

# Advanced Statistical Methods for Psychology 830:400 Spring 2019

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Office Hours: by appointment (schedule via email)

## Lecture

Sections	Days	Time	First Meeting	Location
01	Tue. & Thu.	1:40pm – 3:00pm	01/22/2019	PSY 301

## Course Materials

### Readings:

- Required Textbook: *OpenIntro Statistics. 3rd Ed.* (Diez, Barr, & Cetinkaya-Rundel, 2015) ISBN: 978-1943450039  
This book can be downloaded as a [free PDF](#) or purchased as a paperback from amazon.com for less than \$15.
- Recommended Text: *Naked Statistics: Stripping the Dread from the Data* (Whelan, 2014) ISBN: 978-0393347777  
Additional readings will be posted on the course Sakai site.

### Laptop PC (Window, Mac, or Linux):

You will need a laptop pc with internet access to view course materials on the Sakai site, as well as to use the R and RStudio software required for lab exercises.

### Software:

This course makes extensive use of the R and RStudio software packages. In addition, I recommend that you get access to a basic spreadsheet program (e.g., Excel in MS Office, Numbers in iWork, Calc in OpenOffice). If you don't have one installed, Google Sheets should be accessible through any major web browser.

## Course Goals

The main objective of this course is to teach you how to take raw behavioral science data, explore it, and present the results in a useful way. I will present a broad introduction to some of the fundamental tools and concepts of statistics for representing, visualizing, modeling, and interpreting data.

In comparison to Quantitative Methods (a prerequisite), this course will cover some more advanced techniques including exploratory data analysis, nonparametric methods, multiple regression, model fitting, and modern Monte Carlo and bootstrap resampling techniques. The main difference, however, is that this course will focus on cultivating an intuitive understanding for these techniques and how to apply them to practical problems and discouraging rote “plug and chug” computation and uncritical application of traditional NHST methods.

To that end, we will deal almost exclusively with real datasets gathered to answer scientific questions, and you will learn to use the popular, free (open source), and powerful software package 'R' to explore, visualize and analyze these data.

Above all, I intend the course is designed to be useful, and I hope that you find it to be one of the most useful courses of your undergraduate career. It is intended to be useful for students who want to go on to do graduate-level academic research as well as for students who want to go directly into public or private sector jobs involving data science or the collection, analysis, and presentation of data.

## Course Requirements

Attendance & Participation: Attendance for this course is mandatory. The class will cover many conceptual issues that are not covered in the textbook.

You will not be able to learn the material without attending lectures. If you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

## Exams:

A closed-book midterm exam will be administered in class during the eighth week of the semester. It will consist of conceptual questions posed in a mixture of brief essay and short-answer formats. The (comprehensive) final exam will be structured similarly to the midterm exams, but will be somewhat longer, and will be scheduled during the official Rutgers final examination period. You must take both exams. There will be NO make-up exams. If you miss a scheduled class or exam, you will need to provide a valid and documented excuse. If an exam is cancelled or postponed on the day of the exam, there will be a member of the Psychology Department in the room at the scheduled time to make the announcement. Notices posted on doors or on the blackboard are likely hoaxes.

## Weekly Lab Exercises:

A primary aim of this course is to give you practical experience exploring and analyzing data using statistical software. Toward this end, each new unit introduced during the lecture portion of the class will be further explored during a lab portion, in which you will learn to use the R statistical software package to answer questions about data. Lab exercises will be typically be assigned in class on Thursday (and posted on the Sakai site) and will be due by the end of class on the following Thursday. You will be responsible for finishing and submitting each exercise by the appropriate due date. No late homework assignments will be accepted.

