STAT 714 Linear Statistical Models

Fall 2025

Dr. Karl Gregory

Class times: 10:05 - 11:20 pm Tuesdays and Thursdays in LeConte College 206
Office hours: 3:00 - 4:00 pm Tuesdays and Wednesdays in LeConte College 216C

Bulletin description: A study of the general linear statistical model and the linear hypothesis. Topics include the multivariate normal distribution, distributions of quadratic forms, and parameter estimation and hypothesis testing for full-rank models, regression models, and less than full-rank models.

Prerequisites: STAT 513 and MATH 544 or STAT 712 or equivalent.

Textbook: Monahan, J. (2008). *A Primer on Linear Models*. CRC Press.

Course website: Additional course material notes will be posted on the course website at https://people.stat.sc.edu/gregorkb/STAT_714_fa_2025/STAT_714_fa_2025.html.

Topics covered: We will spend about four weeks reviewing linear algebra topics such as: Vector and matrix operations; the matrix inverse; characterizing solutions to systems of linear equations; columns space, null space, and rank of a matrix; orthogonal subspaces, bases, and projections; orthogonal decomposition; Gram-Schmidt orthogonalization; eigenvalues and eigenvectors; the determinant; diagonalization; symmetric matrices; spectral decomposition; quadratic forms; and singular value decomposition.

After our review of linear algebra topics we will follow Monahan (2008), covering topics including: Projection and idempotent matrices; the generalized inverse; the geometry of least squares; estimability; reparameterization of linear models; the Gauss-Markov model; best linear unbiased estimation; the Aitken model; generalized least squares; distributions of quadratic forms; Cochran's theorem; analysis of variance; inference in the linear model; testing a general linear hypothesis; likelihood ratio tests; simultaneous confidence intervals; variance component estimation in random and mixed effects models, and restricted maximum likelihood.

Grading:

1. First midterm exam (Tuesday, Sep 30th): 25%
2. Second midterm exam (Tuesday, Nov 4th): 25%
3. Final Exam (Thursday, Dec 11th, 9:00 am): 30%
4. Homework: 10%
5. Quizzes: 10%

Homework assignments must be completed in handwriting.

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: Most of the assessments will be in-class, on paper, for the reason that the use of AI to complete homework assignments and projects has become so pervasive,

so there will be little opportunity to depend on AI during this course. Homework assignments must be completed in handwriting, as a further deterrent from the use of AI.

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**.