Texas A&M University-Corpus Christi  
Department of Mathematics and Statistics  
MATH 5315.W01 and MATH 5315.W11  
Statistical Methods in Research I  
Fall, 2011

1 Course Information

Lecture  
Lectures will be prerecorded and may be viewed at any time.

Lab  
Lab meetings will require my live participation and are currently scheduled MW 5-6 pm.

Professor  
Dr. Blair Sterba-Boatwright

Office  
CI 306

Phone  
361-825-2724 (however, e-mail generally works better)

E-mail  
blair.sterbaboatwright@tamucc.edu  
I usually respond to student questions quickly if I’m online, and nearly always within 24 hours on weekdays unless something unusual occurs. Some weekends I’ll be generally available, some weekends I won’t.

ClassURL  
I will be using a Blackboard 9 page for this course. You can log on by going to bb9.tamucc.edu

Office Hrs  
I will be using Skype and/or Saba Centra for office hours. I don’t know the TAMU-G schedule well enough to know what times would be most open for students, so for now, let’s say online office hours will be TR 11-12. However, I am open to changing these. Also, if you need to contact me outside of office hours and want to talk “face-to-face”, you’re welcome to send me an e-mail and if I’m available I’ll start up Skype.

2 Course Description

This course is for graduate students in disciplines other than MATH in the College of Science and Technology, and is designed to prepare them to use statistical methods in their research. This is a non-calculus exposition of the concepts, methods and usage of statistical data collection and analysis. Topics include descriptive statistics, the t-test, one and two-way analysis of variance, multiple comparison tests and multiple regression. Students also learn how to conduct this analyses using computer software, how to read other people’s statistical work, and how to properly report their findings.

3 Prerequisites

MATH 1442 or other undergraduate statistics course or equivalent.
4 Text and Other Supplies

Texts (Recommended)

Some students feel that my lecture notes are complete enough to suffice as a reference for this course. However, I don’t feel they would constitute an adequate reference for your entire professional career. Therefore, depending on your budget, I recommend that you get some of the following books, if not for this semester, then for the future:

- Gotelli, N. J. and Ellison, A. M. (2004) *A Primer of Ecological Statistics*, Sinauer Associates, ISBN 978-0-87893-269-6. This is the book on which my lecture notes are based. This is an excellent introduction to statistics, particularly (as the title indicates) for ecologists, but does not cover nearly as much material as Quinn and Keough. It includes several chapters that I won’t discuss much or at all, including a couple on designing field experiments.

- Quinn, G. P. and Keough, M. J. (2002) *Experimental Design and Data Analysis for Biologists*. Cambridge University Press. ISBN 978-0-521-00976-8. This is a much more extensive coverage of statistics than Gotelli and Ellison, and is the text we use for Stats II, if you’re heading for that course. It is also probably the best reference book of the three I’ll mention. However, I don’t think it’s as good a text for a first semester course as Gotelli and Ellison, primarily because it moves a little fast for beginners and because the early chapters are not organized the way I’d do it.

- Logan, M. (2010) *Biostatistical Design and Analysis Using R: A Practical Guide*, Wiley-Blackwell. ISBN 978-1-4051-9008-4. This is a useful reference work for R, the statistical package we’ll be using. There is a very nuts-and-bolts set of guidelines at the end of each chapter that may help you organize your analysis, although I think there’s enough of an art to it that I rarely follow these guidelines exactly myself. He also has detailed worked examples (which I will occasionally steal). He talks briefly about the statistics in each chapter, but not in enough detail for this to be useful as a stand-alone textbook.

Software

We will be using the statistical package R. This is open source and may be downloaded for free. To get your own copy: go to [www.cran.r-project.org](http://www.cran.r-project.org) and download your favorite flavor. While there, go to the Manuals link on the left and also download the Introduction to R

- Advantages compared to SAS and SPSS: open source package with worldwide community contributing new routines all the time, easiest to install at home or on a thumb drive so very portable, gaining popularity, most flexible package, best graphics, best for simulation, available in all platforms (Mac, Windows, Linux)

- Disadvantages compared to SAS and SPSS: not menu driven, more difficult to learn without a programming background, can be difficult to find what you want in the help files, treatment of mixed models is more difficult (although arguably more modern)
5 Student Learning Outcomes

Probability and distributions
- Students will understand the derivation of important discrete distributions based on the axioms and elementary rules of probability
- Students will analyze experimental situations to determine which discrete distribution is applicable, and will be able to diagnose and adjust for erroneous choices
- Students will decide if given samples can be successfully modeled with normal distributions, and will be able to choose among several elementary transformations to increase normality

Summary statistics and confidence intervals
- Students will use graphs and summary calculations to make preliminary investigations of datasets
- Students will compute confidence intervals using classical methods based on the Central Limit Theorem and using bootstrapping techniques

Conceptual framework for design and analysis of experiments
- Students will understand three approaches to analysis of experiments: hypothesis testing based on Monte Carlo techniques; hypothesis testing based on frequentist techniques; and Bayesian analysis
- Students will be able to analyze descriptions of experiments to determine appropriate statistical experimental design.

Three important types of statistical analysis:

Regression
- Students will be able to diagnose situations in which regression is the appropriate statistical tool.
- Students will be able to use R to perform all relevant statistical calculations for a regression.
- Students will be able to diagnose and correct problems with regression models.

