Spring 2022

BSTA 651
Linear and Generalized Linear models

Syllabus for First Half of the Course (Linear Models)

Time: Tu, Wed: 1:30 PM- 2:50 PM from Jan 12, 2022 – March 14, 2022 (1st Half)
Location: Bluejeans

Instructors: Justine Shults, Ph.D (Linear Models) and Yong Chen, Ph.D (Generalized Linear Models)

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Text-book: Linear Models in Statistics, 2nd Edition by Rencher and Schaalje (Wiley ISBN: 978-0-471-75498-5)

Additional references: **1.** Linear Models by Searle (Wiley ISBN 0-471-18499-3)
2. Generalized Linear Models, Second Edition by McCullagh and Nelder (Chapman & Hall/CRC Press ISBN-13: 978-0412317606)

Note: You do not need to purchase the references. A good text on matrix algebra (e.g. by Harville, ISBN 978-0-387-22677-4) will also be useful to have for future reference.

Prerequisites: BSTA 620 and BSTA 630. Both BSTA 621 and BSTA 631 may be taken concurrently, with permission of the instructor.

This course provides an introduction to the theory (primarily) and application of linear and nonlinear models. Topics covered in this course include: (1) multiple linear regression models; (2) analysis of variance models; and (3) generalized linear models (second half of the course).

Weekly (approximately) homework assignments will be given. Please work on these assignments independently, unless indicated otherwise.

In addition, there will be 1 examination for the first half of the course. Your final grades will be based on your work in both the homework problems and the two exams according to the following distribution:

(1) HW (40%); (2) Part I exam (25%); (3) Final (30%); (4) Class-Participation (5%).

Note regarding software: The emphasis of this course will be on the theory of linear models, but some applications will also be presented. Please be sure that your results for any analysis are clearly summarized, and any supporting code is included.

Spring Break:

No classes will be held on March 7 or March 9.

Classes and Topics for Part 1 (Linear Models) [This will be updated slightly as the course progresses]

Activity	Date	Reading	Topic	Homework: Assigned	Due
Lecture 1	Wed: 1/12/2022	R: Ch 1-2	Introduction and Review of Matrix Algebra	HW1	
Lecture 2	Wed: 1/19/2022	R: Ch 6-7	Linear Regression: simple and multivariable		
Lecture 3	Mon:1/25/2022	R: Ch 2,4 and 7.6	Multivariate Normal Distr. & Maximum likelihood Regression		
Lecture 4	Wed: 1/27/2022	R: Ch 7	Estimation (OLS & ML), R-squared and Centering		HW1
Lecture 5	Mon: 1/31/2022	R: Ch 5	Distribution of Quadratic Forms		
Lecture 6	Wed: 2/2/2022	R: Ch 5	Independence and Distribution of Quadratic Forms	HW2	
Lecture 7	Mon: 2/7/2022	R: Ch 8	Testing in Multivariable Full Rank Linear Regression Models		
Lecture 8	Wed: 2/9/2022	R: Ch 8	Testing General Linear Hypotheses for Full Rank Linear Models	HW3	HW2
Lecture 9 Parts A and B	Mon: 2/14/2022	R: Ch 12	Estimable Functions, Testing for Non Full-Rank Models. One way ANOVA.		
Lecture 10	Wed: 2/16/2022	R: Ch 14	Two-way ANOVA Models	HW4	HW3
Lecture 11	Mon: 2/21/2022	R: Ch 16	Cell Means Model for Unbalanced Data		
Lecture 12	Wed:2/23/2022		Review- Application of Theory for Nested Model	HW5	HW4
Lecture 13	Mon: 2/28/2022	R: Ch 7	Impact of Model Misspecification and Generalized Least Squares		
Lecture 14	Mon: 3/2/2022	R: Ch 16.c	Analysis of Covariance (ANCOVA)		HW5
Midterm	Mon: 3/14/2022		Closed Book “in class” Midterm		
Spring Break: 3/5 – 3/13					