

University of Montana

ScholarWorks at University of Montana

University of Montana Course Syllabi, 2021-2025

Fall 9-1-2022

PSYX 520.01: Advanced Psychological Statistics I

Daniel J. Denis

University of Montana, Missoula, daniel.denis@umontana.edu

Follow this and additional works at: <https://scholarworks.umt.edu/syllabi2021-2025>

Let us know how access to this document benefits you.

Recommended Citation

Denis, Daniel J., "PSYX 520.01: Advanced Psychological Statistics I" (2022). *University of Montana Course Syllabi, 2021-2025*. 298.

<https://scholarworks.umt.edu/syllabi2021-2025/298>

This Syllabus is brought to you for free and open access by ScholarWorks at University of Montana. It has been accepted for inclusion in University of Montana Course Syllabi, 2021-2025 by an authorized administrator of ScholarWorks at University of Montana. For more information, please contact scholarworks@mso.umt.edu.

Advanced Psychological Statistics I

PSYX 520 – Autumn 2022

Course Location and Time

Skaggs 246
Friday 12:00 – 2:50 PM

Instructor Information

Instructor: Daniel J. Denis, Ph.D.
Office: 369 Skaggs
Email: daniel.denis@umontana.edu
Office Hours: Wed, 1-3, Fri, 11-12.

Teaching Assistant: Thomas Macko
Office: 359 Skaggs
Email: thomas.macko@umconnect.umt.edu
Office Hours: Tuesday, 3:30 – 4:30, Thursday, 11-12.

Course Overview & Expectations

Although the course is self-contained, it is assumed that you have taken **at least one undergraduate statistics course and preferably a research methods course as prerequisites**. The scope of the course is generally applied, however select theoretical details and results will be emphasized inasmuch as they facilitate the understanding of statistical concepts. It is imperative to gain an **understanding** of statistics, and a sense of its logical **foundation**, before knowing **how** and **when** to apply them correctly (and in many cases, whether they should be applied at all). It is only through studying principles in sufficient depth can one appreciate what can vs. cannot be concluded from the application of statistics to data.

Credits

3.0

Learning Outcomes

1. By completion, you should have a reasonable understanding of the nature of statistics, have learnt to think statistically and probabilistically, as well as appreciate its common applications and benefits and limitations within scientific practice. You should be able to critically evaluate select scientific statements based on statistical evidence in journal articles. You should also have gained some facility with software computing packages featured in the course, which you can then extend on independently later as needed in your work, and be able to apply what you have learned in class to the computer to carry out select statistical tests as well as other statistical computations.
2. Understanding the wealth of statistical procedures used in psychology and science in general begins with an understanding of the **key fundamental foundations** that are a component of virtually every statistical method or procedure, and that lie at the very heart of statistical

science. Unifying concepts and principles will be emphasized in this course as to encourage a general understanding. **The goal is to strike a balance between showing you HOW to apply statistics and providing an appreciation for WHAT you are doing, so that you may generalize your skills to new domains and new quantitative approaches throughout your career.** In addition to providing the initial skills of data analysis, the goal is to provide you with the foundation required to permit independent study of statistical topics in psychological research and possibly beyond into **psychometrics** and **mathematical psychology** and initial preparation for reading papers in journals such as **Psychometrika** and **British Journal of Mathematical and Statistical Psychology**. Psychology and related sciences have literally seen an explosion of statistical methods in the last few decades, and unless you have a foundation for understanding them, you will quickly get lost in the “cookbook” approach, and not really understand what you are doing. To avoid this, you need some understanding of what unites virtually all statistical methods. Seek to understand **unifying principles**, and statistics will make much more sense to you. **Do not memorize. Rather, aim to understand. Strive to “demystify” the complexity and you will start to look at a statistics book in a different way (as a unifying theme rather than a collection of unrelated topics). And as you study further into the future (via coursework or self-study), you will better appreciate how essential having that foundation is to learning new things.**

