ST 732: Applied Longitudinal Data Analysis
SPRING 2014
MW 1:30PM-2:45PM, 1108 SAS Hall

Instructor: Ana-Maria Staicu (ana-maria_staicu@ncsu.edu), SAS Hall 5242, (919) 515-0644
Office Hour: Tuesday 3PM-4:20PM
Teaching Assistant: TBA, Ph.D. Candidate (TBA@ncsu.edu)
TA Office Hour: Monday 11-12PM, Thursday 10-11AM (?), SAS Hall 1101

Course Prerequisite: ST 512 (Experimental Statistics for Biological Sciences II), or equivalent.
Course Webpage: http://www.stat.ncsu.edu/people/staicu/courses/st732/

Recommended textbooks
- Davidian, M. Lecture notes. (The class notes are based primarily on this material. It may be purchased at the Sir Speedy across the street from Patterson on Hillsborough.)

Courses Objectives
To introduce students to statistical models and methods for the analysis of longitudinal data, i.e. data collected repeatedly on individuals (humans, animals, plants, samples, etc) over time (or other conditions). In a nutshell the course covers: classical methods including univariate repeated measures ANOVA, GLM for longitudinal data, linear mixed models, estimation and inference, maximum and restricted maximum likelihood, fixed and random effects.

Computing
SAS will be the primary software used in the class [check on-line documentation for version 9.1.3]. R will also be used; R is freely available at http://www.r-project.org/.

Grading
- Final (letter) grade will be based on the final semester \( \text{SCORE} = \frac{(\text{HW} + \text{M} + \text{F})}{3} \), where \( \text{HW} \) is the homework average, \( \text{M} \) is the mid-term exam, and \( \text{F} \) final exam (each out of 100). Conversion of this score into letter grade will be made according to the following tentative grading scale: 99-100% A+, 92-99% A, 90-92% A-, 88-90% B+, 82-88% B, 80-82% B-, 78-80% C+, 72-78% C, 70-72% C-, 68-70% D+, 62-68% D, 60-62% D-, 0-60% F.

HW: There will 5-10 homework assignments. Problems and due dates will be posted on the course webpage. Unexcused late homework will be discounted by 50%.
M: The midterm exam is tentatively scheduled for **February 26**. The mid-term exam will be a take-home project, where students will conduct an analysis of a longitudinal data set and write a short research report.

F: The final exam is scheduled for 1:00 on **May 5**. The final exam will be a presentation of a research project of the student’s choice.

- Any conflicts with the scheduled exam dates must be submitted in writing to the instructor well in advance. The final exam grade can replace a university-excused missing exam grade. Unexcused missing exams, or inadequate notice of missing an exam will result in a grade of 0 for the exam.

**Help outside of class:** You are encouraged to seek help from both the professor and teaching assistant as soon as difficulty arises.

**Academic Integrity:** North Carolina State University has a strict policy on academic integrity. Please review this policy at [http://www.ncsu.edu/provost/academic_policies/integrity/reg.htm](http://www.ncsu.edu/provost/academic_policies/integrity/reg.htm).

**Cheating will not be tolerated.** You may work together on homework assignments, but simply giving answers to another student or receiving answers from another student is cheating.

**Students with disabilities:** Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653, [http://www.ncsu.edu/provost/offices/affirm_action/dss](http://www.ncsu.edu/provost/offices/affirm_action/dss).

**H1N1 influenza:** If you are ill with symptoms of H1N1 influenza (i.e. fever over 100, sore throat, cough, stuffy or runny nose, fatigue, headache, body aches, vomiting and diarrhea) please do not come to class. Instead, immediately contact your medical provider or Student Health Services (515-7107) for advice or to arrange an appointment. If you are diagnosed with H1N1, please inform your instructor immediately. You will be required to be isolated away from class until at least 24 hours after you are free of fever (100 degrees), or signs of a fever, without the use of fever-reducing medications.
Tentative Outline of Course Topics:

1. Preliminaries: Introduction. Ch 1-4
   Review of matrix algebra (individual study).
   Random vectors, multivariate normal distribution, review of linear regression
   Introduction to modeling longitudinal data, exploring covariance structure.

2. Classical methods for normally distributed, balanced repeated measurements: Ch 5-7
   Univariate repeated measures analysis of variance.
   Drawbacks and limitations of classical methods

3. Methods for normally distributed, unbalanced repeated measurements: Ch 8-10
   General linear models and models for correlation.
   Random coefficient models.
   Linear mixed effects models.

4. Methods for non-normally distributed, unbalanced data: Ch 11-12
   Probability models for discrete and continuous nonnormal data and generalized linear models.
   Generalized estimating equations for population-averaged models.

5. Advanced topics (brief overview, time permitted): Ch 13
   Generalized linear mixed effects models. Nonlinear mixed effects models

Additional References:
Students may find the following texts useful for more in-depth mathematical treatment of course topics or alternative perspectives, although none of these is required: