

**Syllabus for PADM 576**  
**Multivariate Statistical Methods**  
**Spring 2020**  
**TTh 4:35-5:50 pm, Olmsted E-265**

**Professor:** Dr. Daniel J. Mallinson

Office:	Olmsted W-160K
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Course Webpage	<a href="https://sites.psu.edu/djmallinson/padm-576/">https://sites.psu.edu/djmallinson/padm-576/</a>

## Course Description

This course introduces students to applications of multivariate statistical procedures used by scientists and practitioners. The course will focus on both theoretical and practical uses of statistics. The student completing this course will have a greater technical knowledge of multivariate statistics and the software used to estimate them. They will be able to apply this knowledge when reading research articles and conceptualizing statistical analyses for future research projects. Further, the course will develop students' skills as academicians by increasing their capability of executing rigorous quantitative research.

**Prerequisites:** PADM 503 or equivalent coursework.

## Learning Goals and Objectives

- Goal 1: Students will understand the fundamental assumptions of multivariate statistical analyses
  - Objective 1a: Students will identify and explain the core assumptions of each statistical technique that they learn
  - Objective 1b: Students will appraise the extent of assumption violations present in datasets used in the course
  - Objective 1c: Students will execute the appropriate correction for violations of statistical assumptions
- Goal 2: Students will understand the appropriate application of multivariate statistical analyses

- Objective 2a: Students will identify the appropriate statistical test for research hypotheses
- Objective 2b: Students will implement those tests correctly
- Objective 2c: Students will interpret statistical results correctly
- Goal 3: Students will conduct their own research with multivariate statistical analyses
  - Objective 3a: Students will design their own study using secondary data
  - Objective 3b: Students will implement all phases of the research process, including appropriate statistical analysis choices and interpretation
  - Objective 3c: Students will appraise the meaning, as well as theoretical and practical implications of their findings

**Methods for Learning and Teaching:** This course will contain a mix of lecture and application exercises. It is vital for your own comprehension of the course material that you come to class prepared to discuss assigned readings.

## Reaching Our Goals

**Attendance:** Your attendance in class is always expected. It is easy to fall behind in a research methods course and attending class will go a long way to helping you keep up with the course material. Please contact me via [e-mail](#) if you are unable to attend class. I will follow the University's attendance policy when it comes to excused absences. See <https://handbook.psu.edu/content/class-attendance>.

Students also have an obligation to notify me within the first three weeks of the semester if they will miss any class session due to a religious observance. I am pleased to do this, but will need notification in order to plan make-up work.

**Preparation and Participation:** I expect you to read the assigned material before class and be able to discuss what you read. I also expect you to come to class prepared with questions regarding things in the reading that were unclear.

**Do Not Suffer in Silence:** Please do not suffer in silence throughout the course if you are struggling. Instead, let me know — as soon as possible — what things are not making sense and we can work it out. If you are having a problem of any kind in the course, please talk to me about it as soon as possible.

**Be Flexible:** While the syllabus represents an agreement between us, I reserve the right to revise and modify it throughout the course, if it is necessary to achieve our goals. Situations beyond either of our control can also emerge that require changes to the course. I will notify you right away when any changes are made.

**Cell Phones and Laptops:** Please be respectful of your fellow students and me by silencing your cell phone during class and limiting laptop use to only class-related activity.<sup>1</sup>

**E-mail Policy:** I will work to respond to e-mails by the next business day. This means that e-mails sent on the weekends will be responded to by Monday.

## Required Readings

The following book is required for the course:

Jenkins-Smith, Hank C. et al. 2017. *Quantitative Research Methods for Political Science, Public Policy and Public Administration: With Applications in R*. Third Edition. CC-BY-4.0. ([Open Access Link](#))

Additional required readings will be made available on Canvas.

## Recommended Reading

Matloff, Norman. 2011. *The Art of R Programming*. No Starch Press.

Or some other “how-to” on R programming. There are lots of them out there.

## Lecture Slides

I will be using lecture slides throughout the course. These will be uploaded to the course website (<https://sites.psu.edu/djmallinson/padm-576/>) and Canvas prior to each class period.

## Assessing Your Progress Towards Our Goals

The following types of assessment will be used to track your progress towards meeting our course goals: weekly exercises and a final research paper.

Each component represents the following percentage of your final grade:

Weekly Exercises	60%
Research Paper	40%

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<sup>1</sup>In fact, research demonstrates that students who take handwritten notes generally perform better than those that use laptops: Mueller, Pam A. and Daniel M. Oppenheimer. 2014. “The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking.” *Psychological Science* 25(6): 1159-1168.

We will use the following grade scale:

Letter	Percent
A	94 to 100
A-	90 to 93
B+	87 to 89
B	84 to 86
B-	80 to 83
C+	77 to 79
C	70 to 76
D	60 to 69
F	Below 60

**Weekly Exercises:** In a typical week in the course we will spend Tuesday discussing a method and its theoretical and mathematical foundations, then Thursday working on an exercise applying that week's material. The exercise will be due by next Tuesday's class.

**Research Paper:** As a culminating experience, students will work in pairs or alone to develop their own research study that applies the material we learn in class. The goal would be to produce a publishable quality final paper, with feedback from the professor. The final paper will include:

- A statement of the research question and aims of the project
- Brief literature review
- Theory
- Specific hypotheses that will be tested
- Description of data and methodology used
- Appropriate statistical analyses and interpretation
- Discussion and Policy/Academic Implications
- Technical Appendix with R code and output

See Appendix [A](#) for details.

**Make-Up Grades:** You are allowed to make-up academic work only in the case of excused absences. These absences may include missing class for a [University-sanctioned activity](#)

(with proper documentation), illness, religious observance, or family responsibilities. If you know in advance that you are going to miss class, please contact me before the absence to make arrangements for completing the work. If you are absent for an unexpected reason, please check in with me as soon as possible. You will have one week from the day of your return to class to make up a missed assignment.

## Academic Integrity

Academic dishonesty is not limited to simply cheating on an exam or assignment. The following is quoted directly from the *PSU Faculty Senate Policies for Students* regarding academic integrity and academic dishonesty: “Academic integrity is the pursuit of scholarly activity free from fraud and deception and is an educational objective of this institution. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating of information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students.”

All University and Penn State Harrisburg policies regarding academic integrity/academic dishonesty apply to this course and the students enrolled in this course. Refer to the following URL for further details on the academic integrity policy of Penn State Harrisburg: <http://harrisburg.psu.edu/academics/academic-guidelines-and-policies>. Each student in this course is expected to work entirely on her/his own while taking any exam, to complete assignments on her/his own effort without the assistance of others unless directed otherwise by the instructor, and to abide by University and Penn State Harrisburg policies about academic integrity and academic dishonesty. Academic dishonesty can result in an assignment of “F” or “XF” as the final grade for the student.

## Disability Access

Penn State welcomes students with disabilities into the University’s educational programs. Every Penn State campus has a Student DisAbility Resources office. Student DisAbility Resources at Penn State Harrisburg is located in SEC 205. The Disability Services Coordinator, Alan Babcock, can be reached via email at [aub15@psu.edu](mailto:aub15@psu.edu) or phone 717-948-6025.

To receive consideration for accommodations, you must contact Student DisAbility Resources (SDR), participate in an intake interview, provide documentation of your disability, and complete a Self-Assessment. Additional information is available on the Disability Services website (<http://harrisburg.psu.edu/disability-services>). If the documentation supports requests for reasonable accommodations, SDR will provide you with an accommodations letter, which you will give to your professors. You will receive accommodations after you give your accommodations letters to your professors. You should share your accommodations letters with your professors as early in the semester as possible. Professors do not provide

accommodations retroactively.

## Counseling Services

Students may face a variety of concerns over the course of their time at PSH- depressed mood, anxiety, stress, family concerns, body image, substance use, sexuality and many others- that may interfere with their ability to focus on their studies. Counseling Services provides FREE mental health and social support for all currently enrolled students. Staff follow strict legal and ethical guidelines concerning the confidentiality of counseling. Counseling services is located in SEC 205 and can be reached by phone at (717) 948-6025. You can find more information at the Counseling Services webpage, <http://harrisburg.psu.edu/counseling-services>.

## Educational Equity

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, harassment, and/or incivility due to age, ancestry, color, disability, gender, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity at the Report Bias site: <http://equity.psu.edu/reportbias/statement>. Direct all inquiries regarding the nondiscrimination policy to our Penn State Harrisburg Office of Student Affairs at the following link <https://harrisburg.psu.edu/webform/office-student-conduct-incident-report-form>.

## Mandated Reporting

As an instructor, one of my responsibilities is to help create a safe learning environment on our campus. I also have a mandatory reporting responsibility related to my role as an educator. It is my goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in our one-on-one meetings. I will seek to keep information you share private to the greatest extent possible. However, per University policy AD85 (<https://policy.psu.edu/policies/ad85>), I am required to share information regarding sexual misconduct or information about a crime with the University including incidents of sex-based discrimination and harassment (discrimination, harassment, sexual harassment, sexual misconduct, dating violence, domestic violence, stalking, and retaliation). While faculty are ethically bound to report any information as it relates to University policy, we are also a resource and want to be sure you are aware of the services available to you.

The first resource that should you should contact is Felicia Brown-Haywood at the Penn State Harrisburg Title IX Office (E131 Olmsted Building): 717-948-6180.

Other resources that are available include:

- Penn State Harrisburg Counseling and Psychological Services, E131 Olmsted Building: 717-948-6025
- Department of Safety & Police
  - Campus Police: 717-979-7976
  - Local Police: 717-543-2200 or 911
- YWCA Confidential Domestic Violence & Sexual Assault Services: 1-800-654-1221 (available 24/7)
- Contact Helpline: 800-932-4616 (24-hour community crisis hotline)
- Pinnacle Health Harrisburg: 717-782-3131
- Penn State Harrisburg Student Health Services, 220 Capital Union Building: 717-948-61015
- Penn State Hotline: 800-560-1637 (Anonymous reporting)

## Basic Needs Statement

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Office of Student Affairs ([syw10@psu.edu](mailto:syw10@psu.edu), 717-948-6180) for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable him to provide any resources that he may possess.

## Writing Tutoring and Other Academic Support

The [Russell E. Horn Sr. Learning Center](#) provides tutoring for writing assignments as well as for other aspects of the academic experience. You can make an appointment in one of the four ways listed below. An appointment is recommended, though not required.

Website	Online Scheduler	Phone	In Person
<a href="http://harrisburg.psu.edu/learning-center">harrisburg.psu.edu/learning-center</a>	<a href="http://psuh.mywconline.com">psuh.mywconline.com</a>	717-948-6475	SEC 201

### Writing

The Learning Center provides tutoring support for writing assignments in this class. Do you need help developing your thesis and ideas? Do you need objective feedback when you're

drafting or revising your papers? Do you have questions about MLA, APA, or Chicago styles? Do you want to improve your academic writing skills? The writing tutors at the Learning Center are experts at helping students improve their writing. Writing handouts are available at [psu.box.com/v/WritingResources](http://psu.box.com/v/WritingResources) and in print in SEC 201.

### Other Academic Support

Is English an additional language for you and your home language is “getting in the way?” Are you spending excessive amounts of time trying to finish your assigned readings? Are you nervous about participating in class and presenting speeches? American & Academic Literacy (AAL) appointments support international and other multilingual students with their transition to the U.S., and can help all students with their speeches. Our Academic Skills Consultants can also help with time management, organization, and study skills. Like us at [facebook.com/RussellEHornSrLearningCenter/](https://facebook.com/RussellEHornSrLearningCenter/) and follow us on Twitter @PSUHLIC.

## Course Schedule

We will attempt to follow this schedule as closely as possible, but we may take more time on some concepts and less time on others. For this reason, a digital version of this syllabus can be found on [my website](#). Slides used in class will also be posted on the online syllabus and Canvas before class. All changes to the schedule will be announced in class or via e-mail and the online syllabus will be constantly up-to-date. Required course readings are listed and due dates for assignments are in bold. Links to some additional readings are included in the syllabus on my website, others will be uploaded to Canvas. If you have trouble, please do not hesitate to [e-mail](#) me.

### Week 1: Introductions

- January 14: Introduction to the course and each other
- January 16: R Introduction

### Week 2: Let's Learn R

- January 21: R Introduction
- January 23: Publishing as a Grad Student
  - King, Gary. (1995). “[Replication, Replication](#).” *PS: Political Science and Politics* 28: 444-452.
  - King, Gary. (2006). “[Publication, Publication](#).” *PS: Political Science and Politics* 39: 119-125.



