

PSY 5360N - Advanced Statistical Methodology

**Texas State University
Spring 2018**

Instructor Information	Instructor: Alessandro De Nadai, Ph.D. Office: UAC 253L Email: adenadai@txstate.edu Phone: (512) 245-2526	Class Information	Meeting Times: Thursdays 2:00-4:50 PM Room: UAC 206 Credit Hours: 3 Office Hours: Wednesdays 2:00-4:00 PM, or by appointment
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Course Overview

The use of data is critical in many domains. Academic science depends on data for advancement, and in the private sector, job acquisition and decision making is becoming more heavily dependent on data. This is for good reason, as many benefits and improved insight can result from proper use of data-based inference. Thus, knowledge of the nature of data and what to do with it can be a major advantage.

Nearly all data analysis frameworks can be construed in terms of the general linear model (GLM). This course covers a broad spectrum of the use of the GLM, starting with the foundations that underlie this model, and ending with coverage of broad extensions that result from the model (e.g., generalized linear mixed models for individual studies, meta-analysis for aggregating studies). The GLM can flexibly handle a wide array of independent and dependent variables (including continuous as well as categorical and other nonnormally-distributed variables). Knowledge provided by this course will permit you to take any source of data, formulate any kind of hypothesis based on the acquired data, produce statistical results that inform this hypothesis, and make appropriate inferences from these results.

The class focuses on the data analysis stage of research in the context of what comes before and after this stage. Content focuses largely on the use of hypothesis-based models in scientific research, but the same methods are applicable to other domains such as public policy and private industry. To achieve the course objectives, we will use the R statistical programming environment, which will allow us to implement a variety of models and help us learn about the models themselves through supervised practice. You will work with collected data and generate material appropriate for academic and professional publication/presentation. Focus will be placed on working with already collected data and designing solutions to future problems by using data.

Specific Course Objectives

- To improve skills in research so that design, analysis, and reporting are integrated
- To be able to identify a number of common study designs in behavioral research
- To be able to quickly manipulate datasets in the statistics package R
- To see how to translate research ideas and hypotheses into statistical syntax in the statistics package R
- To be able to quickly interpret output from statistics programs into publication-quality text
- To address common errors and troubleshoot novel problems that occur when performing analyses
- To gain confidence in working with statistical syntax
- To develop skills to take on personal projects that are just beyond your immediate capacity
- To consolidate prior statistical learning by repeated practice in new contexts
- To gain experience in presenting statistical concepts through writing and oration
- To be able to evaluate benefits and drawbacks of different research approaches and to appropriately critique other academic and lay press reporting of statistics

Central Methods Used to Achieve Course Objectives

1. Instructor lecture
2. Instructor-guided practice
3. Independent practice of statistical programming with subsequent feedback
4. Writing and presentation-based assignments with feedback

Supplemental Methods Used to Achieve Course Objectives

- Practice teaching yourself new statistical concepts, with helpful techniques provided by the instructor
- Practice troubleshooting errors that arise when conducting analyses
- Complete a personal project using course-related strategies (which can directly contribute to your career advancement)
- Assist other class members - Learn by teaching them and receiving instruction from them

Course Readings

We will use the TRACS online course management system provided by Texas State for all course readings, which are provided in PDF format. A list of the books and specific articles used can be found at the end of this document.

Other Course Materials

We will be using predominantly using the statistical package R this semester, and implementing analyses in R via the RStudio software. R is freely downloadable at <http://www.r-project.org>. RStudio is freely downloadable at <https://www.rstudio.com/>. Be sure to completely install R before installing RStudio (RStudio depends on R).

Assignments Contributing to Final Grade

Homework + Contribution to Class Wiki: 50% (equal contribution among all assignments)

Teaching how to use a new R package: 10%

Final Exam: 20%

Final Paper: 20%

Grading

Grades will be based on your performance on course assignments and course attendance (see below for detail on course attendance). Your final grade will be on the following scale.

90% and above	A
80% - 89%	B
70% - 79%	C
60% - 69%	D
Below 60%	F

Attendance

Because much of the course is demonstration and practice with feedback, attendance will be necessary for learning. However, attendance will be used as part of the final grade in only one circumstance - when a student's final grade is within the range of one percentage point below a higher grade.

