STAT 517: Advanced Statistical Models

Fall 2022

Instructor:	Ray Bai	**Time:**	MWF 2:20 PM – 3:10 PM
Email:	RBAI@mailbox.sc.edu	**Place:**	LeConte 103

Course Page:

  https://blackboard.sc.edu/   (Check regularly for announcements and homework assignments)

Instructor Office Hours: Tuesdays and Thursdays 1:00-2:00 pm in LeConte 207

Teaching Assistant: TBA

TA Office Hours: TBA

Course Description: The purpose of this course is to cover more advanced statistical models than those covered in STAT 515-516. Whereas the sequence STAT 515-516 thoroughly covered linear regression, STAT 517 will introduce models that go beyond the "traditional" linear regression model in several ways.

First, we will study *generalized linear models*, which will allow us to fit regression models where the response variable is *not* necessarily continuous (e.g. binary, multi-categorical, and count responses). Next, we will introduce *random effects* and *mixed effects models* for repeated measures and longitudinal data. Then we will relax the linearity assumption and study nonparametric and semiparametric models, including additive models and tree-based models. If time permits, additional topics such as penalized regression and spatial regression will also be discussed. The tentative schedule of topics is:

- **Week 1**:   review of R and linear models

- **Week 2-4**:   models for binary responses

- **Week 5**:   models for multi-categorical and ordinal responses

- **Week 6-7**:   models for count responses

- **Week 8-9**:   random effects and mixed effects models

- **Week 10-12**: nonparametric and semiparametric regression models

- **Week 13**:   penalized regression models

- **Week 14**:   spatial regression models

Learning Outcomes:

1. Be able to fit models to data when the classical linear regression model is inappropriate.

2. Check model assumptions of statistical models and conduct estimation and inference for model parameters.

3. Be able to analyze real datasets and draw meaningful conclusions from the data analysis.

Prerequisites: Grade of C or higher in STAT 513 or STAT 516

Main References: We will use typed handouts prepared by the instructor. Parts of these lecture notes are *not* complete and will be filled in during lecture. Thus, it is in your best interest to attend lectures.

Computing: We will use the software R for computing and data analysis. You can download R for free from https://www.r-project.org/. The basics of R will be taught in class, and R will be mainly used for data analysis. Students do not need to write very complex functions or programs in R. Students interested in learning to program more complicated things in R should enroll in STAT 540: Computing in Statistics.

Homework: There will be 6-8 homework assignments. Homework assignments require the use of R.

Homework Policy: Students are allowed to discuss the problems and work together with their classmates on the homework, but each student must write up and turn in their **own** solution.

Exams: There will be two midterms and a final. The two midterms will be in class and their dates will be announced later. The final exam will be during the final exam period. The final exam is on **Friday, December 9** at **12:30 pm**. Please do not plan to leave town before the final exam.

In general, exams may not be made up, barring extenuating circumstances. In order to be given permission to make up an exam, documentation must be presented to the instructor.

Grading: Your grade will be determined according to the following distribution:

- Homework: 20%

- Midterm 1: 25%

- Midterm 2: 25%

- Final Exam: 30%

The grading scale is as follows: 90-100 = A, 87-89 = B+, 80-86 = B, 77-79 = C+, 70-76 = C, 67-69 = D+, 60-66 = D, 59 and below = F.

Honor Code: See the Carolinian Creed in the *Carolina Community: Student Handbook and Policy Guide*. The *minimum* punishment for violations of the USC Honor Code is a grade of zero for the work in question. In accordance with university policy, there may be other punishments, including an automatic F in the class and/or expulsion from the university.

Accommodation: If you need special accommodations for examinations or any other aspects of the course, please contact me before or during the first week of the semester.

Note that reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, contact the Office of Student Disability Services by phone (803-777-6142) or e-mail sasds@mailbox.sc.edu. All accommodations must be approved through the Office of Student Disability Services.