

PSY 6500: Multivariate Statistics

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Class Hours: Tu & Th 9:30 a.m. - 10:45 p.m.

Class Room: Morrissey Hall 2603

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/PSY6500>

Prioritizing Wellness

Having a “normal” life in the face of a pandemic 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.

Virtual Office Hours and Meetings via Zoom

Given ongoing concerns about health and safety during the pandemic, I will be conducting all office hours and other meetings virtually, via Zoom, until further notice. You can schedule a virtual meeting with me at any time via email. My Zoom personal meeting id is: **865 911 5844**, which can be reached directly via my personal link: <https://slu.zoom.us/j/8659115844>. I am also happy to answer question via email, chat on the phone [cell: +1(313)720-7082], or discuss topics through the discussion board on our GitHub site.

Flexibility in Course Delivery/Modality

Given that we are still operating in the context of a pandemic, there is a possibility that we will experience some disruption to our ability to meet in person at some point this semester. If this does occur, we will meet virtually via Zoom during our normally-scheduled class time. As a reminder, my Zoom personal meeting id is: **865 911 5844**, which can be reached directly via my personal link: <https://slu.zoom.us/my/cortrudolph>.

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 and participation (i.e., when you are healthy and able to do so – arriving to class on time, being present and actively engaged in discussions and activities) is a component of your final grade. Accordingly, regular attendance is strongly encouraged, however I will strive to be *very* flexible to accommodate the challenges and realities of the current state of the world. As such, 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 learning checks when assigned) to participate in discussions and in-class activities. That said, I fully recognize that it may not be possible for you to attend each and every course for any number of reasons, and that is okay.

All course materials are made available on our course website, and you can always reach out to me or a classmate for more information about what was discussed in class if you are absent. If you are unable to attend class for whatever reason, please notify me ahead of time if possible or at your earliest convenience, just so that I know you are okay.

Most importantly, if you are feeling sick, stay home.

Learning Checks

Throughout the semester, learning checks 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.

Learning checks should be completed electronically using RMarkdown (i.e., as knitted .HTML files). For any given learning check, 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 learning checks 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 learning checks 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.

Some learning checks may be completed as part of in-class activities. Otherwise, learning checks are designed to have you apply the material we have learned in class, and are due on the Tuesday following the presentation of a given topic (e.g., the “Week 3 Learning Check” is due on the Tuesday of “Week 4”).

We will spend approximately 20 minutes at the beginning of Tuesday class session discussing the previous week’s learning check via “pair and share.” More specifically, you first will break into

groups of two, and discuss your answers to each question with a partner for approximately 10 minutes (i.e., “pair”). After this discussion, one pair will be selected at random to present their answers to a chosen learning check question to the class (i.e., “share”).

Exams

There will be a take-home midterm and take-home final examination. Both exams will be assigned on the Tuesday of a given exam week, and are due by the end of class on the Thursday of an exam week. More details of both will be provided as we move forward.

Final Grading Breakdown

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

Component	Weight
Exam 1	25%
Exam 2	25%
Learning Checks	25%
Class Attendance/Participation	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

Face Masks

Throughout the COVID-19 pandemic, key safeguards like face masks have allowed SLU to safely maintain in-person learning. If public health conditions and local, state, and federal restrictions

demand it, the University may require that all members of our campus community wear face masks indoors.

Therefore, any time a University-level face mask requirement is in effect, face masks will be required in this class. This expectation will apply to all students and instructors, unless a medical condition warrants an exemption from the face mask requirement (see below). When a University-wide face mask requirement is in effect, the following will apply:

- Students who attempt to enter a classroom without wearing masks will be asked by the instructor to put on their masks prior to entry. Students who remove their masks during a class session will be asked by the instructor to resume wearing their masks.
- Students and instructors may remove their masks briefly to take a sip of water but should replace masks immediately. The consumption of food will not be permitted.
- Students who do not comply with the expectation that they wear a mask in accordance with the University-wide face mask requirement may be subject to disciplinary actions per the rules, regulations, and policies of Saint Louis University, including but not limited to those outlined in the Student Handbook. Non-compliance with this policy may result in disciplinary action, up to and including any of the following:
 - dismissal from the course(s)
 - removal from campus housing (if applicable)
 - dismissal from the University

To immediately protect the health and well-being of all students, instructors, and staff, instructors reserve the right to cancel or terminate any class session at which any student fails to comply with a University-wide face mask requirement.

When a University-wide face mask requirement is not in effect, students and instructors may choose to wear a face mask or not, as they prefer for their own individual comfort level.

ADA Accommodations for Face Mask Requirements Saint Louis University is committed to maintaining an inclusive and accessible environment. Individuals who are unable to wear a face mask due to medical reasons should contact the Office of Disability Services (students) or Human Resources (instructors) to initiate the accommodation process identified in the University's ADA Policy. Inquiries or concerns may also be directed to the Office of Institutional Equity and Diversity. Notification to instructors of SLU-approved ADA accommodations should be made in writing prior to the first class session in any term (or as soon thereafter as possible).

Attendance Policy

The health and well-being of SLU's students, staff, and faculty are critical concerns, as is the quality of our learning environments. Accordingly, the following University policy statements on in-person class attendance are designed to preserve and advance the collective health and well-being of our institutional constituencies and to create the conditions in which all students have the opportunity to learn and successfully complete their courses.

1. Students who exhibit any potential COVID-19 symptoms (those that cannot be attributed to some other medical condition the students are known to have, such as allergies, asthma, etc.) shall absent themselves from any in-person class attendance or in-person participation in any

class-related activity until they have been evaluated by a qualified medical official. Students should contact the University Student Health Center for immediate assistance.

