

Statistical Methods II Syllabus

Department of Psychology and Neuroscience

PSYO 3502 Fall 2023

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructors and Office Hours

Instructor: Dr. Sean P. Mackinnon, mackinnon.sean@dal.ca

Office Hours: Tues, 3pm to 5pm, LSC 2540
Other appointments by appointment (send an email)

Teaching Assistants: (Aaron Shephard) acshephard@dal.ca
(Brannon Senger) bsenger@dal.ca

Course Structure

Lectures: Monday/Wednesday, 11:35am to 12:25pm, LSC C240

Laboratories: Fridays, 8:35am – 10:25am, LSC C238

Course delivery: In-person, with recorded lectures. Labs are not recorded.

Course Description

This course is the continuation of PSYO 2501.03, with the examination of more complex, but commonly used, inferential statistics. Topics include factorial ANOVA, ANCOVA, and multiple regression. This course is intended for Honours students in Psychology or Neuroscience. Class work includes computer-based assignments.

Course Prerequisites/Corequisites

Restricted to PSYO and NESC Honours students only. PSYO 3502.03 is to be taken concurrently with PSYO 4500X/Y.06/ NESC4500X/Y.06.

Key knowledge or skills expected of students coming into the course

Students are expected to have basic algebra and arithmetic skills at a high school level. This includes: Order of operations, fractions, decimals, negative numbers, basic algebra, exponents and square roots. Some familiarity with using laptop/desktop computers (Mac or PC) is also expected. Students are expected to know how to read and write results sections using APA formatting (PSYO 2000). Students are also expected to have taken at least one undergraduate course in statistics during their career thus far (usually, PSYO 2501). This includes general understanding of basic statistical principles (e.g., inferential statistics, p-values,

confidence intervals, error, hypothesis testing). No prior experience using jamovi or R software is expected.

CLASS FORMAT

In general, the format of a typical week goes like this:

Sunday	Take some time to rest (or catch up!)
Monday	50 min live lecture. It will be recorded but may not be posted online until the next day.
Tuesday	If there was a graded lab in the previous week, they are due by 11:59PM on Tuesdays.
Wednesday	50 min live lecture. It will be recorded but may not be posted online until the next day.
Thursday	Lab handouts posted on Brightspace for those who want to start early.
Friday	Dedicated time to work on the labs using statistical software and in-person support from the instructor and TAs. They are 2-hour sessions in a different room, and you will be provided a printed handout of the lab to make it easier to work on it.
Saturday	Take some time to rest (or catch up!)

Learning Objectives

- 1. Conceptual knowledge:** Explain the statistical theory underlying numerous statistical tests, explain in plain language what R code is doing, and be able to determine if the underlying assumptions are met or violated
- 2. Application:** Select the right statistical model, data visualization, and data restructuring to use given a specific hypothesis and type of data.
- 3. Calculation:** Manage databases and analyze data using jamovi and R software. That is, be able to use these programs to calculate the necessary statistical models and plots.
- 4. Reproducibility:** Produce statistical syntax and output that is fully transparent and reproducible by a third party. That is, analyze data in such a way that a third party can reproduce it exactly.
- 5. Interpretation:** Interpret the results of statistical analyses while balancing the competing needs of technical accuracy and simplifying for a lay audience.

Student Resources

Our weekly workshops on most Fridays are a main source of support for learning the material (one Instructor and all teaching assistants will be present during workshops to help you). Our Brightspace page also has a discussion board where you can post questions about course material asynchronously. The Instructor holds

weekly drop-in office hours for In-person one-on-one assistance (see schedule above). Finally, If none of the above work for you, you can send the Instructor or teaching assistants an email with questions or to schedule a virtual meeting at a mutually convenient time.

