PSYC 532: General Linear Model

Days/Time: Monday/Thursday: 10:00AM – 11:20AM

Location: MacLaurin D115

Instructor: Dr. John Sakaluk (He/Him/His) (professor.sakaluk@gmail.com)

Office/Office Hours: Cornett A240 (see office hours schedule)

Required Texts:

- The book can either be downloaded for free (legally), or, if you prefer a hardcopy, you can purchase one rather cheaply (~$40 currently)


- The book can be accessed for free (legally) online here. However, if you plan on sticking around in R, a hardcopy (~$40) will be invaluable.

Assorted assigned readings from articles/chapters

- In addition to your textbook, I will post periodic readings from important articles/textbook chapters. Content from these readings is fair-game for tests.

Recommended Supplemental Texts:


- If I am successful in convincing you to “throw in” with R, then these two books will become everyday go-to resources for you. Much of their content can be found with a quick google if you are in a jam, but in my experience, the ~$75 to own both is well-worth the investment to be able to have them on-hand.

Required Software:

R: http://cran.stat.sfu.ca

- R is the primary data-analysis software we will be using for the course. It is free, and works on both Windows and Mac computers. Click the appropriate “Download and Install R” link, depending on your operating system, and the install the software from the downloaded file.

R Studio: https://www.rstudio.com/products/rstudio/download2/

- While R will be our primary statistics workhorse, it is not a very pretty program. RStudio is a free (and Windows-/Mac-friendly) supplemental program, that dresses R up a bit to make it more user-friendly and functional.
Meeting Policy
I am only available to meet for class purposes during my office hours. In order to ensure that everyone will have opportunities to meet with me during them, I have tried to mix up my week-to-week availability, rotating through different days/times so that no one will be consistently disadvantaged (i.e., because of a reoccurring class during office hours). See the Office Hours Schedule for details.

Email Policy
I will respond to emails regarding the class in batches at my professor.sakaluk@gmail.com email: one batch Monday afternoon and again Thursday afternoon (approx. 4PM – 5PM). Please plan accordingly if you need to get in touch with me via email regarding questions/concerns about class content and/or course organization. Emergency-related emails (i.e., medical, family, personal, etc.,) should be directed to my UVic account (sakaluk@uvic.ca) to which I will respond more dynamically.

Course Description
Psychologists of all description—social, clinical, cognitive, developmental, and others—must possess a sufficient mastery of statistics, for the purposes of conducting their own research, and evaluating others’. The general linear model encapsulates a broad array of data analysis techniques, and is typically considered the foundation of statistical training for psychologists. In our class, you will be learning to understand these analyses—and other important statistical principles—conceptually, as well as learning how to conduct, interpret, and report these analyses yourself.

But in the wake of widespread concerns about the reproducibility and replicability of psychological research findings, a foundational course like this must evolve beyond simply telling students which statistical model(s) to select, what buttons to push to get output, what pieces of output are “important”, and how to write descriptions of your results.

Specifically, in our course, you will also learn how to:
1. Self-teach, program scripts, visualize data, and work in a team—all increasingly necessary skills for a career in research
2. Make principled decisions about study design and statistical inference
3. Identify and capitalize on the benefits of pre-registration and exploratory research, in order to increase the convincingness and efficiency of your research
4. Create and manage reproducible research and data analysis workflows, so that other researchers can easily verify your findings
5. Calculate and judiciously use metrics of evidential value, in order to appropriately calibrate your level of skepticism for your/other’s research findings.

Group Work
Our class will take place in a high-tech “Active Learning Classroom”. You will be placed in “Pods” for the semester, based on an Intake Survey that I will send out prior to the first day of class; with few exceptions, Pod membership should remain consistent throughout the semester.
Members of a Pod will work together throughout the semester on in-class activities, discussions, and labs. For Group Work, students will be evaluated both in terms of their Pod’s performance, as well as their performance within their Pod. It is likely that members of a Pod will cultivate a “niche” or “specialization”, for components of the class for which they are particularly skilled (e.g., results writing, data visualization, reproducible script creation, workflow management, model selection and coding, etc.). This is to be expected, and totally acceptable. And don’t worry—there will be plenty of individual assessment too. Substantive concerns about pod functioning (e.g., bullying, exclusion, prolonged absences, etc.,) should be brought to my attention as soon as possible.
Turning Assignments In
Many assignments (both Pod and Individual) will be managed and submitted via the Open Science Framework (OSF) system. Students are not expected to be familiar with the OSF at the start of class, and we will have a class day early-on dedicated to a tutorial explaining how it will be used in this way. However, you should create an OSF account (http://osf.io) as soon as possible, as it will be used as the main platform for delivering/receiving materials in the class.

