STAT 516 Statistical Methods II

Spring 2026

Dr. Karl Gregory

Class times: 10:05 - 11:20 pm Tuesdays and Thursdays in LeConte College 107
Office hours: 1:00 - 2:00 pm Mondays and Wednesdays and 9:00 - 10:00 am Thursdays in LeConte College 216C. Note that I am always free to hang around after class for several minutes!

Bulletin description: Applications and principles of linear models. Simple and multiple linear regression, analysis of variance for basic designs, multiple comparisons, random effects, and analysis of covariance. Statistical packages such as SAS.

Prerequisites: A grade of C or higher STAT 515, STAT 509, STAT 512, or equivalent.

Textbook: None.

Course website: All course materials will be posted on the course website at https://people.stat.sc.edu/gregorkb/STAT_516_sp_2026/STAT_516_sp_2026.html.

Course overview: This course is a continuation of Statistical Methods I (STAT 515). It builds on the simple linear regression and one-way ANOVA material covered in Statistical Methods I, introducing a series of extensions of these models which allow for multiple covariates and more intricate experimental designs. By the end of the course, students will be familiar with a variety of linear statistical models commonly used by practitioners in agriculture, psychology, biology, manufacturing, medicine, economics, and other disciplines.

Following is an overview of the topics we will cover:

I. **Multiple linear regression**: We will begin with a review of hypothesis testing for the mean and simple linear regression, which are covered in STAT 515. We will then study multiple linear regression, which aims to predict or explain the variability in a response variable using several predictor variables or covariates (instead of just a single covariate). In the multiple linear regression setting we will consider the effects of multicollinearity (covariates being correlated with one another), the effect of adding a large number of covariates to the linear regression model, and strategies for selecting a set of important covariates from among all the covariates available in a data set.

II. **One-way ANOVA and factorial designs**: Following our discussion of multiple linear regression, we will review the topic of one-way ANOVA, or the comparison of two or more means, which is covered in Statistical Methods I. Here we will raise the question of how to adjust inferences when making multiple comparisons (for testing multiple hypotheses with the same data) and learn to implement Tukey's HSD and Dunnett's method for making multiple comparisons of means. This will prepare us to study more intricate experimental designs, such as 2-way factorial designs which will be the main focus of this part of the course.

III. **Random and mixed effects models**: After our study of 2-way factorial designs, we will consider models called random or mixed effects models, beginning with the one-way random effects model. This will prepare us to study more complicated designs including the randomized complete block design and the randomized complete block split-plot

design. These experimental designs allow one to accommodate inhomogeneity between groups of subjects or experimental units.

IV. **Analysis of covariance**: Next we will cover analysis of covariance (ANCOVA), which allows one to account for in-homogeneity of subjects in any of the foregoing experimental designs by incorporating into the model the value of a covariate recorded on each subject, such as age. We will see that this can increase statistical power, that is the ability to identify differences between group means.

V. **Logistic regression**: We will finish the semester by covering logistic regression, which is a regression model for data with a binary response taking the value 0 or 1, for example indicating whether a subject has an infection or not. In this model the conditional distribution of the response given the covariate values is not assumed to be Normal, but rather a Bernoulli distribution.

Grading:

1. First midterm exam (Monday, Feb 23rd): 25%
2. Second midterm exam (Wednesday, Apr 8th): 25%
3. Final Exam (Monday, May 4th, 12:30 pm): 25%
4. Homework: 25%
5. Attendance: up to 5% bonus.

Homework must be uploaded to blackboard as a pdf. The lowest homework score will dropped. Attendance will not regularly be taken, but on several days during the semester we will collect data in class. Being in class on these days will count towards your attendance bonus. If your final exam score is higher than the lower of your two midterm exam scores, your final exam score will replace that midterm exam score in the calculation of your course grade.

The thresholds 90%, 87%, 80%, 77%, 70%, 67%, and 60% must be met to earn an A, B+, B, C+, C, D+, or D, respectively. Students not meeting the 60% threshold will receive an F.

Statement on the use of AI: As in-class, no-AI exams are worth 75% of your course grade, doing the homework assignments without AI assistance is essential to your success in this course.

Honor code: See the Carolinian Creed in the Carolina Community: Student Handbook & Policy Guide. Violations of the USC Honor Code may result in a 0 for the work in question, and, in accordance with University policy, other punishments up to and including expulsion from the University.

Accommodations: If you require special accommodations they must be arranged in advance through the Office of Student Disability Services in Suite 102 of Close-Hipp, 803-777-6142, SADRC@mailbox.sc.edu.