PSY 6500: Multivariate Statistics

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Required Texts

[1] J. Cohen, P. Cohen, S.G. West and L.S. Aiken. *Applied multiple regression/correlation analysis for the behavioral sciences*. Psychology Press, 2014.

[2] B.G. Tabachnick and L.S. Fidell. *Using multivariate statistics*. Pearson, 2013.

Required Software (Open Source)

[1] R Core Team. *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing. Vienna, Austria, 2018. http://www.r-project.org.

[2] RStudio Team. *RStudio: Integrated Development Environment for R*. RStudio, Inc. Boston, MA, 2018. http://www.rstudio.com/.

GitHub

This course will use `GitHub` for file sharing. A free account can be set up by visiting www.github.com. Our course `GitHub` site is: https://github.com/orgs/PSY6500/teams/psy6500_spring_2021

Prioritizing Wellness

Having a "normal" life in the face of a global pandemic and political upheaval is impossible, so I encourage you first and foremost to have self-compassion. Even the strongest of us are struggling right now, so we need to take care of ourselves and recognize that none of this is "normal." We also need to show compassion for others, now more than ever. Thus, the first and most important guiding principle of this course is that we will prioritize physical and mental wellness, both for ourselves and others, above all other things.

Course Description

This course will provide an overview of multivariate and multivariable statistical techniques with an emphasis on broad interpretative principles rather than on specific mathematical details.

More specifically, the course will:

1. Provide foundational knowledge of multivariable and multivariate analytic techniques commonly used in behavioral science research.
2. Promote the understanding and critical evaluation of various multivariable and multivariate approaches through the use of computer applications, interpretation of outputs, and discussion of published research.
3. Provide students with opportunities to explore the application of multivariable and multivariate techniques within their area of research interest.

Course Format

Given the online format, this course is primarily lecture based. However, there will be opportunities for group discussions, and active learning activities from time to time. Lectures will cover technical details on analytic approaches, assumptions and appropriateness of tests, and interpretation of results. Group discussions will focus on application and interpretation of specific statistical tests. Active learning exercises will involve programming using R, interpretation of output, and presentation of results.

Course Goals:

In addition to the general learning objectives outlined above, this course will address the following goals:

1. Scholarship and Knowledge: The knowledge gained in the course will allow students to better appreciate and critically evaluate the use of multivariate statistics in their own work and the work of others.
2. Intellectual Inquiry and Communication: Students will have opportunities to engage in conversations about the strengths, weaknesses, and applications of various statistical approaches through class discussions.
3. Community Building: Students will work in teams on common in-class projects. By working in student teams, students will appreciate multiple perspectives on research design and approaches to data analysis.
4. Leadership and Service: Students will demonstrate leadership through in-class discussions and group activities. Indirect appreciation for service will be demonstrated through a community-focused group project.
5. Ethics & Values: Students have opportunities to reflect on the intersection between their personal values and professional codes of conduct through discussion and coursework.

Course Requirements:

Class Attendance & Participation

Attendance is required and expected, but I will strive to be *very* flexible to accommodate the challenges and realities of online course delivery, especially considering the current state of the world. That said, you are encouraged to attend class on a regular basis and to be prepared (e.g., having read the requisite chapters and/or articles; having completed problem sets when assigned) to participate in discussions and in-class activities.

You are responsible for obtaining information presented in class from a classmate if you are absent. If you are unable to attend class, please notify me ahead of time if possible or at your earliest convenience, just so that I know you are okay.

Problem Sets

Throughout the semester, problem sets are assigned that are designed to give students the opportunity to expand on material from lectures and the texts/readings. Individual exercises may involve answering conceptual questions related to the methods covered in class, applications of statistical methods, reflections, computations and use of R, evaluations of journal articles, and/or interpreting results.

For some weeks, there are assigned problem sets. Problem sets should be completed electronically using `RMarkdown` and submitted via `GitHub` as `knitted .HTML` files to the appropriate folder (*n.b.,* I will explain this in class). For any given problem set, it is recognized that you may not always be able to answer all of the questions or to answer them correctly. The purpose of the problem sets is to challenge you, give you hands-on experience working with real data, and provide you with an opportunity to gain practice without explicit grading. Therefore, I will simply be noting whether you have prepared the problem sets and/or have demonstrated effort. To reiterate, these are not graded efforts; rather they should serve to guide your understanding of important points that we have covered in lecture or through assigned readings, and may benefit you for examinations. When relevant, full answers will be discussed in class, and posted to self-check your work.

Note: some problem sets may be completed as part of in-class activities. Otherwise, problem sets should be completed by the Tuesday of any given week.

Exams

There will be a midterm and a final exam. The final exam is not explicitly cumulative, however knowledge is!

Final Grading Breakdown

The following percentage weights and ranges will be used for the calculation of final grades:

- Attendance & Participation 25%
- Problem Sets 25%
- Midterm Exam 25%
- Final Exam 25%

Grade	Percentage
A	93-100%
A-	90-92.9%
B+	87-89.9%
B	83-86.9%
B-	80-82.9%
C+	77-79.9%
C	73-76.9%
C-	70-72.9%
D	60-69.9%
F	0-59.9%

Syllabus Revisions

Other readings or activities may be assigned or substituted throughout the semester. Scheduling may be rearranged to accommodate guest lecturers or other events that may occur. Any changes made will be done as far in advance as possible to allow students the time necessary to prepare for class. The instructor reserves the right to make changes and/or additions to course policies as deemed appropriate.

