Educational Psychology 905: Multivariate Analysis

Course Information:

Instructor:	Dr. Jonathan Templin	Website:		http://jonathantemplin.com
Email:	jtemplin@ku.edu	Phone:		(785) 864-5714
Room:	650 JRP	Office:		614 JRP
Time:	T 1:30–4:20pm			

Course Homework Website: http://www.hofflinhomeworkhub.com/EPSY905

Office Hours Calendar Link:

https://calendar.google.com/calendar/embed?src=jtemplin%40ku.edu&ctz=America%2FChicago

Graduate Teaching Assistant: Jihong Zhang

GTA Email: jihong.zhang@ku.edu

GTA Office Hours: 9-11am Fridays in 617 JRP

Note: The online syllabus at the address provided above will always have the most current information.

Course Objectives, Materials, and Pre-Requisites:

In this course, contemporary approaches to multivariate analysis using mixed-effects models estimated with maximum likelihood and Bayesian methods are presented. Classical topics in multivariate analysis including multivariate analysis of variance and exploratory factor analysis, are covered in the context of mixed-effects models, preparing students for subsequent courses and research that use such model-based methods. Topics include extensions of linear models (regression and analysis of variance) for non-normal data with link functions, introductory matrix algebra, missing data modeling techniques, models for repeated measures data, and path analysis models for multivariate regression evaluating both moderation and mediation effects.

We will be covering linear models for univariate and multivariate outcomes extensively. We will then take a survey of current methods for advanced/multivariate data analysis.

The course will use the R statistical package with the R Studio frontend/development suite and a set of packages including the EPSY905R Package (Templin, 2018) for all computational and data analysis work involved in the course. Due to the way homework is administered in the course, all assignments must be completed in R. For all other specific information regarding general course policies, course evaluation rubrics, and grading systems, please see the course syllabus at the link below.

Tentatively, the course will be held in a flipped format. Students will watch lecture videos during the week before class. Class time will be spent with Q & A about the video contents and then an exercise relating to the topic or homework using R.

All readings will be made available via campus OneDrive shared folder. Please email me for an invitation to this folder.

Prerequisite

Multivariate statistics builds upon the general linear model, which is typically taught in a first PhD-level graduate statistics courses. Within the Department of Educational at the University of Kansas, this means having taken and completed EPSY 810 (General Linear Models).

Statistical Computing

This course will use R for all statistical analyses. Lectures will feature R syntax and brief demonstrations using the R Studio user interface. R and R Studio work on Windows, Linux, and Mac operating systems.

Both R and R Studio are available for free from the following websites:
R: http://www.r-project.org/
R Studio: http://www.rstudio.com/

R and R Studio work by using a series of downloadable packages, which will be described during the second lecture of the course regarding the use of R.

Computing

Because of the reliance of the course on statistical computing, it is strongly encouraged that course participants bring a laptop to class and office hours to follow along with the syntax distributed with lecture.

Course Website/Technology

This course will not use Blackboard for lecture materials. Instead, we will use freely available commercial software for communication and dissemination of course materials. All lectures will be on YouTube (https://www.youtube.com/channel/UC6WctsOhVfGW1D9NZUH1xFg?view_as=subscriber). Blackboard will be used for storing your individual grades and for quizzes.

Course Website
Course lecture slides, lecture examples, video files, assignments, and information are available on the website. The website for the course is listed at the top of this syllabus.

Course Homework System
All course homework assignments except Homework #1 will be available on the homework website at http://www.hofflinhomeworkhub.com/EPSY905. Homework #1 will be available on the course website.

Course Structure and Student Evaluation

Students will be asked to watch lecture videos and to replicate the example R syntax outside of class each week. Then, there will be a quiz that must be completed in Blackboard before the in-person class meets each week (1:30pm Tuesdays). The quiz is intended to gauge student learning from the videos online. The day the class meets, students can re-take the quiz to make up any missed points.

Additionally, homework will be assigned approximately every two weeks. Most homework assignments will be completed in the online homework system.

Student evaluation will be made on the basis of homework grades and quiz grades. **All homework and answers must be from each student's own work and not be copied or paraphrased from anyone else's answers.**

Grades are based on 100 points of coursework. Up to **72 points** can be earned from **homework assignments** (eight in total; worth 9 points each). Up to **30 points** may be earned from **quizzes** on the at-home lecture material (15 quizzes; worth two points each). Please note there will be at least one opportunity to earn up to **5 points of extra credit** (labeled Homework 0 in the online course website), bringing the total possible points in the course to 107.

Additional Readings
The bulk of the course is driven by watching lecture videos and replicating analyses in R. That said, additional reading materials are available each week for further study. These are not assigned readings.

Policy on Late Homework Assignments and Incompletes:

In order to be able to provide the entire class with prompt feedback, **late homework assignments will incur a 5-point penalty.** However, extensions may be granted as needed for extenuating circumstances (e.g., conferences, family obligations) if requested **at least three weeks in advance of the due date**. As quizzes are intended to be quickly taken and can be taken throughout the week, they cannot be made up.

Course Grading System

Total Points	Grade
100-93	A
92-90	A-
89-87	B+
86-83	B
82-80	B-
79-77	C+
76-73	C
72-70	C-
69-60	D
Below 60	F

How to Succeed in this Course
- Watch the online lecture videos each week
- Ask questions when you do not understand. No question is too basic.
- Come to class (and bring your questions about the online lectures)
- Come to office hours
- Interact with our TA
- Do the homework (consider it practice on applying statistics)

Tentative Schedule of Topics:

Date	Topic
16 Jan	Introduction to R
23 Jan	General Linear Models (GLMs)
30 Jan	Interactions in GLMs
06 Feb	Generalized Linear Models
13 Feb	Least Squares and Maximum Likelihood Estimation
20 Feb	Matrix Algebra and the Multivariate Normal Distribution
27 Feb	Multivariate Linear Models
06 Mar	Path Analysis
13 Mar	Linear Mixed Effects Models
27 Mar	Repeated Measures Analyses
03 Apr	Bayesian Statistics and Markov Chain Monte Carlo Estimation
10 Apr	Missing Data and Multiple Imputation
17 Apr	Bootstrapping and Functional Data Analysis (Contemporary Nonparametric Methods)
24 Apr	Exploratory Data Analyses with Principal Components and Exploratory Factor Analysis
02 May	Exploratory Data Analyses with Clustering and Latent Class-Based Methods