It is important to note that **I do not accept late work, unless accompanied by the appropriate formal documentation.**

Simulating “Real World” Data Analysis in the Classroom
With very few exceptions and unless explicitly noted, you will always have access to your notes, previous code, and the Internet, when completing individual or group activities or assessments.

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* “Traditional” individual testing format, with no notes, code, Internet, etc., permitted.

The final letter grade in the course will be based on a total rounded percent score. For example 89.5 to 89.9 is rounded up to 90% (A+), whereas 89.4 is rounded down to 89%(A).

A+ = 90 – 100  B+ = 77 – 79  C+ = 65 - 69  F = 0 - 49
A  = 85 - 89   B = 73 – 76   C = 60 – 64
A- = 80 - 84   B- = 70 – 72  D = 50 - 59

Students are expected to familiarize themselves with the Important Course Policy Information (attached).

Data Camp R Tutorial (2.5%)
As many students will likely be mostly—if not totally—unfamiliar with using R, one of the first priorities of the class will be to get students comfortable with R syntax. Data Camp offers an
easy-to use online tutorial that will help to expose students to basics of R syntax and programming. The tutorial covers working with variables, vectors, matrices, factors, data frames, and lists—all common elements of R syntax that should serve you well to be familiar with, both for this class, and well beyond. In total, the tutorial should take approximately 4 hours to finish.

**Bonus: Additional Data Camp R Class (+2.5%)**
Data Camp has supplied our class with their entire suite of R-related courses for free (would cost $$$$ on your own). You are encouraged to take advantage of as many of these classes as you would like—access expires at the end of the course. If you submit a certificate of completion from one of these additional classes, you will be credited an additional 25 points (one-time only).

**Article Critique (5%)**
You will be asked to write a brief (~5 page) critique of an empirical article, based on what you learn about replicability and evidential value. Details of this assignment will be posted on the class website.

**R Tests (15% each x2)**
There will be two R tests, during which you will have class time to individually pre-register, analyze, and visualize an assigned data set, as well as write-up the results of your analyses, and store all necessary materials in a reproducible workflow on an OSF project.

**Written Test (15%)**
There will be one traditional written test, generally consisting of multiple choice, matching, and short answer questions. This test is to determine whether you have learned the necessary conceptual material of the course—you will not be asked to reproduce R code for it, but you may be asked to interpret output/graphs.

**Pod Contribution (multiplier of Pod Assignments)**
Students will be rated by their Pod members (and myself) in terms of their contribution to the Pod. This contribution level will be used as a multiplier for each student’s total Pod Assignments grade: their final contribution level will be determined by a simple majority vote (I will serve as a tie-breaker, when necessary). In effect, this makes the contribution of assignments to students’ final grade a combination of their group score and individual contribution level.

**Contribution Level***
**Underwhelming (.85 multiplier):** Student did not contribute adequately to the Pod’s group work
**Acceptable-to-Excellent (1.0 multiplier):** Student contributed adequately (or even beyond expectations) to the Pod’s group work
**Overbearing (.85 multiplier):** Student regularly tried did too much, or “took over” the Pod

*Part of effective group work is communicating expectations and checking in regularly. I encourage you to periodically discuss how Pod dynamics are going, so there are no surprises at semester-end.

**Examples:**

John’s Pod ends with a total pod assignment grade of 250/300. Three of his four Pod members rate his contribution as underwhelming, so his new final pod assignment score is .85 * 250 = 212.50/300.

Kari’s Pod ends with a total pod assignment grade of 300/300. Two of her four Pod members rate her contribution as exemplary, and the instructor agrees (breaking any tie), so her new final pod assignment score is 1 * 300 = 300.
Final Project (15%)
Students will be asked to write a final paper consisting of an introduction, pre-registered hypotheses, analyses, and visualizations (all in a reproducible workflow), and a discussion section, all using reproducible research practices. Students will be able to select data from any number of already-available data sources (e.g., their advisor’s labs, public-access datasets online). Details of this assignment will be posted on the class website.

Pod Survey (2.5%)
In order to create balanced Pods, I need students to complete a very brief survey that will give me a quick overview of their areas of strength and comfort with skills that will be necessary throughout the course.

Pod Assignments (5% each x6)
Pods will work together on six (loosely) incremental assignments, that will require them to collaborate to first set up a reproducible group workflow, and then perform and report on various statistical analyses through that workflow. Pod grades will not only be determined by whether the submitted assignment is “right” (20 pts), but also to what extent it is reproducible (30 pts). Details of these assignments will be posted on the class website.

Respect for Diversity
It is my intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socio-economic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

A Note on Self-Care
Remember to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone.

