Psychology 359: Advanced Research Methods in Behavioural Sciences
Tentative Syllabus: Fall 2015

Course Information and Objective

Class Th 2-3:30 in Swing 405
T/TH 3:30-5 in Earth Science Building (ESB) 1013
Normally we will have lab on the Thursday class in ESB 1013.
Although we have T 2-3:30 in Swing 405 scheduled, we will generally not meet at that time, although we may use that slot for a review session on Oct 13 so keep this slot open.

This course is an advanced introduction to statistical methods in psychology. There are 4 main goals of this course.

1. A general introduction to statistical inference. Some of this should be review, but many of you will have covered this at different levels in previous courses. Here we will cover parameter estimation, sampling theory, hypothesis testing, confidence intervals, effect sizes, causal inference, statistical power, and understanding *p*-values. These are the basic inferential tools for all statistical analyses and for understanding your data. We will generally use the simple two-group experimental design (i.e., *t*-tests) while covering these topics.
2. An introduction to ANOVA. Here we will cover the one-way ANOVA, mean comparisons, and the two-way ANOVA (main effects, interactions, contrasts). We will only cover between-group designs given our limited time.
3. An introduction to the general linear model (multiple regression) focusing on one predictor and two predictor regression equations, mediation, and moderation.
4. Reporting and conveying results. Each problem set will ask you to write a brief summary of the results in APA format. Generally these will only be 1-4 sentences long. We will provide templates as guides. Remember to communicate what you learned/discovered/concluded. Statistics are simply the appendages to sentences that provide the rationale or basis for your conclusion.

The first three goals will roughly correspond to the three sections of this course. By the end of this course you will be able to (1) identify relevant statistical approaches to analyzing data, (2) appropriately conduct those appropriate analyses, (3) report your results, and (4) explain and defend your conclusions. For each of the sections and modules we cover I will provide a general review guide so that you know what topics I expect you to know.

Office and Appointments

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Please make an appointment with one of us if you cannot make the scheduled office hours. Office hours and locations will be posted on the class website (see below).

Class Website & Discussion Board.

The class discussion board will be available through my website, http://www.appliedregression.com. This will provide an updated class schedule as well as the class discussion board. I encourage you to use the discussion board to ask me and or Jordan questions, as well as solicit advice from your fellow students. ***The forum is private and only this class can see your postings – it is not visible to the public.***

Text

Navarro, D. (2014). *Learning Statistics with R: A Tutorial for Psychology Students and Other Beginners (Version 0.4)*. Freely available textbook shared by the author. A full pdf of the textbook is online at http://health.adelaide.edu.au/psychology/ccs/teaching/lsr/ as well as at http://learningstatisticswithr.com/. I have placed a pdf of the book on the Dropbox folder as well.

Software

The primary major statistical package that we will teach this semester is *R* (http://cran.r-project.org/). You will need to download and install this on a computer for several parts of several assignments. R is free and works for Windows or Mac (or Linux). You will also want to download and install R Studio for your desktop/laptop. Again, freely available at http://www.rstudio.com/products/rstudio/. ***You will need to bring a laptop to lab with R and R Studio installed on it. If you do not have a laptop, please see me. The lecture hall we will use for lab (ESB 1013) has power outlets next to the desks.***

Grading

Course grades will be based on three major components. First, there will be 8 problem sets during the semester that will be worth 40% of your grade. Second, there will be a midterm and a final exam, each worth 25% of your grade. Participation and lab assignments will be worth 10%. Lab assignments will be graded as completed/not completed.

Late lab assignments will be given a half mark. Problem sets are to be turned in the date they are due in lecture. Failure to turn in a problem set by the due date will result in the loss of 5% of the assignment's value for each day beyond the deadline. Keep a copy of all assignments in case of loss. *Although I strongly encourage you to work in groups to discuss your assignments, I require that every person turn in their own programming, output, and assignment; Group projects are not acceptable.*

Handouts, Additional Materials, and Additional Readings

These will be made available through a shared Dropbox folder (read only). I will provide read access to the class folder to each person in the class. The shared folder will have the problem sets, lab notes, lab assignments, readings, as well as lecture notes.

Strategy for the Course

It is critical to keep up with the course and the readings on a *weekly (daily, hourly?)* basis. As soon as you can, identify several classmates from whom you can get notes (or clarifications of the lecture notes) should you miss class. It has been my experience that students tend to have extreme difficulty studying on their own without attending this class. Coming to lecture and completing the problem sets will help you keep up and will help to check your understanding of the material.

