

**Advanced Statistical Applications using R  
Applied Multivariate Statistics  
ENTX 6300 - 001**

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Time – Weds, 1-4 pm  
Experimental Sciences Rm 301

**COURSE INFORMATION**

*Web page:* <http://www.tiehh.ttu.edu/scox/>  
*Office hours:* MW 9-10; other times by appointment

**1. Purpose**

The primary goal of this course is to explore advanced topics in statistics that are relevant to the environmental sciences in general, and, more specifically, that are relevant to your own research. In particular, we will be focusing on the analysis of multivariate ecological data, emphasizing data typical of 454 pyrosequencing studies in microbial ecology. To accomplish this, we will be using the R statistical programming package. It can be downloaded at <http://cran.r-project.org>. Details about R, documentation, extended statistical routines and datasets (in the form of R 'packages'), and other helpful information, also can be found there.

**2. Prerequisite**

ENTX 6385 or equivalent. This course assumes a working knowledge of applied statistics (including topics such as statistical distributions, hypothesis testing, anova, and regression).

**3. Textbooks**

**a. Required:**

- i. No Textbook will be required. Materials will be handed out when appropriate.

**b. Good References for R:**

- i. *An Introduction to R*. Free to download at <http://cran.r-project.org/doc/manuals/R-intro.pdf>
- ii. Dalgaard, P. 2002. *Introductory Statistics with R*. Springer-Verlag. ISBN 0-387-95475-9.
- iii. Venables, W. N. and B. D. Ripley. 2002. *Modern Applied Statistics with S*. Springer. ISBN 0-387-95457-0.

**4. Expected Learning Outcomes**

This class primarily will be based on an "individual-studies" model of instruction and will not follow a formal lecture-based format. Think of statistics as a philosophical approach to evaluating your observations of the real world. As such, it is a tool that helps you interpret your observations. As with any tool – the only way to become adept at using it is to, well, use it! That is what we will do as a group. My role as the instructor is to provide guidance and help you avoid some common mistakes; however, we will all be learning from each other.

The primary goal of this course is to assure that you:

- a. are comfortable with the application of a variety of multivariate statistical methods, including hypothesis tests (e.g., MANOVA/DFA), indirect gradient analyses (e.g., PCA, CA), and direct gradient analyses (e.g., CCA),
- b. can identify situations (based on the scientific questions being addressed) in which each of the above analyses may be appropriate, and
- c. are familiar with the use of the R statistical programming environment, including the ability to import, manage, plot, and analyze data.

**5. Specific Course Requirements and Policies**

**\*\*ALL STUDENTS MUST BRING A LAPTOP COMPUTER TO CLASS EACH WEEK\*\***

Your mastery of the above outcomes will be assessed based on participation in weekly computer lab exercises and homework/lab problem sets (approximately weekly). Homework/Lab assignments will require you to work out particular problems and appropriately interpret results. You will also have the opportunity to present one lecture on a topic of your choice to your peers. Grades will be based on individual performance. There will be no curve. Grades will be determined by the following breakdown:

- 50% Weekly Problem Sets
- 25% Student Lecture(s)
- 25% Final

**Student Lectures:** Student lectures will focus on a particular multivariate technique, and may utilize powerpoint, presentation via marker/chalk board, handouts, and interactive R sessions. All lectures should address the following:

1. The conceptual background for the technique
  - a. When is it appropriate to use (what sort of data, what questions, etc.)?
  - b. How does it work?
  - c. What are its strengths/weaknesses?
  - d. What other techniques are similar?
  - e. References?
2. The implementation of the technique in R
  - a. What functions/packages are necessary?
  - b. What is the syntax?
3. A worked out example
4. A set of homework problems that emphasize the major points in 1 and 2.

## 6. Attendance

Attendance will not be monitored; however, it is highly unlikely that any student will be successful without attending class.

## 7. Various

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**Observance of a Religious Holy Day** - Texas House Bill 256 requires institutions of higher education to excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day. The student shall also be excused for time necessary to travel. An institution may not penalize the student for the absence and allows for the student to take an exam or complete an assignment from which the student is excused. No prior notification of the instructor is required.

**ADA Statement** - Any student who because of a disability may require special arrangements in order to meet course requirements should contact the instructor as soon as possible to make any necessary accommodations. Student should present appropriate verification from AccessTECH. No requirement exists that accommodations be made prior to completion of this approved university procedure.

**Academic Integrity / Academic Misconduct - Texas Tech University Catalog: (p.49)** - "It is the aim of the faculty of Texas Tech University to foster a spirit of complete honesty and a high standard of integrity. The attempt of students to present as their own any work that they have not honestly performed is regarded by the faculty and administration as a serious offense and renders the offenders liable to serious consequences, possibly suspension."

**Cheating** - Dishonesty on examinations and quizzes or on written assignments, illegal possession of examinations, the use of unauthorized notes during an examination or quiz, obtaining information during an examination from the examination paper or otherwise from another student, assisting others to cheat, alteration of grade records, illegal entry to or unauthorized presence in an office are instances of cheating.

**Plagiarism** - Offering the work of another as one's own, without proper acknowledgment, is plagiarism; therefore any student who fails to give credit for quotations or an essentially identical expression of material taken from books, encyclopedias, magazines, internet, and other reference works, or from the themes, reports, or other writings of a fellow student, is guilty of plagiarism.

**Civility in the Classroom** - More information about this topic is available on-line at [www.studentaffairs.ttu.edu/vpsa/publications/civility.htm](http://www.studentaffairs.ttu.edu/vpsa/publications/civility.htm)

**Students with Disabilities / ADA Statement** - Any student who because of a disability may require special arrangements in order to meet course requirements should contact the instructor as soon as possible to make any necessary accommodations. Student should present appropriate verification from AccessTECH. No requirement exists that accommodations be made prior to completion of this approved university procedure.

**Office of the Ombudsman** - The Office of the Ombudsman is available to assist students with any conflict or problem that has to do with being a student at Texas Tech University. You may visit the Ombudsman in 202 Student Union Building or call 742-4791.