ANOVA
- Students will be able to diagnose situations in which ANOVA is the appropriate statistical tool.
- Students will be able to use R to perform all relevant statistical calculations for an ANOVA.
- Students will be able to diagnose and correct problems with ANOVA models.
- Students will be able to perform and interpret post-hoc tests for one-way ANOVAs.
Analyzing categorical data

- Students will be able to diagnose situations in which contingency table and goodness of fit tests are appropriate statistical tools.
- Students will be able to use R to perform all relevant statistical calculations for contingency tables and goodness of fit tests.

6 Instructional Methods and Activities

Methods for instruction include the following:

- Lecture
- Use of computer resources, including statistical software, spreadsheets, and the Internet for data location, data organization, and data analysis
- During a few weeks, “lab” time may be replaced by additional lecture

7 Evaluation and Grade Assignment

Methods of evaluation and the criteria for grade assignments are as follows:

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<tr>
<th>Type of Assignment</th>
<th>Weighting in Final Grade</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Homework</td>
<td>25%</td>
<td>Consultation with your classmates is OK but work you submit should be individual. Homework will be done by e-mail.</td>
</tr>
<tr>
<td>Three semester tests</td>
<td>25% each</td>
<td>Tests will be two hours long. You may use open notes, book, computer. I will make sure I’m available online in case you have questions during the course of the test. I’m not sure yet how they will be proctored in Galveston, so dates and times are currently up in the air. The tests will be somewhere around Wednesday Sept. 28, somewhere around Wednesday Nov. 2 and sometime during the week of Dec. 12.</td>
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Based on the above, grades will be assigned according to the following scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Average</th>
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<tbody>
<tr>
<td>A</td>
<td>85-100</td>
</tr>
<tr>
<td>B</td>
<td>72-84</td>
</tr>
<tr>
<td>C</td>
<td>59-71</td>
</tr>
<tr>
<td>D</td>
<td>46-58</td>
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<tr>
<td>F</td>
<td>0-45</td>
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8 Tentative Course Schedule

**Week_1** Introduction to course and software; Gotelli and Ellison, Chapter 1

**Week_2** Lecture: Gotelli and Ellison, Chapter 1; Lab: R as probability calculator

**Week_3** Lecture: Gotelli and Ellison, Chapter 2; Lab: Handling data in R

**Week_4** Lecture: Gotelli and Ellison, Chapter 2 (continued); Lab: Graphs in R

**Week_5** Lecture: Gotelli and Ellison, Chapter 3; Lab: Confidence Intervals in R

**Week_6** Lecture: Gotelli and Ellison, Chapter 4; Lab: Test 1

**Week_7** Lecture: Gotelli and Ellison, Chapter 5; Lab: t-tests in R

**Week_8** Lecture: Gotelli and Ellison, Chapter 5 (continued); Lab: t-tests in R

**Week_9** Lecture: Gotelli and Ellison, Chapters 6 & 8; Lab: Monte Carlo methods

**Week_10** Lecture: Gotelli and Ellison, Chapter 9; Lab: Monte Carlo methods (continued)

**Week_11** Lecture: Gotelli and Ellison, Chapter 9 (continued); Lab: Test 2

**Week_12** Lecture: Gotelli and Ellison, Chapters 9 (continued) & 10; Lab: Regression

**Week_13** Lecture: Gotelli and Ellison, Chapter 10 (continued); Lab: Regression (continued)

**Week_14** Lecture: Gotelli and Ellison, Chapter 10 (continued); Lab: ANOVA

**Week_15** Lecture: Gotelli and Ellison, Chapter 11; Lab: ANOVA (continued)

**Week_16** Lecture: slush factor; Lab: N/A

9 Class Policies

- If you are unable to attend a test and you wish to make it up, I need to hear from you no later than 24 hours after the missed test. You should be able to provide adequate documentation of why your absence was necessary. If you wait more than 24 hours to contact me, you will also need to provide adequate documentation of why you were unable to meet the 24-hour deadline. As an example, “I was called out of town unexpectedly on business” might be a valid reason to miss a test, but it is not an adequate reason to miss the 24-hour notification requirement.

- A grade of I (Incomplete) will only be given in exceptional circumstances, such as a death in the family or personal injury that might prevent someone from taking the final exam. In this case, it is the responsibility of the student to notify me as soon as possible, preferably by e-mail, and to complete the required "Incomplete Form" available from the University Registrar. If this is not done, a score of 0% will be assigned for any incomplete tests and a final grade will be computed using the criteria described above.
• University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a grade of 0% on that assignment or test.

• Although obviously I hope all goes smoothly for you this semester, events can sometimes occur that make dropping a course necessary or wise. I encourage you to consult with me before you decide to drop to be sure it is the best thing to do. Should dropping the course be the best course of action, you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form. Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Friday, November 4, is the last day to drop a class with an automatic grade of “W” this term.

10 University Statements

Grade Appeals

As stated in University Rule 13.02.99.C2, Student Grade Appeals, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Rule 13.02.99.C2, Student Grade Appeals, and University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules Web site at http://www.tamucc.edu/provost/university_rules/index.html For assistance and/or guidance in the grade appeal process, students may contact the Office of Student Affairs at (361) 825-2612, by e-mail at student.affairs@tamucc.edu or in person at UC 318.

Disability Accommodation

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call or visit Disability Services at (361) 825-5816 in Driftwood 101.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.
Classroom/Professional Behavior

Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.