It is a good strategy to review your notes from the previous lecture before coming to class. In this way you will discover if parts of your notes are not clear can ask for clarification in class. I will look to you throughout the course for feedback about your level of understanding. **You should ask questions in class**. If you have a question, it is very likely that other students in the room have the same question. It helps to actively participate in class.

Tentative Topics and Class Schedule

Sept 10 Welcome and Introduction

Broad overview of the course and why we are learning R.

Readings: Navarro chapters 3 and 4. This provides a good introduction to R and R Studio which we will go over in lab the following week. Feel free to skim chapters 1 and 2, but that should be extremely basic review.

No lab this first week.

Sept 15, 17 One-way ANOVA

Introduction to the one-way analysis of variance. We will cover the ANOVA summary table and how to calculate all aspects by hand as well as contrasts, pairwise comparisons, and writing a results section.

Readings: Navarro chapter 14 and Faraway, J. J. (2005). *Linear Models with R*. Chapman & Hall, chapter 14. Seaman, Levin, & Serline (1991). Note that you can ignore (skip) section 14.10 in Navarro on the Kruskal-Wallis test. Yes, these ANOVA two chapters cover the same material, but it is often helpful to have another exposure from a slightly different perspective. For Seaman, Levin & Serlin, read the abstract, focus on Tables 3 – 6, and read the *Specific Recommendations for the Substantive Researcher* section on pages 584-5. Yes, ignore all of the technical material in the middle.

Lab: Introduction to R and R Studio and the ANOVA example in Navarro, chapter 14. Topics covered include contrasts, Fisher-Hayter and Tukey pairwise comparisons.

Sept 22, 24 Two-way ANOVA

Introduction to the two-way ANOVA. ANOVA summary table, main effects and interactions. Contrasts, pairwise tests on marginal means, how to decompose interactions, and how to write a results summary.

Readings: Navarro chapter 16 (skip sections 16.6 to 16.11) and Faraway chapter 15.

Problem Set 1 due Tuesday, Sept 22 at the beginning of lecture.

Problem Set 2 due Thursday, Sept 24 at the beginning of lecture.

Lab: Reanalysis of the ANOVA example in Navarro, chapter 16. Topics covered include contrasts, Fisher-Hayter and Tukey pairwise comparisons on marginal means, and simple main effects.

Oct 6, 8 Effect sizes, confidence intervals (CIs), statistical power

How to compute effect sizes and confidence intervals for effect sizes and how to conduct a statistical power analysis.

Readings for Sept 29: Howell Confidence Intervals on Effect Size.pdf. Now for a double dose of my research: Biesanz (2014) and Biesanz & Schrager (2014) skip pages 21-27 in both manuscripts. Both of these manuscripts are very technical so do your best with them. I will explain these in lecture. Focus on the big picture, not the technical details.

Problem Set 3 due Thursday, Oct 8 at the beginning of lecture.

Lab: Computing effect sizes and confidence intervals for Cohen's *d* and the correlation. Statistical power analysis using G*Power and Biesanz & Schrager (2014).

Oct 13 Integration and Review

Applied empirical example that integrates all we have covered thus far. We will examine a two-way ANOVA, decompose the results, determine effect sizes and confidence intervals, and provide a written summary. This will also provide a review session for the midterm.

No new readings this week.

Lab: We will verify our calculations in R and determine confidence intervals for effect sizes since that cannot be done by hand in class.

Problem Set 4 due Oct 13 at the beginning of lecture.

Oct 15 In-class midterm. We will use both class periods for the midterm.

Oct 20 Current Issues and the Crisis in Psychology. What is the problem?

Discussion of current issues in the statistical analysis of psychological data.

Readings for Sept 25 (note that these are short, readable, and entertaining):

False Positive Rates: Economist Article.

Researcher degrees of freedom: Simmons et al (2011)

Simine Vazire's blog post: Life After Bem

Laura King's letter in Dialogue vol 26 (pages 6-9).

OSF. (2015). Estimating the reproducibility of psychological science. Science.

Problem Set 5 due Oct 20 at the beginning of lecture.

Oct 22 Current Issues and the Crisis in Psychology. What is the response?

Discussion of the response to the current crisis in psychology. Readings are for the most part short and entertaining.

Readings: Lucas & Donnellan (2013), Eich (2013), Cumming (2014), Funder et al (2013).