Counselling Services - Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students. https://www.uvic.ca/services/counselling/

Health Services - University Health Services (UHS) provides a full service primary health clinic for students, and coordinates healthy student and campus initiatives. http://www.uvic.ca/services/health/

Centre for Accessible Learning - The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations https://www.uvic.ca/services/cal/. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Elders' Voices - The Office of Indigenous Academic and Community Engagement (IACE) has the privilege of assembling a group of Elders from local communities to guide students, staff, faculty and administration in Indigenous ways of knowing and being. https://www.uvic.ca/services/indigenous/students/programming/elders/index.php

Child Care and Child-Friendly Policy
The following text has been adapted from Dr. Melissa Cheyney (2018):

It is my belief that if we want women in academia, that we should also expect children to be present in some form. Currently, the university does not have a formal policy on children in the classroom. The policy described here is thus, a reflection of my own beliefs and commitments to student, staff and faculty parents.

1) All exclusively breastfeeding babies are welcome in class as often as is necessary to support the breastfeeding relationship. Because not all women can pump sufficient milk, and not all babies will take a bottle reliably, I never want students to feel like they have to choose between feeding their baby and continuing their education. You and your nursing baby are welcome in class anytime.

2) For older children and babies, I understand that minor illnesses and unforeseen disruptions in childcare often put parents in the position of having to chose between missing class to stay home with a child and leaving him or her with someone you or the child does not feel comfortable with. While this is not meant to be a long-term childcare solution, occasionally bringing a child to class in order to cover gaps in care is perfectly acceptable.

3) I ask that all students work with me to create a welcoming environment that is respectful of all forms of diversity, including diversity in parenting status.

4) In all cases where babies and children come to class, I ask that you sit close to the door so that if your little one needs special attention and is disrupting learning for other students, you may step outside until their need has been met. Non-parents in the class, please reserve seats near the door for your parenting classmates.

5) Finally, I understand that often the largest barrier to completing your coursework once you become a parent is the tiredness many parents feel in the evening once children have finally gone to sleep. The struggles of balancing school, childcare and often another job are exhausting! I hope that you will feel comfortable disclosing your student-parent status to me. This is the first step in my being able to accommodate any special needs that arise. While I maintain the same high expectations for all student in my classes regardless of parenting status, I am happy to problem solve with you in a way that makes you feel supported as you strive for school-parenting balance. Thank you for the diversity you bring to our classroom!
## Tentative Schedule of Dates*

*Tentative dates subject to change at my discretion pending class progress*

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic(s)</th>
<th>Reminders</th>
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| 1    | Thu., Sep. 6 | • Class Intro  
• Evidential value                                                      | • Pod Survey due SUNDAY Sept. 10 at 11:59 PM |
| 2    | Mon., Sep. 10 | • Tools of Statistical Inference  
• Meet your pods  
• What is a p-value?  
• *Interpreting Confidence Intervals*  
• *Understanding Statistical Power and Significance Testing* | • Dienes (2008), Chapter 3: Neyman, Pearson, and Hypothesis Testing  
• Cohen (1994) |
| 2    | Thu., Sep. 13 | • Replicability and Reproducibility  
• *p-hacking simulator*  
• Borderline p-values [demo1](#) and [demo2](#) | • Nelson et al., 2018: |
| 3    | Mon., Sep. 17 | • Setting up a replicable and reproducible workflow  
• *The Open Science Framework and pre-registration* | • Nosek et al. (2018) |
| 3    | Thu., Sep. 20 | • R Data Management  
• Importing and describing data | • Data Camp tutorial due  
• Reproducible workflow assignment due  
• Gandrud (2015), Chapter 1: *Introducing Reproducible Research*  
• MacCallum et al. (2002) |
| 4    | Mon., Sep. 24 | • Visualizing Data  
• *Making pretty plots* | • Importing and describing data assignment due  
• Preacher et al. (2005) |
| 4    | Thu., Sep. 27 | • Simple Group Comparisons  
• *t-tests in R* | • Data visualization assignment due  
• Lakens (2013) |
| 5    | Mon., Oct. 1 | • Less-Simple Group Comparisons  
• *ANOVs in R* | • Schönbrodt et al. (2017) |
| 5    | Thu., Oct. 4 | • Measures of Association and Model Testing  
• Correlation and bivariate | • Fox and Weisberg (2010)  
• Group comparisons |
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<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Assignment Due</th>
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<tr>
<td>6</td>
<td>Mon., Oct. 8</td>
<td>NO CLASS (THANKSGIVING)</td>
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<td>6</td>
<td>Thu., Oct. 11</td>
<td>JOHN AWAY AT CONFERENCE</td>
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<tr>
<td>7</td>
<td>Mon., Oct. 15</td>
<td>LAB TEST 1 (Weeks 3-5)</td>
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<td>7</td>
<td>Thu., Oct. 18</td>
<td>• Categorical Predictors and Multiple Regression Models</td>
<td>• West et al. (1996)</td>
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<td>8</td>
<td>Mon., Oct. 22</td>
<td>• Categorical Predictors and Multiple Regression Models in R</td>
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<td>8</td>
<td>Thu., Oct. 25</td>
<td>• Interactions in Regression</td>
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<tr>
<td>9</td>
<td>Mon., Oct. 29</td>
<td>• Interactions in Regression in R</td>
<td>• Modeling associations assignment due</td>
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<td>9</td>
<td>Thu., Nov. 1</td>
<td>• Other Advanced Linear Models</td>
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<td>10</td>
<td>Mon., Nov. 5</td>
<td>• Curvilinear and mediation models in R</td>
<td>• Bullock et al. (2010)</td>
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<td>10</td>
<td>Thu., Nov. 8</td>
<td>• Advanced regression models assignment due</td>
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<td>11</td>
<td>Mon., Nov. 12</td>
<td>NO CLASS: READING WEEK</td>
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<td>11</td>
<td>Thu., Nov. 15</td>
<td>• Data “Forensics”</td>
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<td>• p-Checker</td>
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<td>Mon., Nov. 19</td>
<td>• Ryan lecture TBD</td>
<td>• Article Critique due</td>
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<td>12</td>
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<td>Lab Test 2</td>
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<td>13</td>
<td>Mon., Nov. 26</td>
<td>Work Day for Final Assignment</td>
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<td>13</td>
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<td>Review for Test</td>
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<td>14</td>
<td>Mon., Dec. 3</td>
<td>Written Test</td>
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Commitment to Inclusivity and Diversity

