PSYC*6060, Course Outline: Fall 2017

General Information

Course Title: Research Design and Statistics

Course Description:
The purpose of this course is to give students the conceptual and practical tools they need to answer a wide variety of research questions in Psychology using quantitative data analysis. We will cover the fundamentals of inferential statistics and null hypothesis testing; how to conduct data analysis and interpret statistical output using a variety of parametric and non-parametric techniques; and some of the current controversies and considerations surrounding open science in Psychology, and how to avoid questionable research practices.

Credit Weighting: 0.5 credit(s)

Academic Department (or campus): Psychology

Semester Offering: F17

Class Schedule and Location:
Lecture: Wednesdays @ 8:30am-11:20am, MacNaughton Building (MACN), Room 201
Lab: Wednesdays @ 3:30pm-4:20pm, Rozanski Hall (ROZH), Room 108

Instructor Information

Instructor name: Scott A. Cassidy, M.A.
Instructor email: cassidys@uoguelph.ca
Office hours and location: Mondays @ 11:00am-12:00pm, Blackwood Hall (BWH), Room 111

GTA Information

GTA Name: TBA
GTA Email: TBA

Course Content

Specific Learning Outcomes:
By the end of this course, students should be able to:

1. Understand and apply advanced concepts in statistics to data analysis in psychology.
2. Recognize and describe various quantitative research methods, and apply them appropriately to a range of research questions in psychology.
3. Analyze and interpret statistical data to test a claim or investigate a research question.

4. Effectively utilize statistical software to aid in data analysis.
5. Apply critical thinking and troubleshooting skills to the analysis of quantitative data.
6. Apply analytic approaches and concepts learned in class to novel research questions.
7. Demonstrate written communication skills - the ability to express ideas in a clear, concise, and professional manner.
8. Manage time effectively, and ensure personal organization.
9. Demonstrate academic and intellectual integrity.

Class Content:
The topics I'll be covering at our class will often build off of one another; so to get the most out of the course, you should try to attend every class if possible. My role as an instructor at our classes is twofold: First, my role is provide background information and some context around the statistical analyses and concepts assigned for the class. Following this, my second role is to facilitate the application of the concepts we cover in class to running and interpreting example data. We will use the class sessions to facilitate interactive learning in which we experiment with the concepts covered in class, and learn how to apply them to novel situations and research questions. As we do this, I expect you to participate in the active learning activities, ask anything you do not understand, or comment on anything that you are interested in.

Note on Assigned Readings(s):
I will make a number of different readings available for each of the topics that we will cover this semester. However, I do not consider these readings to be assignments that you have to complete; there are no conceptual tests or quizzes in our class, and I will not be assessing you on whether you complete the readings. Instead, I consider the readings I have listed as potential sources or reference material that I think you may find useful, either while you're completing your lab assignments and the data analysis project (see below), or in your future research work. To that end, I have divvied the readings for each week into three sections:

Read before class: Readings listed here provide fundamental concepts or other important information on the topic we'll be covering. I will be teaching the class at a level that assumes all students have covered this information. To make sure that everyone in the class begins with what I feel to be essential information, I would ask you to read this before our class. I have kept these readings to a minimum where possible, to respect what I understand to be your busy schedules as first-semester graduate students.
For reference: Readings listed here provide technical information on how to run and interpret the analytic or methodological techniques we'll be covering in class. I do not expect you to read these ahead of our class, and do not feel that doing so will provide you with any substantive benefit. Instead, I encourage you to use the chapter(s) or article(s) listed here on an as-needed basis for reference when you are completing the lab assignment in the corresponding week. These readings are meant to cover each analysis in more detail than I can realistically provide

during our class time; and the teaching assistant or I may refer you back to these readings if there is something that you are struggling with that is addressed there.

