

Spring 2020

**BSTA 651**  
**Biostatistics III: Linear and Generalized Linear models**

**Time:** Tu, Th: 1:30 PM- 2:50 PM from Jan 16, 2020 – April 28, 2020 (lectures); May 7 (final exam)

**Location:** Blockley Hall

**Instructors:** Justine Shults, Ph.D

**Contact information:**

Justine Shults, Ph.D,

**Office:** Blockley 626 (and Roberts 4471)

**Phone:** 215-518-8628

**Email:** shultsj@email.chop.edu

**Office Hours:** Tuesdays and Thursdays/ After Class or by appointment

**Teaching Assistant:**

**Office:** Blockley 108/109

**Email:** Sarah.Weinstein@pennmedicine.upenn.edu

**Office Hours:** Mondays 3:30-4:30pm

**Text-book:** Linear Models in Statistics, 2<sup>nd</sup> 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.

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

In addition, there will be 2 examinations. One midterm exam and one final exam. 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. Examples for Part I of the course will primarily be presented in Stata. If you are asked to do programming for an assignment and would like to use a different software package, please consult the instructor for permission. Please be sure that your results are clearly summarized, and any supporting code is included.

**Spring Break:**

No classes will be held on March 10 or March 12.

**Reading Days:**

Reading days will be held from April 30- May 3.

**Final Exam:**

**Please see the final exam policy that is posted on the following UPenn web-site:**

<https://catalog.upenn.edu/pennbook/final-examinations/>

**Please also see the following exam schedule for 2020:**

[https://www.registrar.upenn.edu/pdf\\_main/19A\\_Final\\_Exam\\_Tentative\\_01102020.pdf](https://www.registrar.upenn.edu/pdf_main/19A_Final_Exam_Tentative_01102020.pdf)

Our scheduled final exam will be held on Thursday, May 7 from 9 a.m. to 11 a.m. (Location to be determined.) The final exam will cover material from the entire semester, but with more of an emphasis on the second half of the semester.

**Classes and Topics for Part A (Linear Models): (Please note that this will be updated to include GLM. Please be sure to read the text.)**

Activity	Date	Reading	Topic	Homework:	
				Assigned	Due
Lecture 1	Th: 1/16/2020	R: Ch 1-2	Introduction and Review	HW1	
Lecture 2	Tu: 1/21/2020	R: Ch 6-7	Linear Regression: simple and multivariable		
Lecture 3	Th: 1/23/2020	R: Ch 2,4 and 7.6	Multivariate Normal Distr. & Maximum likelihood Regression		
Lecture 4	Tu: 1/28/2020	R: Ch 5	Distributions of Quadratic Forms	HW2	HW 1
Lecture 5	Th: 1/30/2020	R: Ch 8	Regression: Tests of hypothesis and confidence intervals		
Lecture 6	Tu: 2/4/2020	R: Ch 8	General tests of hypothesis	HW 3	HW 2
Lecture 7	Th: 2/6/2020		Catch up and/or examples		
Lecture 8	Tu: 2/11/2020	R: Ch 12	Non-full rank models and estimable functions	HW 4	HW 3
Lecture 9	Th: 2/13/2020	R: Ch 13	One way analysis of variance model- balanced case		
Lecture 10	Tu: 2/18/2020	R: Ch 14	Two way analysis of variance model- balanced case	HW 5	HW 4
Lecture 11	Th: 2/20/2016	R: Ch 15	Analysis of variance- cell means model for unbalanced data		
Lecture 12	Tu: 2/25/2020	R: Ch 16	Analysis of Covariance	HW 6	HW 5
Lecture 13	Th: 2/27/2020	R: Ch 7	Generalized Least Squares		
Lecture 14	Tu: 3/3/2020		Misc. & Review		HW 6
Midterm	Th: 3/5/2020		Midterm Exam (Closed Book)		
<b>Spring Break: 3/7 – 3/15</b>					