## Research Project & Presentation:

The research project will provide you with the opportunity to apply the concepts and techniques that you learned in the course to a topic of interest to you. You should have a brief proposal ready by the first class following the midterm indicating the question(s) that you are interested in and your plan for investigating this question. At the end of the semester, you will have to prepare a project report detailing:

- Brief background on and motivation for your topic of interest (i.e., why are you interested in this topic, what is the current state of scientific knowledge regarding it?)
- A description of your dataset (i.e., where it came from, how it was collected, etc.)
- A description of your analysis and results (include an explanation of why you chose the analysis you did, what your assumptions were, a description of the results of each analysis, and a copy of the code you used)

You will also prepare a brief (5-10 min.) presentation to explain your research project to the class. Detailed information regarding the requirements of the proposal and project will be posted on Sakai.

## Grade Breakdown

Component	Weight
Midterm Exam	20%
Final Exam	20%
Weekly Lab Exercises	25%
Project & Presentation	25%
Attendance & Participation	10%
Total	100%

## Academic Integrity

Collusion (getting any form of assistance from other students or outside sources) on exams is prohibited. Students suspected of doing so will be brought up on charges before university's Office of Student Conduct, and penalties, up to and including expulsion, will be imposed for those found guilty. (See <http://academicintegrity.rutgers.edu/academic-integrity-policy/> for specifics).

## Academic Accommodations

Should you require academic accommodations, you must file a request with the Office of Disability Services for Students (<https://ods.rutgers.edu/my-accommodations>). You should register with disability services as soon as possible. It is your responsibility to self-identify with the Office of Disability Services and to provide me with the appropriate documentation from that office at least one week prior to any request for specific course accommodations. There are no retroactive accommodations. If you require accommodations for exams (e.g., extended time, reduced distractions) you

will be responsible for setting up and scheduling your own accommodations for each exam. The request form can be found at <https://ods.rutgers.edu/my-accommodations/exam-request>.

## Anticipated Course Schedule

The schedule below is subject to change. Please check the Sakai site regularly for announcements, updates, and additional readings.

Date	Topics	Assigned Readings
Tue. 1/22 Thu. 1/24	<a href="#">Course Orientation &amp; Intro to R/ RStudio</a>	
Tue. 1/29 Thu. 1/31	<a href="#">Research Design &amp; Data Analysis (EDA)</a>	Chapter 1
Tue. 2/5 Thu. 2/7	<a href="#">Probability</a>	Chapter 2
Tue. 2/12 Thu. 2/14	<a href="#">Random Variables and Distributions</a>	Chapter 3 (3.1, 3.2, & 3.4)
Tue. 2/19 Thu. 2/21	<a href="#">Foundations of Inference I: Estimation, Hypothesis Testing, &amp; Power</a>	Chapter 4
Tue. 2/26 Thu. 2/28	<a href="#">Foundations of Inference II: Intro to the Bootstrap</a>	Posted Reading (Part 1 only) or this reading (through section 5.3, if you're more adventurous)
Tue. 3/5 Thu. 3/7	<a href="#">Inference for Categorical Data (proportions)</a>	Chapter 6
Tue. 3/12	Catch up & Midterm Review	
<b>Thu. 3/14</b>	<b>Midterm Exam</b>	
Tue. 3/19 Thu. 3/21	<b>Spring Break</b>	
Tue. 3/26 Thu. 3/28	<a href="#">Inference for Categorical Data (Chi Square)</a>	Chapter 6 Project Proposals Due
Tue. 4/2 Thu. 4/4	<a href="#">Correlation &amp; Regression</a>	Chapter 7
Tue. 4/9 Thu. 4/11	<a href="#">Multiple Linear Regression</a>	Chapter 8
Tue. 4/16 Thu. 4/18	<a href="#">The Classics: review of t-tests and one-way ANOVA</a>	Chapter 5
Tue. 4/23 Thu. 4/25	<a href="#">Factorial &amp; Repeated Measures ANOVAs</a>	Posted Reading
Tue. 4/30	Student Presentations	Project Reports Due
Thu. 5/2	Student Presentations & Final Review	
TBA	FINAL EXAM @ TBA Be sure to check <a href="http://finalexams.rutgers.edu/">http://finalexams.rutgers.edu/</a> for updates	