For interest: Readings listed here go beyond the concepts I expect you to master coming out of this class. You will not be assessed on material covered here (assuming it is not also covered elsewhere). Instead, these readings provide useful ancillary information on the topic being covered that week; for example, the Stone-Romero & Rosopa (2008) reading in our "mediation and moderation" week covers how to design a study where you want to test for mediation. I encourage you to download these articles if they correspond to an analysis that you feel you may need to use in your future research work, and refer back to it when and if that need arises.

Topics and Class Schedule:

Week	Date	Topic(s) Covered	Assigned Reading(s)
1	September 13	1. Course Overview 2. It's Pronounced "*Arggh*!": A Gentle Introduction to Using *R*	
2	September 20*	1. Introduction to the New Statistics 2. A Guide to Loading, Preparing, and Cleaning Your Data in *R*	**Read before class:** Field et al. Chapters 1-2 **For reference:** Field et al. Chapter 3 **For interest:** Cumming & Calin-Jageman, Chapter 3
3	September 27*	1. Correlation and Regression Analyses 2. A Guide to Running Simple Correlational and Regression Designs in *R*	**Read before class:** N/A **For reference:** Field et al. Chapters 6-7 **For interest:** Motulsky & Ransnas (1987) Maxwell & Delaney (1993)
4	October 4*	1. What's the Deal with Mediation and Moderation? 2. Using *R* to Analyze and Interpret Mediated and Moderated Regression Effects	**Read before class:** N/A **For reference:** Field et al. Chapter 7 Baron & Kenny (1986) Tingley et al. (2013) **For interest:** Stone-Romero & Rosopa (2008) Aquinis & Gottfredson (2010)

5	October 11*	1. Dealing with Factorial Predictors: t-tests/ANOVAs 2. A Guide to Running Independent Groups t-test and Oneway ANOVA Designs in *R*	**Read before class:** N/A **For reference:** Field et al. Chapters 9-10 **For interest:** Cochran (1947) Lix, Keselman, & Keselman (1996)
6	October 18*	1. Advanced Factorial Designs: Fancy ANOVAs 2. A Guide to Running Within- and Between-Subjects Multiple ANOVA Designs in *R*	**Read before class:** N/A **For reference:** Field et al. Chapters 12-14 **For interest:** Charness, Gneezy, & Kuhn (2002)
7	October 25*	1. The Weird Things We Assume About Our Data 2. Hipster Stats: A Guide to Running Non-Parametric Tests in *R* when your Assumptions Fail You	**Read before class:** N/A **For reference:** Field et al. Chapters 5, 15 **For interest:** Hunter & May (2003) Hunter & May (1993)
8	November 1 *	1. Factorial Outcomes: Frequency/Probability Data 2. A Guide to Running Chi-Square and Logistic Regression Designs in *R*	**Read before class:** N/A **For reference:** Field et al. Chapters 8, 18 **For interest:** McHugh (2013) Lewis & Burke (1949) Hsieh, Bloch, & Larsen (1998) Peng, Lee, & Ingersoll (2002)
9	November 8*	1. Why you Should Fear Multilevel Statistics 2. A (Very Light) Introduction to Running Multilevel Regression Designs in *R*	**Read before class:** N/A **For reference:** Field et al. Chapter 19 **For interest:** Scherbaum & Ferreter (2009) Bauer, Preacher, & Gil (2006)

10	November 15*	1. Factor Analysis: Creating and Validating Scales 2. A Guide to Running Exploratory Factor Analyses and Scale Statistics in *R*	**Read before class:** N/A **For reference:** Field et al. Chapter 17 **For interest:** Fabrigar et al. (1999) Costello & Osborne (2005) Hayton, Allen, & Scarpello (2004)
11	November 22*	1. Study Design: Choosing the Right Tools for the Job 2: '*Over 9000*': A Guide to Determining Power for your Favourite Study Designs	**Read before class:** Cumming & Calin-Jageman, Chapter 2 **For reference:** Field et al., pg. 958 Champely et al. (2017) **For interest:** Johnson & Onwuegbuzie (2004)
12	November 29	1. How to Cheat at Research (and Why you Shouldn't): Open Science and Best Practices in Data Analysis	**Read before class:** Cumming & Calin-Jageman, Chapter 10 **For reference:** N/A **For interest:** Ioannidis (2005) John et al. (2012) Wilkinson (1999) Sijtsma (2016)

* Denotes a week where there is a lab assignment.