In this instance, if a student attends 90% of classes or more (i.e., one or fewer absences), then his/her grade will be rounded up to the next letter grade. To illustrate, if a student has an 89.3% grade on assignments and attends 100% of classes, this student will receive an A. If a student has an 89.3% grade on assignments and attends 80% of classes, this student will receive a B. If a student has an 88.9% grade on assignments and attends 100% of classes, this student will still receive a B (because 88.9% is not within one percentage point of the higher grade).

Excused absences will only be provided in the circumstances delineated in section 03.01 of University Policies and procedures Statement 02.03.01 (which can be found at <http://policies.txstate.edu/division-policies/academic-affairs/02-03-01.html>). Signed documentation from a medical provider or other appropriate professional will be required. Students will be considered as attending class if they arrive within 10 minutes of the class start time.

Late Work

Late work is marked down 20% for each business day that it is late. Work is considered one day late if it is not provided to the instructor within the first 10 minutes of the class date on which it is due. Late work can be brought to the Psychology Suite (UAC 253; open 8 AM-5 PM on Monday-Friday) and time-stamped by the department assistants, who can place the completed work in my mailbox.

Note Taking and Recording

You are encouraged to take notes on the lectures/discussions. However, you are not permitted to take notes or audio/video record for purposes of sale and/or distribution.

Some class demonstrations may be recorded in video format and provided to you. These are intended to serve as helpful reminders from class instruction. Distribution of these videos to others is not permitted.

Accommodations for Students with Disabilities

Texas State University does not discriminate on the basis of disability in the recruitment and admissions of students or in the operation of any of its programs and activities. If you have a disability or other need that may require special accommodations, please speak with me before the end of the second class meeting, so that I can work to implement accommodations as you need. You will be asked to provide documentation from the Office of Disability Services (Suite 5-5.1, LBJ Student Center, telephone 245-3451). For further information, see: <http://www.txstate.edu/effective/upps/upps-07-11-01.html>.

Absences Due to Religious Observances

No student shall be compelled to attend class or sit for an examination at a day or time prohibited by his or her religious belief. Students are requested to notify the instructor by the end of the second class meeting if they intend to be absent for a class or announced examination. Official policy documentation can be found at <http://policies.txstate.edu/university-policies/02-06-01.html>.

Drops and Withdrawals

Students are responsible for initiating all drops and withdrawals. The deadline to drop this class is March 27. After this date, you may only withdraw from a class for a very serious reason that is clearly beyond your control, such as injury or accident (which must be documented). Usually, such circumstances mean that you withdraw from all of your classes at the university. For further information, see: <http://www.registrar.txstate.edu/registration/drop-a-class>.

Academic Dishonesty and Academic Grievance Procedures

University Policy: The honor code at Texas State University can be accessed at <http://www.txstate.edu/honorcodecouncil/Academic-Integrity.html>, and the Code of Student Conduct can be found at <http://www.dos.txstate.edu/handbook/rules/cosc.html>. Instances of cheating will result in conference with the student and an academic penalty (which includes the possibility of an "F" in the course). In addition, the matter may be referred to the Honor Code Council Chair, the Associate Vice President for Academic Affairs, and/or the Dean of Students for further action. If you have any questions about whether your actions may violate the honor code or code of student conduct, please contact the course instructor for clarification.

Psychology Department Policy: The study of psychology is done best in an environment of mutual trust and respect. Academic dishonesty in any form spoils this environment. Academic dishonesty consists of any of a number of things that interfere with a good student-teacher relationship. A list of academically dishonest behaviors includes but is not limited to: (1) passing off others' work as one's own, (2) copying off of another person during an examination, (3) signing another person's name on an attendance sheet, (4) in written papers, paraphrasing from an outside source while failing to credit the source or copying more than four words in sequence without quotation marks and appropriate citation.

Technical Support

If you experience software difficulties (e.g., logging into TRACS, downloading or uploading a file, completing an assessment, accessing your grades, etc.), please choose one of the options below. If the issue is preventing you from completing a deadline-based assignment, then also contact the course instructor via email. All emails to the course instructor will receive a reply within two business days.

Options for help:

- Contact TRACS support staff at: 512.245.5566 or tracs@txstate.edu
- Chat with TRACS staff at: <http://tracsfacts.its.txstate.edu/chatwithtracs/tracschat.html>
- Obtain information at: <http://tracsfacts.its.txstate.edu/Documents/Student-Guides.html>

Syllabus Modification

The goal of this syllabus is to provide a general overview and outline a plan for the semester. This syllabus may be modified throughout the semester. Any modifications will be mentioned in class and also posted on TRACS.