2. Students (whether exhibiting any of potential COVID-19 symptoms or not, and regardless of how they feel) who are under either an isolation or quarantine directive issued by a qualified health official must absent themselves from all in-person course activities per the stipulations of the isolation or quarantine directive.
3. Students are responsible for notifying their instructor of an absence as far in advance as possible; when advance notification is not possible, students are responsible for notifying each instructor as soon after the absence as possible. Consistent with the University Attendance Policy, students also are responsible for all material covered in class and must work with the instructor to complete any required work. In situations where students must be absent for an extended period of time due to COVID-19 isolation or quarantine, they also must work with the instructor to determine the best way to maintain progress in the course as they are able based on their health situation.
4. Consistent with the University Attendance Policy, students may be asked to provide medical documentation when a medical condition impacts a student's ability to attend and/or participate in class for an extended period of time.
5. As a temporary amendment to the current University Attendance Policy, all absences due to illness or an isolation/quarantine directive issued by a qualified health official, or due to an adverse reaction to a COVID-19 vaccine, shall be considered "Authorized" absences

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 harassment, including sexual assault, stalking, domestic or dating violence, we encourage you to report this to the University. If you speak with a faculty member about an incident that involves a Title IX matter, that faculty member must notify SLU's Title IX Coordinator and share the basic facts of your experience. This is true even if you ask the faculty member not to disclose the incident. 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.

Anna Kratky is the Title IX Coordinator at Saint Louis University (DuBourg Hall, room 36; anna.kratky@slu.edu; 314-977-3886). If you wish to speak with a confidential source, you may contact the counselors at the University Counseling Center at 314-977-TALK or make an anonymous report through SLU's Integrity Hotline by calling 1-877-525-5669 or online at <http://www.lighthouse-services.com/slu>. To view SLU's policies, and for resources, please visit the following web addresses: <https://www.slu.edu/about/safety/sexual-assault-resources/index.php> and <https://www.slu.edu/general-counsel>.

SLU's Title IX Policy (formerly called the Sexual Misconduct Policy) has been significantly revised to adhere to a new federal law governing Title IX that was released on May 6, 2020. Please take a moment to review the new policy and information at the following web address: <https://www.slu.edu/about/safety/sexual-assault-resources/index.php>. Please contact the Anna Kratky, the Title IX Coordinator, with any questions or concerns.

Accessibility and Disability Resources

Students with a documented disability who wish to request academic accommodations must formally register their disability with the University. Once successfully registered, students also must notify their course instructor that they wish to use their approved accommodations in the course.

Please contact the Center for Accessibility and Disability Resources (CADR) to schedule an appointment to discuss accommodation requests and eligibility requirements. Most students on the St. Louis campus will contact CADR, located in the Student Success Center and available by email at accessibility_disability@slu.edu or by phone at 314.977.3484. Once approved, information about a student's eligibility for academic accommodations will be shared with course instructors by email from CADR and within the instructor's official course roster. Students who do not have a documented disability but who think they may have one also are encouraged to contact to CADR. Confidentiality will be observed in all inquiries.

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.

University Counseling Center

The University Counseling Center (UCC) offers free, short-term, solution-focused counseling to Saint Louis University undergraduate and graduate students. UCC counselors are highly trained clinicians who can assist with a variety of issues, such as adjustment to college life, troubling changes in mood, and chronic psychological conditions. To make an appointment, call 314-977-8255 (TALK), or visit the clinic on the second floor of Wuller Hall.

Class Schedule

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

Week 01, 01/17 - 01/21 Review Syllabus & Overview of Course

- Textbook readings

Week 02, 01/24 - 01/28 Multivariate Thinking & Review of Statistical Concepts

- Textbook readings TF 1-3; CCWA 1

Week 03, 01/31 - 02/04 (Re)Introduction to R; Data Screening

- Textbook readings TF 4
- Learning Check Learning Check “A”

Week 04, 02/07 - 02/11 Matrix Algebra

- Textbook readings TF Appendix A
- Learning Check Learning Check “B”

Week 05, 02/14 - 02/18 Review of Covariance, Correlation, & Regression

- Textbook readings TF Appendix A

Week 06, 02/21 - 02/25 Multiple Regression Concepts Part 1

- Textbook readings TF 5; CCWA 2-5

Week 07, 02/28 - 03/04 Multiple Regression Concepts Part 2

- Textbook readings TF 5; CCWA 2-5
- Learning Check Learning Check “C”

Week 08, 03/07 - 03/11

- Midterm Exam Week

Week 09, 03/14 - 03/18

- Spring Break, No Class

Week 10, 03/21 - 03/25 Multiple Regression Applications - Moderation

- Textbook readings CCWA 7
- Learning Check Learning Check “D”

Week 11, 03/28 - 04/01 Multiple Regression Applications - Mediation

- *No Class Thursday*
- Textbook readings CCWA 12
- Learning Check Learning Check “E”

Week 12, 04/04 - 04/08 ANOVA & ANCOVA

- Textbook readings TF 6
- Learning Check Learning Check “F”

Week 13, 04/11 - 04/15 Multivariate Regression, Path Analysis, & MANOVA

- Textbook readings CCWA 16; TF 7 & 9
- Learning Check Learning Check “G”

Week 14, 04/18 - 04/22 Mixed Effects Models

- Textbook readings TF 15

Week 15, 04/25 - 04/29

- SIOP Conference, No Class

Week 16, 05/02 - 05/06

- Final Exam Week