Course Materials

Open Access Textbooks

Hadley, W. & Grolemund, G. (2023). R for Data Science 2nd edition. [available from url: <https://r4ds.hadley.nz/>]

Navarro D. J. and Foxcroft D. R. (2018). *Learning statistics with jamovi: A tutorial for psychology students and other beginners*. (Version 0.70). [Available from url: <https://sites.google.com/brookes.ac.uk/learning-stats-with-jamovi>]

These textbooks are open access textbooks. This means the electronic version of the book is FREE and available online without any cost. However, unlike in PSYO 2501 there is no print version available at the bookstore; the readings are available only online. Note that the Hadley et al. just updated to the 2nd edition in June, 2023. Make sure you don't accidentally go to the 1st edition (the chapter numbers don't match, so you'll get confused!).

All readings are free to access and do not require that you purchase anything.

Electronic Devices

This class will require a laptop or desktop computer with statistical software installed. Macs or PCs are both acceptable and will be about equally easy either way. You won't be able to complete this class with just a smartphone or tablet.

Required statistical software

All students are required to have the following software on their computers: R, RStudio and jamovi software. All software can be downloaded for free online.

<https://www.r-project.org/>

<https://www.rstudio.com/products/rstudio/download/>

<https://www.jamovi.org/download.html>

In the very first lab, you can bring your computer in and try to install all these things with myself and the TAs available for troubleshooting.

Course Assessment

Component	Weight (% of final grade)	Due Date(s)
8 of 10 Lab Assignments --Lab 1 (Intro to R) --Lab 2 (Data Wrangling) --Lab 3 (Intermediate Data Viz) --Lab 4 (Categorical Data) --Lab 5 (t-tests) --Lab 6 (Multiple Regression) --Lab 7 (ANOVA) --Lab 8 (ANCOVA) --Lab 9 (Factorial ANOVA) --Lab 10 (Nonparametric tests)	80% (10% each)	Sept 19 Sept 26 Oct 3 Oct 17 Oct 24 Oct 31 Nov 7 Nov 14 Nov 28 Dec 5
Take Home Final Exam	20%	Dec 12

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

Student Collaboration and Working in Groups

You are encouraged to work together in small groups when completing assessments in this class. Statistics is a difficult and often anxiety-provoking topic with a lot of problem-solving, and you will learn a lot more if you work with others to solve the problems and discuss your answers together. This is much easier if you show up to the Friday lab sessions! There are no formal assigned groups, but if you're having trouble finding colleagues to collaborate with, let me know and I can introduce you to a classmate!

8 LABS (8 of 10; 80%)

Most weeks, you will be provided a handout with instructions for a hands-on applied statistical analysis activity. This will usually involve analyzing a dataset and interpreting the results, though other applied problems may sometimes be provided.

Like in PSYO 2501, your grade will come from answering quiz questions in Brightspace. These questions will be closely linked to the activities of the lab, so actually doing the lab is important for doing well on these questions. However, unlike PSYO 2501 I will not be assessing you using closed-ended questions (e.g., multiple choice, enter single numbers) and will instead use more long-form written formats and review of your saved data analysis. Typically, you will need to submit:

- a) Submitting complete syntax files that show all your results (i.e., the code/files that run your analyses)
- b) Very short written answers to questions (e.g., interpreting results)

Your lab submissions will generally be **due at 11:59PM on Tuesdays. Late lab assignments up to 3 days late will be assigned a flat late penalty of -10%**. The submission portal will close at 11:59PM on Fridays, 3 days after the due date. It will usually take a few days to grade all the assignments. After 3 days, you can no longer submit the assignment, and you will get a zero. This is because we need to get feedback to students in a timely fashion before the next lab is due, but feedback cannot be released if there are still students completing the assignments.

Grading is not best 8 of 10. Instead, you are to submit a TOTAL of 8 labs. That means there are two lab assignments in the term that you do not have to do, and you may elect to choose any 2 lab assignments to omit. If you complete more than 8 lab assignments, only the first 8 will count towards your grade. **You do not need to notify me or provide documentation the first two times you miss a lab because there is some flexibility built into the course design.** Remember, you only must do 8 of 10 labs, so you can miss 2 lab deadlines without penalty

See below under "Student Declaration of Absence" for policies on accommodations for late submissions or missed labs beyond the first two.

FINAL TAKE-HOME EXAM (20%)

At the end of the year during the last week of classes, you will be given a take-home exam. It will consist primarily of short-answer questions, but also potentially some small statistical analysis tasks. The exam could cover any material covered in the entire class, with the intent of creating an exam that will take ~3 hours to complete. You'll be given until Dec 12 to complete it, it is not timed, and will be fully open book. **A late final exam up to 3 days late will be assigned a flat late penalty of -10%** unless you use a student declaration of absence.

STUDENT DECLARATION OF ABSENCE

Student declaration of absence forms are a standardized way to handle student absences that interfere with the completion of graded academic requirements (exams, quizzes, presentations, papers, etc.).

Here is the procedure you should follow if you experience short-term illness, distress or other extenuating circumstances that affects your ability to complete assessment components:

- a) The Student Declaration of Absence form or alternate verification of the absence must be submitted to the course instructor, or to the instructor's designate **online through Brightspace** within three (3) calendar days following the last day of absence. I only accept forms submitted via Brightspace, not in person or by email.
- b) The Declaration may only be used a **maximum of 2 times throughout the term.**

Here are the specific rules for each assessment component:

Late Lab Assignments. Using your student declaration of absence on a late submission will remove one -10% late penalty from an assignment, so long as it is not more than 3 days late. You may receive your feedback a couple of days later than the rest of the class.

Missed Lab Assignments. The SDA accounts only for short-term disruptions to a maximum of 3 days. Thus, if you don't complete an entire lab even with a 3-day extension, the SDA does not cover this. However, you can still miss up to 2 labs without penalty given our 8 of 10 grading criteria. That is, the first two labs that you fail to submit do not affect your grade and thus do not require a student declaration of absence. Normally, missing a third lab will result in a zero on that component. However, if you miss a third lab due to a longer-term illness we should discuss things on a case-by-case basis, as it would be an issue longer than the maximum of 3 days for short-term illnesses covered by the student declaration of absence.

Late Final Exam: Using your student declaration of absence on a late submission will remove the -10% late penalty from the final exam, so long as it is not more than 3 days late. If you are later than 3 days, get in contact with me via email or you may end up with an "Incomplete" on your transcript.

Policies may differ slightly for students with registered accommodations with accessibility services depending on the nature of your accommodations plan; however, in general this set of policies will be the first line of defense for all students, including those with registered accommodations. Students with long-term problems (e.g., prolonged illness or injury) not already covered by a registered accommodation with accessibility services should get in contact with me, and we can discuss how to proceed on a case-by-case basis.

If you have any questions, please feel free to talk with me; life happens sometimes, and we can work together to find a productive solution.

ACADEMIC INTEGRITY IN LABS

You are allowed to work with colleagues during the lab (and in fact, are encouraged to do so!), and can compare and contrast your results on lab assignments in study groups outside of class, if that is your preference. That said, grades are still individual, and you should take care to avoid plagiarism. The majority of the grading will be done by humans and requires the assessment of your independent writing. Because approaches to writing and conducting analyses are idiosyncratic, please do not copy answers verbatim from colleagues when submitting answers to labs online. This is easily identified and qualifies as academic integrity issue. A similar issue would arise if submitting someone else's code/syntax as your own; like writing, statistical syntax is also idiosyncratic, and copying is often easy to identify. Similarly, do not post assignment questions to homework sites such as chegg.com. These are easy for me to find, and experience has taught me that these services usually get my questions wrong!

Finally, please do not post my workshop questions to Artificial Intelligence (AI) resources such as ChatGPT because they will plagiarize my course notes for their own corporate interests. Beyond this, you should also consider using AI resources at your own risk in PSYO 3502; they are well-known to have difficulty with statistical problems that reference external datasets, because they were never intended to solve these kinds of problems. If you want to experiment with using AI resources, I strongly recommend you get a second opinion from the TA or myself prior to trusting any output from them!

The safest approach to working with colleagues is to work independently, compare your answers (discussing if necessary), then once you are satisfied that you got similar answers, move on to answer the questions on Brightspace independently.