University Policies

Title IX

Saint Louis University and its faculty are committed to supporting our students and seeking an environment that is free of bias, discrimination, and harassment. If you have encountered any form of sexual misconduct (e.g. sexual assault, sexual harassment, stalking, domestic or dating violence), we encourage you to report this to the University. If you speak with a faculty member about an incident of misconduct, that faculty member must notify SLU's Title IX coordinator, Anna R. Kratky (DuBourg Hall, Room 36; akratky@slu.edu; 314-977-3886) and share the basic facts of your experience with her. The Title IX coordinator will then be available to assist you in understanding all of your options and in connecting you with all possible resources on and off campus.

If you wish to speak with a confidential source, you may contact the counselors at the University Counseling Center at 314-977-TALK. To view SLU's sexual misconduct policy and for resources, please visit the following web addresses: www.slu.edu/here4you and https://www.slu.edu/general-counsel.

Disability Services

Students with a documented disability who wish to request academic accommodations must contact Disability Services to discuss accommodation requests and eligibility requirements. Once successfully registered, the student also must notify the course instructor that they wish to access accommodations in the course.

Please contact Disability Services, located within the Student Success Center, at Disability_services@slu.edu or 314.977.3484 to schedule an appointment. Confidentiality will be observed in all inquiries. Once approved, information about the student's eligibility for academic accommodations will be shared with course instructors via email from Disability Services and viewed within Banner via the instructor's course roster.

Note: Students who do not have a documented disability but who think they may have one are encouraged to contact to Disability Services.

Academic Integrity

Academic integrity is honest, truthful and responsible conduct in all academic endeavors. The mission of Saint Louis University is "the pursuit of truth for the greater glory of God and for the service of humanity." Accordingly, all acts of falsehood demean and compromise the corporate endeavors of teaching, research, health care, and community service via which SLU embodies its mission. The University strives to prepare students for lives of personal and professional integrity, and therefore regards all breaches of academic integrity as matters of serious concern.

The governing University-level Academic Integrity Policy was adopted in Spring 2015, and can be accessed at: https://www.slu.edu/provost/policies/academic-and-course/policy_academic-integrity_6-26-2015.pdf.

Additionally, each SLU College, School, and Center has adopted its own academic integrity policies, available on their respective websites. All SLU students are expected to know and abide by these policies, which detail definitions of violations, processes for reporting violations, sanctions, and appeals. Please direct questions about any facet of academic integrity to your faculty, the chair of the department of your academic program, or the Dean/Director of the College, School or Center in which your program is housed.

Student Success Center

In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. The Student Success Center assists students with academic-related services and is located in the Busch Student Center (Suite, 331). Students can visit https://www.slu.edu/life-at-slu/student-success-center/ to learn more about tutoring services, university writing services, disability services, and academic coaching.

University Writing Services

Students are encouraged to take advantage of University Writing Services in the Student Success Center; getting feedback benefits writers at all skill levels. Trained writing consultants can help with writing projects, multimedia projects, and oral presentations. University Writing Services offers one-on-one consultations that address everything from brainstorming and developing ideas to crafting strong sentences and documenting sources. For more information, visit https://www.slu.edu/life-at-slu/student-success-center/ or call the Student Success Center at 314-977-3484.

Basic Needs Security

Students in personal or academic distress and/or who may be specifically experiencing challenges such as securing food or difficulty navigating campus resources, and who believe this may affect their performance in the course, are encouraged to contact the Dean of Students Office (deanofstudents@slu.edu or 314-977-9378) for support. Furthermore, please notify the instructor if you are comfortable in doing so, as this will enable them to assist you with finding the resources you may need.

Class Schedule

Note: Class schedule for planning purposes only; subject to change.

Week 01, 01/25 - 01/29 Review Syllabus & Overview of Course

Week 02, 02/01 - 02/05 Multivariate Thinking & Review of Statistical Concepts

- **Textbook readings** TF 1-3; CCWA 1

Week 03, 02/08 - 02/12 (Re)Introduction to R; Data Screening

- **Textbook readings** TF 4
- **Problem Set** Problem Set #1

Week 04, 02/15 - 02/19 Matrix Algebra

- **Textbook readings** TF Appendix A

Week 05, 02/22 - 02/26 Review of Covariance, Correlation, & Regression

- **Textbook readings** TF Appendix A
- **Problem Set** Problem Set #2

Week 06, 03/01 - 03/05 Multiple Regression Concepts Part 1

- **Textbook readings** TF 5; CCWA 2-5

Week 06, 03/01 - 03/05 Multiple Regression Concepts Part 2

- **Textbook readings** TF 5; CCWA 2-5
- **Problem Set** Problem Set #3

Week 07, 03/08 - 03/12 Catch Up Week

Week 08, 03/15 - 03/19

- Midterm Exam Week

Week 09, 03/22 - 03/26 Multiple Regression Applications - Moderation

- **Textbook readings** CCWA 7
- **Problem Set** Problem Set #4

Week 10, 03/29 - 04/02 Multiple Regression Applications - Mediation

- ***No Class Thursday***
- **Textbook readings** CCWA 12
- **Problem Set** Problem Set #5

Week 11, 04/05 - 04/09 Multivariate Regression & Path Analysis

- **Textbook readings** CCWA 16

Week 12, 04/12 - 04/16 ANOVA & ANCOVA

- **Textbook readings** TF 6
- **Problem Set** Problem Set #6

Week 13, 04/19 - 04/23 MANOVA

- **Textbook readings** TF 7 & 9
- **Problem Set** Problem Set #7

Week 14, 04/26 - 04/30 Mixed Effects Models

- **Textbook readings** TF 15

Week 15, 05/03 - 05/07 Catch Up Week

Week 16, 05/10 - 05/14

- Final Exam Week