Brent Robert's blog posts: Roberts1 and Roberts2

Entertaining alternative viewpoint: Jason Mitchell's Failed Science Blog Post

Oct 27, 29 Introduction to Regression: One and Two Predictors

An introduction to the general linear model, starting with simple one and two predictor models.

Reading: Navarro Chapter 15, sections 15.1 to 15.7

Lab: Examining Navarro's data in detail. Running one and two predictor regressions in R.

Nov 3, 5 Moderation (Interactions)

Modeling interactions among continuous variables.

Reading: Aiken & West (1991) Chapters 1 to 3.

Lab: Examining the lecture example in detail (conscientiousness data from Biesanz, West, & Graziano, 1998).

Problem Set 6 due Nov 3 at the beginning of lecture.

Nov 10, 12 Group Codes, ANOVA and ANCOVA in the Regression Framework

How do we analyze ordinal or nominal predictors in the regression framework? How do covariates work in the ANOVA context (i.e., ANCOVA).

Reading: West, Aiken, & Krull (1995). Excellent article and very thorough.

Lab illustrates how to conduct dummy and effect coding.

Problem Set 7 due Thursday, Nov 12 at the beginning of lecture.

Nov 17, 19 Resampling & Missing data

Real data almost never behave. How do you handle missing data appropriately? We will focus on multiple imputation for handling missing data. We will also examine resampling as a means of appropriately forming inferences when assumptions are violated.

Missing Data Readings: Schafer & Olsen (1998) and Schafer & Graham (2002)

Resampling Reading: Singh & Xie.pdf (*International Encyclopedia for Education)*

Lab: Multiple imputation will be conducted using the norm package and we will also examine the boot package. Extensive examples will be examined in detail and I will provide you with code templates so that both of these approaches will be quite easy to implement later.

Problem Set 8 due Nov 19 at the beginning of lecture.

Nov 24, 26 Assumptions, Diagnostics, Effect Sizes & CIs

A more detailed look at assumptions, diagnostics, and how to compute effect sizes and confidence intervals.

Reading: Navarro Chapter 15, sections 15.8 to 15.10. Skip sections 15.10.1 to 15.10.3.

Lab: Examining assumptions and diagnostics in R. Computing confidence intervals for the standardized regression coefficient and correlation.

Problem Set 9 due Thursday, Nov 26 at the beginning of lecture.

Dec 1, 3 Mediation and Review

How do we examine meditational models? How do we appropriately test mediation?

Reading: Baron & Kenny (1986), MacKinnon Annual Review (2007)

Lab examines several meditational models and how to test these in R.

Problem Set 10 due Thursday, Dec 3 at the beginning of lecture.

Psychology Department's Position on Academic Misconduct

Cheating, plagiarism, and other forms of academic misconduct are very serious concerns of the University, and the Department of Psychology has taken steps to alleviate them. In the first place, the Department has implemented software that, can reliably detect cheating on multiple-choice exams by analyzing the patterns of students' responses. In addition, the Department subscribes to *TurnItIn*--a service designed to detect and deter plagiarism. All materials (term papers, lab reports, etc.) that students submit for grading will be scanned and compared to over 5 billion pages of content located on the Internet or in TurnItIn's own proprietary databases. The results of these comparisons are compiled into customized "Originality Reports" containing several, sensitive measures of plagiarism; instructors receive copies of these reports for every student in their class.

In all cases of suspected academic misconduct, the parties involved will be pursued to the fullest extent dictated by the guidelines of the University. Strong evidence of cheating or plagiarism may result in a zero credit for the work in question. According to the University Act (section 61), the President of UBC has the right to impose harsher penalties including (but not limited to) a failing grade for the course, suspension from the University, cancellation of scholarships, or a notation added to a student's transcript.

All graded work in this course, unless otherwise specified, is to be original work done independently by individuals. Do **not** use Google/Yahoo/MSN Search/etc. to find articles for assignments in this course. **Do** use any of the indexes and databases listed under Indexes and Databases, Subject Resources, OneSearch or Metasearch on the Library's website at http://www.library.ubc.ca. (Not sure which index to use? Click HELP on the library homepage at www.library.ubc.ca or try Subject Resources.)

If you have any questions as to whether or not what you are doing is even a borderline case of academic misconduct, please consult your instructor. For details on pertinent University policies and procedures, please see Chapter 5 in the UBC Calendar (http://students.ubc.ca/calendar).