Methods of Assessment:

Weekly Lab Assignments (60% of final grade)

One of the main goals for this course is to practice and build mastery over various data analytic techniques in *R*. To help meet this goal, you will be asked to use the techniques we cover during the lecture portion of our class to analyze a novel data set in the lab portion. Most weeks, there will be a lab assignment where we do this. Each lab assignment will primarily cover material that was taught during the corresponding lecture (although any given assignment may also cover fundamental *R* skills or concepts that we covered earlier in the semester; for example, loading data files).

Each lab assignment will be completed in two parts. First, during our lab period, you will be asked to work in small groups to apply the analyses we covered earlier in the day to a new data

set, and report the outcome of the analyses. The teaching assistant and I will attend these sessions to help answer questions and provide you with the scaffolding you need to complete the analysis. After the lab session, you will then be asked to take the results that you calculated and independently write a short report on the research question, data, and conceptual interpretation of the results you obtained (this may involve revisiting the lecture slides, textbook readings, or external sources to help cement your understanding).

Once completed, both parts of the lab assignment should be submitted together using the *CourseLink* Dropbox. 70% of each lab assignment grade will be based on your analysis of the data; the remaining 30% will be based on your conceptual interpretation of the results. Please include your full *R* script, the answer form for the results, and your conceptual write-up for all submissions. Unless otherwise stated, all submissions will be due by 11:59pm the night before our following class.

Independent Data Analysis Project (40% of final grade)

A second goal for this course is to help you think about research questions in terms of their logistics (data set-up, complexity and appropriateness of analyses, etc.), so that you're in a better position to plan out your methodology and analyze your data when running your thesis project and other research work. To help meet this goal, the other major assessment for this course will involve you selecting an analysis method for a given data set, and running and interpreting your findings in a brief report.

I will upload a simulated data file on our *CourseLink* page early in the semester. You will be asked to select a subset of variables from this data set that you would be interested in analyzing (instead of this simulated data set, you may also use actual data from other sources; such as archival data from your lab or open source data, pending my approval). You will then incorporate these variables into an analysis plan that you run and report on in an APA-style report. To get the most out of the project, I would encourage you to select your data and variables strategically; consider choosing something that fits well with a type of analysis you may need to master for your own research work.

Your final report should detail your research question(s) and their rationale; the operational variables and their proposed relations; what analysis or analyses you chose and why (i.e., what are you conceptually testing?); how you handled power, missing values, data cleaning, etc.; the results of the analyses; and conclusions about the research question(s) you sought to test.

This paper should not exceed eight double-spaced pages (excluding a cover page, any references you feel are applicable, and any tables, figures, or appendices), and should be written in full-sentence APA style (i.e., 1" margins, 12-point Times New Roman Font). Once completed, your analysis plan should be submitted using the *CourseLink* Dropbox, along with your complete *R* script. Your report will be assessed in terms of its numerical accuracy, its replicability (i.e., whether your *R* script runs and is commented appropriately); the appropriateness of the analyses you ran, the thoroughness of your analyses (e.g., did you consider assumptions, missing data, etc.?); your adherence to APA formatting guidelines; and

the extent to which you report demonstrates your understanding of the concepts we covered in class and how they pertain to the research question that you have tested.

Course Assignments and Tests:

Assignment or Test	Due Date	Contribution to Final Grade (%)	Learning Outcome(s) Assessed
Lab Assignments	Assessed throughout the semester	60% (7.50% x 8 weeks)	1, 3, 4, 5, 8, & 9
Data Analysis Project	November 29, 2017	40%	1, 2, 3, 4, 5, 6, 7, 8, & 9

Additional Notes (if Required):

Given time restrictions, marks of the final data analysis paper may not be released until the final grade submission at the end of the semester.

