Texas A&M University-Corpus Christi
Department of Mathematics and Statistics
MATH 6315, Sections .001, .211, .G01 and .G11
Statistical Methods in Research I
Fall, 2014

1 Course Information

Meetings

Section .001, Lecture: MW 8:00-8:50, IH 268
Section .211, Lab: MW 9:00-9:50, CCH 204
Sections .G01 and Lab Section .G11: online

Professor Dr. Blair Sterba-Boatwright

Office CI 312

Phone My office phone is 361-825-2724; my Skype address is ber26nard, but I don’t tend to keep Skype open so make sure I know you intend to call before trying.

E-mail <blair.sterbaboatwright@tamucc.edu> This is the best way to contact me. I try to answer e-mails within 24 hours, except for Friday night through Sunday noon. When I think it appropriate, I will forward e-mail questions and answers to the entire class (without including your name!) when I answer them.

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

OfficeHrs MW 3:30-5:30 pm; T 1-3 pm; other times by appointment. I am happy to set up Webex web conferences if you prefer that to coming to my office. Also, I am frequently available in my cubbyhole in the Center for Coastal Studies on Thursdays and Fridays.

2 Course Description

This course is for graduate students in disciplines other than MATH in the College of Science and Engineering, 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 these 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. (2012) *A Primer of Ecological Statistics*, 2nd ed., Sinauer Associates, ISBN-13: 978-1605350646. 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. Also, I think a few of their recommendations are becoming dated as new statistical techniques have become more mainstream since the book was written.

- Dalgaard, P. (2008) *Introductory Statistics with R*, 2nd edition. Springer-Verlag. As you can tell by the title, this book covers both how to use R and statistics, but the first two chapters are purely about R. Unlike the other two books, it’s not aimed primarily at biologists. I will not be using this book in the course, but it’s a good reference for aspects of R.

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. Also, go to [<http://www.rstudio.com/products/rstudio/download/>](http://www.rstudio.com/products/rstudio/download/) to download a copy of RStudio; it’ll make using R easier, particularly if you use Windows.

- 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:

<table>
<thead>
<tr>
<th>Type of Assignment</th>
<th>Weighting in Final Grade</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>25%</td>
<td>Consultation OK but submission should be individual</td>
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</table>
| Three semester tests | 25% each                 | • Tests will be two hours long.  
                        |                          | • Tests for sections .001/.211 will take place in CCH 204 from 8-10 am; specific times for tests for sections .G01/.G11 are TBA but in the past were usually 10 am-noon.  
                        |                          | • Tests are open notes, book, computer.  
                        |                          | • The first two tests will be Wednesday Oct 8 and Wednesday Nov 10.  
                        |                          | • For sections .001/.211, the third test will be given during the Final Exam period for the Lab, which is 8:00-10:30 am, Monday, Dec. 8. For sections .G01/.G11, the third test date/time is TBA. |

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>88-100</td>
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<tr>
<td>B</td>
<td>76-87</td>
</tr>
<tr>
<td>C</td>
<td>64-75</td>
</tr>
<tr>
<td>D</td>
<td>53-63</td>
</tr>
<tr>
<td>F</td>
<td>0-52</td>
</tr>
</tbody>
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8 Tentative Course Schedule

**Week_1** Introduction to course; lecture: Gotelli and Ellison, Chapter 1; Lab: Intro to R

**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)

9 Class Policies

Timeliness

It is your responsibility to keep track of course deadlines and due dates. In particular:

- Homework assignments show up on Blackboard; I also announce due dates in class. “I didn’t know it was due” is not a valid excuse.

- 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.

- The end of the semester is a busy time for me as well as you, and I do not have time to proctor final exams outside the assigned schedule. Please do not approach me with stories of non-refundable plane tickets, asking for a separate exam time. The exam schedule for this semester was posted in plenty of time for you to make the correct flight arrangements. I will only consider alternate exam times if either (i) you have three finals scheduled for the same day and invoke the University’s rule allowing you to reschedule one of them; or (ii) you have a legitimate academic or professional conflict with the scheduled time. If one of these situations applies to you, please give me adequate notice to work out an alternate time.

Incompletes

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 test. 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.

Academic Continuity

In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi, this course will continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

Dropping the Course

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, Nov. 7, is the last day to drop a class with an automatic grade of “W” this term.

10 University Statements

Academic Integrity/Plagiarism

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.

Grade Appeals (College of Science and Engineering Version)

As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, 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 Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at <http://www.tamucc.edu/provost/university_rules/index.html>, and the College of Science and Engineering Grade Appeals webpage (<http://sci.tamucc.edu/students/GradeAppeal.html>). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

Disabilities Accommodations

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 Corpus Christi Hall 116.

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.