### **Week 3: Linear Regression**

- January 28: Reviewing the Bivariate Linear Model
  - Jenkins-Smith. Chapters 7-9.
- January 30: OLS Exercise 1

### **Week 4: Linear Regression**

- February 4: Multivariate Linear Regression
  - Jenkins-Smith. Chapters 11-14
- February 6: OLS Exercise 2, **No Class Meeting**

### **Week 5: Linear Regression**

- February 11: Linearity, Normality, and Multicollinearity
  - Jenkins-Smith. Chapters 10 and 15.
- February 13: Assumptions Exercise 1

### **Week 6: Linear Regression**

- February 18: Heteroscedasticity and Autocorrelation
  - Jenkins-Smith. Chapters 10 and 15.
- February 20: Assumptions Exercise 2

## Week 7: Hierarchical Linear Modeling

- February 25: HLMs
  - Field, Miles, and Field. *Discovering Statistics Using R*. “Multilevel Linear Models.” Chapter 19.
- February 27: HLM Exercise
  - **Outline of Paper Topic Due**

## Week 8: Generalized Linear Model

- March 3: Dichotomous Dependent Variables
  - Jenkins-Smith. Chapter 16.
- March 5: Logit Exercise

## Week 9: Spring Break

- March 10 and 12: No Class

## Week 10: Generalized Linear Model

- March 17: Count Dependent Variables
  - Date, Sachin. (2019). “[An Illustrated Guide to the Poisson Regression Model.](#)” *Towards Data Science*. September 21.
- March 19: Count Model Exercise, **No Class Meeting**

## Week 11: Generalized Linear Model

- March 24: Ordinal Dependent Variables
  - Greene, William H. and David A. Hensher. (2009). *Modeling Ordered Choices*. Chapters 1 and 2. Don’t get bogged down in the estimation strategies and their math.

- March 26: Ordered Logit Exercise

## Week 12: Factor Analysis

- March 31: Exploratory Factor Analysis
  - Field, Miles, and Field. “Exploratory Factor Analysis.” *Discovering Statistics Using R*. Chapter 17.
- April 2: Factor Analysis Exercise

## Week 13: Course Paper

- April 7: Meetings on Class Papers
- April 9: Meetings on Class Papers

## Week 14: Cluster Analysis

- April 14: Cluster Analysis
  - INWT-Blog-RBloggers. 2018. “[Cluster Analysis - Part 1: Introduction.](#)”
  - INWT-Blog-RBloggers. 2018. “[Cluster Analysis - Part 2: Hands On.](#)”
- April 16: Cluster Analysis Exercise
  - Quick-R. “[Cluster Analysis.](#)”
  - **Rough Draft of Final Paper Due**

## Week 15: Structural Equation Modeling

- April 21: SEM
  - Hox, J.J. and T.M. Bechger. 1999. “[An Introduction to Structural Equation Modeling.](#)” *Family Science Review* 11: 354-373.
- April 23: SEM Exercise
  - Rosseel, Yves. 2012. “[lavaan: An R Package for Structural Equation Modeling.](#)” *Journal of Statistical Software* 48(2): 1-36.

## Week 16: Duration Models

- April 28: Parametric and Semi-Parametric
  - Box-Steffensmeier, Janet M. and Bradford S. Jones. (2004). *Event History Modeling: A Guide for Social Scientists*. Chapters 1 and 2.
  - “[When Should You Use Non-Parametric, Parametric, and Semi-Parametric Survival Analysis.](#)” BoostedML. November 25, 2018.
- April 30: Duration Model Exercise

## Week 18: Finals Week

- Presentation of Research
- **Final Research Paper Due Tuesday May 8 by 5pm**

# Appendices

## A Research Paper

This project is meant to be the culmination of the material you learn in this course as well as PADM 503 and 504. For this assignment, you will work with a partner or design your own study using data. This will employ the entire process of developing a research question, conceptualization, operationalization, data acquisition, data analysis, and interpretation of your results. The aim is to produce a study that is potentially submittable to a scholarly journal.

The final research paper should contain the following sections:

- Statement of the research question and aims of the project
- Brief literature review
- Theory
- Specific hypotheses that will be tested
- Description of data and key measures
- Description of methodology for analyzing the data
- Results
- Policy implications
- Conclusion
- Technical Appendix

The main text of the paper should be no longer than 8,000 words (excluding the title page and references). The paper should be double spaced with 12 point font. I would advise considering a potential target publication outlet at the outset of the study and gearing your specific paper details to that journal's formatting requirements.