Statistics for Engineers and Scientists, MATH 3351

Meeting Times: 1:25-2:20 pm MWF in RBN 3039

Last day to withdraw: Monday, March 31, 2025

Instructor: Nathan Smith

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Office Hours: Tentatively 11:15-12:10 MWF

Text: *Statistics for technology: a course in applied statistics, 3rd ed., revised*, by Christopher Chatfield. ISBN 0-412-25340-2.

Course Topics: Descriptive statistics, probability and probability models, and infererential statistics. We will cover basic confidence intervals and hypothesis testing, as well as linear regression and analysis of variance.

Student Learning Outcomes: By the end of the course students should be able to:

- Determine probabilities for discrete random variables from probability mass func tions and for continuous random variables from probability density functions, and use cumulative distribution functions in both cases;
- Calculate means and variances for discrete and continuous random variables;
- Select an appropriate probability distribution to calculate probabilities in specific applications;
- Understand statistics and the central limit theorem;
- Perform hypothesis tests and construct confidence intervals on the mean or variance of a normal distribution;
- Explain and use the relationship between confidence intervals and hypothesis tests;
- Perform hypothesis tests and construct confidence intervals involving two samples;
- Understand how the analysis of variance can be used in an experiment to compare several means; and
- Use simple linear or multiple linear regression for building empirical models of engineering and scientific data.

Grading:

You are required to take three tests and a comprehensive final exam for the semeseter. On each of these you will receive a curved score out of 100. The computation of your semester grade will be according to the formula

$$\frac{1}{5}T_1 + \frac{1}{5}T_2 + \frac{1}{5}T_3 + \frac{2}{5}F.$$

Over the course of the semester I will be offering you four opportunities to take your three tests (I'll call these test 1, test 2, test 3, and test 4). So if, say, by late April, when you've got a team project due in your engineering class on heat exchange, and a thirteen page paper on the symbolism and themes from Genesis in Steinbeck's *East of Eden* due in your English class, and a test in Chemistry and one in Physics, and let's not even talk about what your mean old Differential Equations teacher is making you do, and if you're happy with your grades on the first three tests, then you won't have to take the fourth test. On the other hand, if you decide to call things off with your significant other a week or so in front of Valentine's Day beacuse, as a student, you'd like to save money on a gift, figuring that you can always patch things up before spring break, but instead your ex best friend slides right in and, distraught, your score on test 1 wasn't what you'd like it to have been, you've got a chance to redeem your grade, if not your love life, with test 4.

Additionally, if your score on the final is lower than one of your four test grades (I assume you'll be pretty busy in late April and a little overwhelmed by all of your classes, see the list above), I will use the formula

$$\frac{1}{5}T_1 + \frac{1}{5}T_2 + \frac{1}{5}T_3 + \frac{1}{5}T4 + \frac{1}{5}F,$$

giving you a break on the final exam pressure. The only thing I ask in return for all of this opportunity and flexibility is that we not do make-up exams; if you have to go help your Great Aunt Phyllis move and it has to be on test day, or if you're in the hospital laid up with the newly discovered Oppossom flu, or you've been captured by a mysterious drone attack, swept up off of the ground in some Spider Man type net, whatever it happens to be, we'll just use your scores on the other three tests.

Attendance: In order for a student to be successful at meeting the student learning outcomes listed above the student must be present. I will be posting things we do in class on canvas for students who need to miss class to access. Obviously if you are ill with coronavirus or tuberculosis or something you shouldn't be coming to class and we'll need to make accommodations, but I have no intention of broadcasting every class on canvas this semester.

Student Academic Conduct: It is your responsibility to learn the material in this course for your own benefit. You should not let this discourage you from working together on your homework but in the end what you turn in should reflect your understanding, not just be copied from someone else. *During the tests, a code of honor will apply under which students are to work alone and neither give help to others nor receive help from any sources.* Students are also expected to help enforce this code. Students are encouraged to obtain a copy of

A Student Guide to Conduct and Discipline at UT Tyler, available in the Office of Student Affairs.

Artificial Intelligence: UT Tyler is committed to exploring and using artificial intelligence (AI) tools as appropriate for the discipline and task undertaken. We encourage discussing AI tools' ethical, societal, philosophical, and disciplinary implications. All uses of AI should be acknowledged as this aligns with our commitment to honor and integrity, as noted in UT Tyler's Honor Code. Faculty and students must not use protected information, data, or copyrighted materials when using any AI tool. Additionally, users should be aware that AI tools rely on predictive models to generate content that may appear correct but is sometimes shown to be incomplete, inaccurate, taken without attribution from other sources, and/or biased. Consequently, an AI tool should not be considered a substitute for traditional approaches to research. You are ultimately responsible for the quality and content of the information you submit. Misusing AI tools that violate the guidelines specified for this course (see below) is considered a breach of academic integrity. The student will be subject to disciplinary actions as outlined in UT Tyler's Academic Integrity Policy.

For this course, you may not use AI tools to produce anything turned in for a grade.

University Policies: We will follow all University policies concerning Withdrawing from Class, Final Exmas, Incomplete Grades, Grade Appeals, Disability/Accessibility Services, Military Affiliated Students, Academic Honesty and Academic Misconduct, FERPA, Covid, Absences, and Campus Carry. See canvas for details (https://uttyler.instructure.com/courses/34488/pages/university-policies-and-information).

Outline

- Summarizing and displaying data
  - graphical summary of data
  - numerical summary of data
- Probability
  - probability spaces and events
  - counting, permutations and combinations
  - random variables
- Discrete random variables
  - discrete and bernouli
  - binomial
  - binomial mean and varianca
  - poisson
  - bivariate distributions
- Continuous random variables
  - definitions, mean and variance
  - normal
  - exponential
  - bivariate distributions
- Estimation
  - point and interval estimation
  - properties of $E(X)$
  - sampling distributions for $\overline{x}$
  - sampling distributions for s^2
  - interval estimation
- Significance tests
  - introduction to significance tests
  - single mean tests

  - tests for two means
  - the paired t-test
  - χ^2 tests for goodness of fit
  - F tests
- Regression
  - simple linear regression
  - confidence intervals
  - r^2
  - multiple regression
- Analysis of Variance
  - One way anova
  - Two way anova
- Time permitting we will explore other topics according to student interest.