3. This course will cover topics which include: functions, essentials of set theory, probability, conditional probability and distributions, independence, association, random sampling and randomization, measurement scales, probability and sampling distributions, discrete and continuous random variables, expectation, the binomial distribution, measures of central tendency, measures of variability, confidence intervals, normal distribution, hypothesis testing, the nature of the null vs. alternative hypotheses, power, inferences about population means, chi-square distribution, *F* distribution, linear contrasts and post-hoc comparison procedures, general linear model, experimental design, simple analysis of variance, factorial analysis of variance, correlation, linear simple and multiple regression, elements of psychometrics such as reliability and validity, applications and computations using software.

Required Texts

PRIMARY:

Ott, R. & Longnecker, M. (2016). *An Introduction to Statistical Methods & Data Analysis*. Cengage.

Software Texts

Davies, T. M. (2016). *The Book of R: A First Course in Programming and Statistics*. No Starch Press.

Morgan, G. A., Leech, N. L. et al. (2012). *IBM SPSS for Introductory Statistics*. Taylor. 5th edition. Routledge.

Optional Texts & Resources

Montgomery, D. C. (2005). *Design and analysis of experiments*. Wiley.

Zar, J. H. (2009). *Biostatistical analysis*. Pearson: New York.

Hays, W. L. (1994). *Statistics*, 5th ed. Wadsworth Publishing Company, Belmont CA.

Dowdy, S., Wearden, S. & Chilko, D. (2004). *Statistics for research*. Wiley: New Jersey.

Morgan, G.A., Leech, N. L., Gloeckner, G. W. & Barrett, K. C. (2011). *IBM SPSS for Introductory Statistics: Use and Interpretation*, 4th ed. Routledge: New York.

Leech, N. L., Barrett, K. C. & Morgan, G. A. (2011). *IBM SPSS for Intermediate Statistics: Use and Interpretation*, 4th ed. Routledge: New York.

Barnett, R.A., Ziegler, M. R., & Byleen, K. E. (2011). *College Mathematics for Business, Economics, Life Sciences, and Social Sciences*. Prentice Hall: MA.

Field, A. (2009). *Discovering statistics using SPSS*. Sage Publications: California.

Kirk, R. E. (2008). *Statistics: An introduction*. Thomson/Wadsworth: Belmont, CA.

Upton, G., & Cook, I. (2006). *Oxford Dictionary of Statistics*. Oxford University Press. New York.

A Note about Texts & Resources

Statistics and data analysis books can be categorized across a wide spectrum from in-depth analytical thought-provoking books, to very surface data-analytic “how to” and “procedural” books. What one kind of text will give you makes up for what another kind will not. One kind of book is no better than the other so long as you understand that they were written with different purposes in mind. ***In this course, all definitions and fundamental concepts will be drawn from our primary text and class lecture notes, and you will be expected to be familiar with these fundamental concepts. Do not learn definitions or concepts from (most) software manuals!***

Office Hours

Office hours are held weekly. You are also strongly encouraged to e-mail questions to the TA or instructor, as they arise. Writing your question out in an e-mail, as clearly as you can (even if very long) is an **excellent** way to clarify what you do not understand, and often, you achieve a deeper understanding of the topic itself. **Be as detailed and specific as you can in your e-mail** so we know how to frame our response to best suit your needs.

Evaluation

There are 3 components that will make up your final grade (see table below for letter distribution):

1. Assignments (20%) Approx. 1/2 theory, 1/2 computation (Binary grading, 0, 1)
2. Mid-Term Exam (30%)
3. Final Exam (50%) *

* **Final Exam = 80% if higher than Midterm.**

Percentage	Grade	Percentage	Grade	Percentage	Grade
100	A	79	B +	59	D +
99	A	78	B +	58	D +
98	A	77	B +	57	D +
97	A	76	B	56	D
96	A	75	B	55	D
95	A	74	B	54	D
94	A	73	B	53	D
93	A	72	B -	52	D -
92	A	71	B -	51	D -
91	A	70	B -	50	D -
90	A	69	C +	< 50	F
89	A -	68	C +		
88	A -	67	C +		
87	A -	66	C		
86	A -	65	C		
85	A -	64	C		
84	A -	63	C		
83	A -	62	C -		
82	A -	61	C -		
81	A -	60	C -		
80	A -				

Policies regarding Tests & Exams

All tests and exams will be written in class. Be on time for all evaluations, as you will not have additional time if you arrive late.