Final Examination Date and Time:

There is no final exam for this course.

Course Resources

Required Texts:

Field, A., Miles, J., & Field, Z. (2012). *Discovering Statistics Using R*. Sage.

Additional journal articles will sometimes be assigned each week as part of the readings. These readings will be posted on *CourseLink*.

Recommended Texts:

Cumming, G., & Calin-Jageman, R. *Introducing the New Statistics: Estimation, Open Science, & Beyond*. Routledge.

Other Resources:

R Statistical Software:
We will be using *R* and *R Studio* to complete exercises in class. Both are free software. You can download and install them with the links below. I encourage you to do so before the first class, as these downloads may be too large to effectively download over the university's wifi network.

You should download the version of *R* that corresponds to your computer's operating system (see headings below). The pieces of software that I've listed here build off of one another; so

for best results, please install them in the order that I've presented them in below:

For Windows users:

1) First, install *R*: here
2) Then, install *R Studio*: here

For MAC OSX users:

1) First, install *R* compatibility software (*XQuartz*): here
2) Then, install *R*: here
3) Then, install *R Studio*: here

CourseLink:

Assignments will be submitted via the *CourseLink* Dropbox. It is your responsibility to ensure that your assignments are submitted correctly. Please double check that you have done this correctly. Late submission penalties will apply in the case on incorrectly-submitted assignments.

Course Policies

Grading Policies

Please be sure to submit all assignments by 11:59pm on the assigned date using the *CourseLink* Dropbox. Assignments submitted in any other way (e.g., email submissions to the instructor or teaching assistant) cannot be accepted. Marks will be docked for late submissions on the final analysis project (10% per day, including weekends); for lab assignments, late submissions can unfortunately not be accepted, and will result in a mark of zero (this is necessary to enforce, as a new lab assignment is given each week, and we may experience a backlog of grading otherwise).

Although there are 10 lab assignments in total this semester, only the best 8 of these will be counted towards your final grades (at a rate of 7.50% for each of the 8 assignments); your 2 lowest-marked lab assignments will be discounted.

Please note that these policies are binding unless academic consideration is given to an individual student.

Course Policy on Group Work:

All assignments must be completed on an individual basis (excluding any group work we go through in our labs). Collaborations among students for the purposes of writing assignments are prohibited. Any student(s) suspected of unauthorized collaboration will be reported to the dean's office for an academic misconduct investigation (see the university's policy on academic misconduct below).

Course Policy on the Use of Electronic Devices and Recording of Lectures:

As with many classes at the University of Guelph, electronic recording of my classes is not allowed without prior consent. If I do permit recordings of our sessions, they are solely for the use of the authorized student, and may not be reproduced or transmitted to others without my express written consent.

Course Policy on Email Communication:

I prefer that students come to my office hours to ask questions (especially as more substantive questions are often better handled in person, where I can help you look through your data with you); to help with this I have scheduled my office hours at a time when – to the best of my understanding – you do not have other classes scheduled.

That said, I am happy to answer emails about course policies, assignment expectations, or general inquiries, as long as I feel your question can be adequately answered in a single email (i.e., not a back-and-forth discussion). I reserve the right to ask students to come to my office hours to follow up on any question if I feel it would be better addressed in person (e.g., *R* help), or requires more substantive discussion than I can provide in a single email. I will do my best to answer any email I receive within 24 hours.

University Policies

Academic Consideration

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, ID#, and e-mail contact. See the academic calendar for information on regulations and procedures for Academic Consideration:
Academic Consideration, Appeals, and Petitions

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of

detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. The Academic Misconduct Policy is detailed in the Graduate Calendar:

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibility Services as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 54335 or email csdexams@uoguelph.ca or the Student Accessibility Services Website

Course Evaluation Information

Please refer to the Course and Instructor Evaluation Website**.**

Drop Date

The last date to drop one-semester courses, without academic penalty, is Friday, November 3rd, 2017. For regulations and procedures for Dropping Courses, see the Graduate Academic Calendar.