Class and Assignment Schedule

Class Week	Date	Topics	Assignments Due This Week	Assigned Activities for Next Week
1	1/18	• Introduction to class and topics		• Obtain access to R/RStudio • Watch Introduction to R video
2	1/25	• Overview of R for applied statistics	• Have working copy of R/RStudio	• Watch introduction to meta-analysis videos
3	2/1	• Meta-analysis - overview and article coding process	• Homework 1	• Consider R package to show class, and class project topic • Watch correlation video • Start watching regression videos
4	2/8	• Hypothesis testing • Bivariate correlation		• Consider R package to show class, and class project topic • Finish watching regression videos
5	2/15	• Multiple regression	• Turn in worksheet on new statistical technique to teach class • Turn in worksheet on class project	• Watch t-test and ANOVA videos
6	2/22	• T-Test and ANOVA	• Homework 2	
7	3/1	• General linear models (GLMs) • Equivalence of regression and ANOVA		• Watch meta-analysis – analytic approaches videos
8	3/8	• Meta-analysis revisited – analytic approaches ○ Connections to GLMs	• Homework 3	• Make headway for exam and final assignments • Read Winter (2013)
9	3/15	• Spring Break – No Class Meeting		
10	3/22 ^b	• Linear mixed models	• Homework 4	• Read Bolker et al. (2009)
11	3/29 ^a	• Generalized linear mixed models (GLMMs)		• Formulate questions for catch up and exam if needed • If needed, prepare questions about exam
12	4/5	• Catch up and review of course content in context • Workshop for presentation and class project • Review for exam	• Homework 5 • Email any questions to address before 4/1 ^a	• Watch video on regression assumptions

13	4/12	<ul style="list-style-type: none"> Addressing violations of analytic assumptions 		<ul style="list-style-type: none"> Finalize presentation of new statistical technique Post to class wiki if have not done so already
14	4/19 ^a	<ul style="list-style-type: none"> Presentation of R package 	<ul style="list-style-type: none"> 10-minute presentation of R package 	<ul style="list-style-type: none"> Prepare for exam
15	4/26	<ul style="list-style-type: none"> Final exam 	<ul style="list-style-type: none"> Exam conducted this class 	<ul style="list-style-type: none"> Finalize class project
16	5/3 (exam week) ^c	<ul style="list-style-type: none"> Presentation of final paper Methods to learn more after the end of class 	<ul style="list-style-type: none"> 10-minute presentation of final paper 	

^aClass on 4/5 has time devoted specifically to catching up on any residual issues. If you have specific questions, email me before the Monday of class week so that I can prepare any specific material for class. This advance notice will allow me to better help you.

^bMarch 27 is the last date possible to drop the course and still receive an automatic "W" grade (see University Academic Calendar for details at <http://www.registrar.txstate.edu/persistent-links/academic-calendar.html>)

^cClass meeting during exam week will be in the same time and place as other class dates; please see <http://www.registrar.txstate.edu/persistent-links/final-exam-schedule.html> for specifics on exam week scheduling

Instructional Course Readings

Winter, B. (2013). A very basic tutorial for performing linear mixed effects analyses. Unpublished manuscript, Department of Cognitive and Information Sciences, University of California, Merced.

Bolker, B. M., Brooks, M. E., Clark, C. J., Geange, S. W., Poulsen, J. R., Stevens, M. H. H., & White, J. S. S. (2009). Generalized linear mixed models: a practical guide for ecology and evolution. *Trends in Ecology & Evolution*, 24, 127-135. doi:10.1016/j.tree.2008.10.008