If you are ever in doubt, ASK ME. I can help you navigate issues of academic integrity in an ethical way.

HOW GRADES ARE ROUNDED FOR FINAL LETTER GRADES

Individual assessment components are not rounded (and are left as a decimal grade when appropriate). Final grades with a decimal value greater or equal to 0.5 (e.g., 65.60%) will be rounded up. Final grades with a decimal value less than 0.5 (e.g., 65.49%) will be rounded down.

Course Content and Schedule

Dates	General Topic	Readings	Due date for lab
Wed., Sep. 6	Getting Acquainted	---	
Fri., Sep. 8	Lab 0: Installing R, RStudio and jamovi		N/A
Mon., Sep. 11	Intro to R and data visualization	Hadley et al., Ch 1-3 & 7	
Wed., Sep. 13	Intro to R and data visualization		
Fri., Sep. 15	Lab 1: Intro to R and data visualization		Sept 19
Mon., Sep. 18	Data Wrangling in R	Hadley et al. Ch 4 (exclude 4.5 and 4.6)	
Wed., Sep. 20	Data Wrangling in R		
Fri., Sep. 22	Lab 2: Data Wrangling in R		Sept 26
Mon., Sep. 25	Intermediate Data Visualization	Hadley et al., Ch 11	
Wed., Sep. 27	Intermediate Data Visualization		
Fri., Sep. 29	Lab 3: Intermediate Data Visualization		Oct 3
Mon., Oct. 2	Day for Truth and Reconciliation (University Closed)		
Wed., Oct. 4	Translating Research Questions to Hypotheses		
Fri., Oct. 6	Intro to jamovi & Categorical Data Analysis (50min, 9:35am lecture, no lab!)	Navarro Ch 3	
Mon., Oct. 9	Thanksgiving Day (University Closed)		
Wed., Oct. 11	Intro to jamovi & Categorical Data Analysis	Navarro, Ch 10	
Fri., Oct. 13	Lab 4: Categorical Data Analysis		Oct 17
Mon., Oct. 16	t-tests and effect size	Navarro, Ch 11	
Wed., Oct. 18	t-tests and effect size		
Fri., Oct. 20	Lab 5: t-tests and effect size		Oct 24
Mon., Oct. 23	Correlation & Multiple Regression	Navarro, Ch 12	
Wed., Oct. 25	Correlation & Multiple Regression		
Fri., Oct. 27	Lab 6: Correlation & Multiple Regression		Oct 31
Mon., Oct. 30	One Way ANOVA	Navarro, Ch 13	
Wed., Nov. 1	One Way ANOVA		
Fri., Nov. 3	Lab 7: One Way ANOVA		Nov 7
Mon., Nov. 6	ANCOVA	--	
Wed., Nov. 8	ANCOVA		
Fri., Nov. 10	Lab 8: ANCOVA		Nov 14
Mon., Nov. 13	FALL STUDY BREAK (NO CLASS)!		
Wed., Nov. 15	FALL STUDY BREAK (NO CLASS)!		
Fri., Nov. 17	FALL STUDY BREAK (NO CLASS)!		
Mon., Nov. 20	Factorial ANOVA	Navarro, Ch 14	
Wed., Nov. 22	Factorial ANOVA		
Fri., Nov. 24	Lab 9: Factorial ANOVA		Nov 28
Mon., Nov. 27	Nonparametric tests & rank transformations	Navarro Textbook Review: 11.9 Review: 12.1.6 Review: 13.9	
Wed., Nov. 29	Nonparametric tests & rank transformations		
Fri., Dec. 1	Lab 10: Nonparametric tests		Dec 5
Mon., Dec. 4	Power, Reproducibility & Open Science		
Tue., Dec 5	Power, Reproducibility & Open Science Lieu Day (Monday Classes Held)		

Wed., Dec. 6	Lieu Day (Monday Classes Held) NO CLASS!		

University Policies and Statements

(Generic statements from the university for all courses)

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at:

https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.