment in class is your responsibility. If you’re not enrolled, it is a violation of Texas law for you to attend classes. There are no automatic drops for course non-attendance. If you do not drop, and fail to complete sufficient course work, you will receive a failing grade.

4. University Policies and Services

4.1. Right to Privacy. Except under specific exceptions provided in the Family Education Rights and Privacy Act of 1974, I will not give information concerning your grades, academic progress, attendance, address, phone, or email to anyone outside the UTSA system unless you give your prior written permission. I will not give or discuss grade information over the phone or via email.

4.2. Plagiarism. Graded assignments which I consider substantially identical will be reported as scholastic dishonesty and processed according to Section 2.37 of the UTSA Handbook of Operating Procedures.

4.3. Campus Concealed Carry. Students possessing a Concealed Handgun License who exercise their right to carry should read and understand the UTSA Campus Carry Policy. The very first policy item "Campus storage for weapons will not be provided by UTSA" reflects an institutional aversion towards concealed carry. I advise any qualified student who carries to behave circumspectly to be safe and avoid pretexts for infringements of our Second Amendment rights. More simply stated: CONCEALED MEANS CONCEALED, and shut up about it. And carrying with a chambered round is just stupid.
4.4. **Additional Policies and Services.** are described here:

- Counseling Services - [http://utsa.edu/counsel/](http://utsa.edu/counsel/)
- Student Code of Conduct and Scholastic Dishonesty - [http://utsa.edu/infoguide/appendices/b.html#sd](http://utsa.edu/infoguide/appendices/b.html#sd)
- Students with Disability Services - [www.utsa.edu/disability](http://www.utsa.edu/disability)
- Supplemental Instruction Services - [http://utsa.edu/trcss/si/](http://utsa.edu/trcss/si/)
- Transitory/Minor Medical Issues - [http://provost.utsa.edu/syllabus.asp](http://provost.utsa.edu/syllabus.asp)
- Tutoring Services Toms Rivera Center - [http://utsa.edu/trcss/tutoring/](http://utsa.edu/trcss/tutoring/)
- The Roadrunner Creed - [https://utsa.edu/about/creed/](https://utsa.edu/about/creed/)

5. **Changes**

This syllabus is provided for informational purposes regarding anticipated course content and schedule of courses. It is based upon the most recent information available on the date of its issuance and is as accurate and complete as possible. I reserve the right to make any changes necessary and/or appropriate. I will make every effort to communicate any changes in a timely manner. Students are responsible for the awareness of these changes.
6. FREQUENTLY ASKED QUESTIONS

6.1. Can I turn my homework in late? Only until midnight of the Sunday after the due date. It’s posted at least a week in advance; how much lead time do you need?

6.2. I didn’t attend class last time. Did I miss anything important? Yes. Many instructors try to encourage class participation by telling students to be uninhibited about asking questions. “There are no stupid questions,” they say. What a crock. “Did I miss anything important?” is the original stupid question.

6.3. Is class attendance mandatory? No. This is not high school. If you miss a class, I assume you had another commitment with a higher priority, and that you will do the reading and study necessary to catch up. If you chronically miss class, I assume you’ve lost interest in the course, and are willing to settle for a less than excellent–perhaps even less than passing–grade.


6.5. I wasn’t in class for the last exercise. How can I make it up? An online version will be posted to BlackBoard on the day of the exercise; you will have two weeks to complete it. You can attempt it up to 3 times, and it will be automatically graded and entered into the course grade book. Don’t dawdle.

6.6. I haven’t taken an R programming course. Do I have to use R for the case studies? Unless you’re competent with another comparable analysis package, e.g. MATLAB, SAS, SPSS, or JMP, then yes. I suspect you didn’t take a semester course to learn to operate your cellphone, so you do have the ability to read instructions–and online helps–to learn on your own; so get crackin’.