All material in lecture/book is testable. However, usually, tests (and the final exam) will consist of a subset of material from each chapter. By attending lectures and keeping up with the class, you should get a good idea of what this subset will consist of.

Assignments

Work turned in that does not show sufficient detail or thought process will receive a grade of **zero**. If you are unsure of how much explanation or work to include in your solutions, **include more than not**.

Course Guidelines & Policies

Disability Modifications

The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or call 406-243-2243. I will work with you and Disability Services to provide an appropriate modification.

Attendance

If you absolutely must miss a class, please note that it is your responsibility to catch up on missed work. *Instructor notes will not be made available on an individual basis at any time, nor can the time of the TA be used to provide catch-up lectures.* Attending class lectures usually helps a great deal in understanding material, and consequently doing well on tests and exams.

Academic Misconduct

You are expected to adhere to the university’s Student Conduct Code with regard to academic integrity. Academic misconduct in this course will not be tolerated and will result in an academic penalty. **If you are suspected of cheating on a test or exam, you will receive zero on that test or exam and be asked to leave the class permanently.** In short, even if you do not know the answer to a question, you are much better off guessing than risking the chance of getting caught cheating.

Policy on Class Disruptions

The expectations for this course are such that you remain respectfully silent while either the instructor is speaking or a colleague in the class is asking or responding to a question. In accordance with **policies set by the University, disruptions in class will not be tolerated.** This policy is set very strict so that **every student has the opportunity to learn in a quiet and constructive environment. A failure to meet this expectation will result in you being dismissed permanently from the class.** This policy is extremely strict as to protect the rights of students who have invested time, money and energy into this course and deserve nothing less than an optimal learning environment. **The instructor will make every effort to make sure you have an ideal learning environment.** Please speak to the instructor privately if you are being disrupted in class.

Incompletes

Departmental and university policies regarding incompletes do not allow one to change “incomplete” grades after 1 year has passed since the “I” was granted.

Tentative Course Timetable

Date	Topic	Ott & Longnecker	Assignments (Binary Grading)
02 Sept.	Introduction, Syllabus, Preview Statistics and the Scientific Method	Chapter 1	
09 Sept.	Using Surveys and Experimental Studies to Gather Data	Chapter 2	A1
16 Sept.	Data Description	Chapter 3	A2
23 Sept.	Probability and Probability Distributions	Chapter 4	A3
30 Sept.	Probability and Probability Distributions	Chapter 4	A4
07 Oct.	Inferences About Population Central Values	Chapter 5	A5
14 Oct.	Inferences About Population Central Values	Chapter 5	A6
21 Oct.	Inferences Comparing Two Population Central Values	Chapter 6 (skip Chapter 7)	A7
28 Oct.	Inferences About More Than Two Population Central Values	Chapter 8	A8

Date	Topic	Ott & Longnecker	Assignments (Binary Grading)
04 Nov.	Midterm Exam (30%)	Chapters 1-6	
11 Nov.	Inferences About More Than Two Population Central Values Multiple Comparisons	Chapter 8 Chapter 9	A9
18 Nov.	Categorical Data Linear Regression and Correlation	Chapter 10 Chapter 11	A10
25 Nov.	Thanksgiving Break (NO CLASS)	-	
02 Dec.	Linear Regression and Correlation	Chapter 11	A11
09 Dec.	Linear Regression and Correlation Multiple Regression and the General Linear Model	Chapter 11 Chapter 12	A12
13 Dec. 8-10 AM	Final Exam (50%)	All material covered in the course is testable.	