Instructional Course Videos

Introduction to R

R. Peng (2015, April 9). Overview and history of R. Retrieved from
<https://www.youtube.com/watch?v=STihTnVSZnl>

Introduction to Meta-Analysis

- P. Cuijpers (2016, November 15). Intro course Meta-Analyses VU: A brief introduction to meta analyses. Retrieved from https://www.youtube.com/watch?v=pP7_VBrG_TY&index=1&list=PL-h5cl5Bkvt0J-O0kq_9J9_aksWFPgR7s
- P. Cuijpers (2016, November 15). 2 Course Meta-Analyses VU: Searching bibliographical databases. Retrieved from https://www.youtube.com/watch?v=Cm8Fx1yKkGY&index=4&list=PL-h5cl5Bkvt0J-O0kq_9J9_aksWFPgR7s
- P. Cuijpers (2016, November 15). 3 Course Meta-Analyses VU: Selection of studies and retrievalment. Retrieved from https://www.youtube.com/watch?v=PdXFybvP5Kw&index=5&list=PL-h5cl5Bkvt0J-O0kq_9J9_aksWFPgR7s
- P. Cuijpers (2016, November 15). 4 Course Meta-Analyses VU: Calculating and pooling effect sizes. Retrieved from https://www.youtube.com/watch?v=VQla4idVnm0&index=6&list=PL-P.h5cl5Bkvt0J-O0kq_9J9_aksWFPgR7s (up to 8:45 mark).
- P. Cuijpers (2016, November 15). 6 Course Meta-Analyses VU: Reporting and publishing meta analyses. Retrieved from https://www.youtube.com/watch?v=W635HfTQx2Q&list=PL-h5cl5Bkvt0J-O0kq_9J9_aksWFPgR7s&index=8

Correlation

Khan Academy (2017, July 11). Calculating coefficient r. Retrieved from
<https://www.youtube.com/watch?v=u4ugaNo6v1Q>

Regression

- D. Bauer (2017, August 2). Regression episode 1: Introduction to linear regression. Retrieved from <https://www.youtube.com/watch?v=u2sKbCfvFw&feature=youtu.be>
- D. Bauer (2017, August 2). Regression episode 2: Ordinary least squares explained. Retrieved from <https://www.youtube.com/watch?v=SnONtEma98o>
- D. Bauer (2017, August 2). Regression episode 3: Testing the model. Retrieved from https://www.youtube.com/watch?v=l9Qh0VN_23k
- D. Bauer (2017, August 2). Regression episode 4: Inferences about specific parameters. Retrieved from <https://www.youtube.com/watch?v=MjhTdNVAfp8>
- D. Bauer (2017, August 2). Regression episode 5: Multiple regression. Retrieved from https://www.youtube.com/watch?v=Qyw2_3cVpa0

T-Test and ANOVA

- D. Longstreet (2012, November 12). How to calculate t test using excel for unrelated groups (independent groups). Retrieved from <https://www.youtube.com/watch?v=38uuiUNLu0Q>
- D. Longstreet (2012, November 4). How to use Excel to calculate t test of dependent groups (repeated measures). Retrieved from https://www.youtube.com/watch?v=j_yDvBLDgow
- D. Longstreet (2012, July 13). How to calculate ANOVA with Excel (analysis of variance). Retrieved from <https://www.youtube.com/watch?v=Ke9ttUj7AQc>
- D. Longstreet (2013, March 24). Introduction to two way ANOVA (factorial analysis). Retrieved from <https://www.youtube.com/watch?v=lZFmFuZGQTK>
- D. Longstreet (2013, March 24). How to calculate a two way ANOVA (factorial analysis). Retrieved from <https://www.youtube.com/watch?v=cNIIIn9bConY>
- D. Longstreet (2013, March 24). How to interpret the results of A two way ANOVA (factorial). Retrieved from <https://www.youtube.com/watch?v=ajLdnsLPErE>

Meta-Analysis - Analytic Approaches

- P. Cuijpers (2016, November 15). 4 Course Meta-Analyses VU: Calculating and pooling effect sizes. Retrieved from https://www.youtube.com/watch?v=VQla4idVm0&index=6&list=PL-h5cl5Bkvt0J-O0kq_9J9_aksWFPgR7s – from 8:45 mark until end
- P. Cuijpers (2016, November 15). 5 Course Meta-Analyses VU: Examining heterogeneity. Retrieved from https://www.youtube.com/watch?v=yJ9Y3NRxD0Y&list=PL-h5cl5Bkvt0J-O0kq_9J9_aksWFPgR7s&index=7
- P. Cuijpers (2016, November 15). 7 Course Meta-Analyses VU: Four decades of research on psychotherapy for adult depression. Retrieved From https://www.youtube.com/watch?v=oe7ur8mTBm0&index=9&list=PL-h5cl5Bkvt0J-O0kq_9J9_aksWFPgR7s

Regression Assumptions

- M. Marin (2013, November 13). Checking linear regression assumptions in R (R tutorial 5.2). Retrieved from <https://www.youtube.com/watch?v=eTZ4VUZHzxw>