The University of Victoria is committed to promoting, providing and protecting a positive and supportive and safe learning and working environment for all its members.

Policy on Academic Integrity including Plagiarism and Cheating

The Department of Psychology fully endorses and intends to enforce rigorously the Senate Policy on Academic integrity [https://web.uvic.ca/calendar2018-09/grad/academic-regulations/academic-integrity.html#](https://web.uvic.ca/calendar2018-09/grad/academic-regulations/academic-integrity.html#), p.39-41 UVic Calendar September 2018). It is of utmost importance that students who do their work honestly be protected from those who do not. Because this policy is in place to ensure that students carry out and benefit from the learning activities assigned in each course, it is expected that students will cooperate in its implementation.

The offences defined by the policy can be summarized briefly as follows:

1. **Plagiarism.** You must make sure that the work you submit is your work and not someone else's. There are proper procedures for citing the works of others. The student is responsible for being aware of and using these procedures.
2. **Unauthorized Use of an Editor.** The use of an editor is prohibited unless the instructor grants explicit written authorization.
3. **Multiple Submission.** Only under exceptional circumstances may a work submitted to fulfill an academic requirement be used to satisfy another similar requirement. The student is responsible for clarifying this with the instructor(s) involved.
4. **Falsifying Materials Subject to Academic Evaluation.** This includes falsification of data, use of commercially prepared essays, using information from the Internet without proper citation, citing sources from which material is not actually obtained, etc.
5. **Cheating on Assignments, Tests, and Examinations.** You may not copy the work of others in or out of class; you may not give your work to others for the purpose of copying; you may not use unauthorized material or equipment during examinations or tests; and you may not impersonate or allow yourself to be impersonated by another at an examination. The Department of Psychology has a policy of not making old examinations available for study purposes. Therefore, use of old exams without the express written permission of the instructor constitutes cheating by the user, and abetting of cheating by the person who provided the exam.
6. **Being an Accessory to Offences.** This means that helping another student to cheat (for instance, by showing or communicating to them answers to an assignment, or by allowing them to view answers on an exam) is an academic offence.

Instructors are expected to make every effort to prevent cheating and plagiarism. This may include the assignment of seating for examinations, asking students to move during examinations, requests to see student identification cards, and other measures as appropriate. Instructors also have available to them a variety of tools and procedures to check for Internet and electronic media-based cheating. In instances of suspected or actual plagiarism or cheating, instructors, following prescribed procedures, are authorized to take steps consistent with the degree of the offence. These measures will range from a zero on the test or assignment or a failing grade for the course, probation within a program to temporary or even permanent suspension from the University.

Rights of Appeal are described in the Policy on Academic Integrity in the University calendar (on p. 40 in September 2018).
The definitive source for information on Academic Integrity is the University Calendar (p. 39-41 in September 2018) (https://web.uvic.ca/calendar2018-09/grad/academic-regulations/academic-integrity.html#)

Other useful resources on Plagiarism and Cheating include:

1. The Study Solutions Office: https://www.uvic.ca/services/counselling/success/study/index.php
2. The Ombudsperson’s office: http://www.uvss.uvic.ca/ombudsperson/pubsguides/plagiarism.pdf
3. UVicLibraryResources: http://www.uvic.ca/library/research/citation/plagiarism/
4. Dr. Mitchell of the UVic English Department: