Statistical Methods I Syllabus

Department of Psychology and Neuroscience

PSYO 2501 Fall 2026

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
Co-Instructor: Anjali Pandey Anjali.Pandey@dal.ca

Drop-in Office Hours: Mondays, 9:30am to 11:30am, LSC 2540 (Sean)
TBA (Anjali)
Virtual meetings by appointment (send an email to any instructor or TA)

Teaching Assistants:
(Mackenzie Hartley) Mackenzie.Hartley@dal.ca
(Samantha Williams) SamanthaWilliams@dal.ca
(Celia Glenham) celia.glenham@dal.ca

Email Expectations: My working hours are usually 9am to 5pm on weekdays, I may not check my email outside those times consistently. I will usually try to respond to you within 1 business day, though it may be longer if your request is complex or time-consuming.

Course Structure

Lectures: Mondays, 4:05pm to 5:25pm (Rowe 1028)

Laboratories: Section B02: Thursdays, 10:05am to 11:25am (Killam MacMechan Auditorium)
Section B01: Fridays, 1:05pm to 2:25pm, (Dunn 117)

Credits: 3 credit course

Course delivery: In-person, with recorded lectures. Exams require on-campus attendance.

Course Description

This course provides an introduction to research design and statistics within Neuroscience and Psychology. Particular emphasis is placed on conducting and interpreting various statistical procedures, including descriptive and inferential statistics (z-test, t-test, ANOVA, chi-square tests), frequently used in these fields.

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. A self-test and basic mathematics review is posted on the course website for those students who need to review these skills. No statistical knowledge is needed before taking the course: It is assumed that this will be students' first statistics course.

Learning Objectives

1. Conceptual Knowledge: Conceptually understand descriptive and inferential statistics, hypothesis testing, and the theory that allows researchers to make inferences about a population from a sample.

2. Application: Select the right statistic or data visualization to use given a specific hypothesis and type of data.

3. Calculation: With the aid of a calculator and provided formulas, be able to calculate simple descriptive and inferential statistics.

4. Interpretation: Interpret and make appropriate inferences from computerized output from statistical software, data visualizations, or summaries of results written in APA format.

Student Resources

Our weekly workshops on most Thursdays/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. Instructors hold 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 any Instructor or teaching assistant an email with questions or to schedule a virtual meeting at a mutually convenient time.

Course Materials

Required Textbook

Diez, D. M., Barr, C. D., & Cetinkaya-Rundel, M. (2019). *Open-Intro statistics 4th edition*. CreateSpace independent publishing platform.

This book has the associated readings for the course, and also contains practice problems and links to online videos. This textbook is an open access textbook. This means the electronic version of the book is FREE and available online without any cost. The associated textbook website with additional resources, and a .pdf copy to download can be found here (and is also posted on our PSYO 2501 Brightspace page):

https://www.openintro.org/book/os/

It asks for a donation, but you can set it to $0 to get the .pdf of the book for free. There are alsoa limited number (~200) of printed copies of the textbook available at the bookstore, for students who prefer to read a paper copy. These textbooks should be around $35 each and arelikely much more convenient than printing the book using a computer printer. You can also buya printed copy of the text from Amazon:

https://www.amazon.ca/OpenIntro-Statistics-Fourth-David-Diez/dp/1943450072

IMPORTANT: The 3rd edition of the book is no longer suitable for the course, as there were some BIG structural changes in the new book version. Use the 4th edition, not the 3rd edition of this book.

Optional Textbook

Klein, G., & Dabney, A. (2013). *The cartoon introduction to statistics.* New York: Hill and Wang.

This textbook is a supplementary guide intended to provide extra help to gain conceptual understanding of statistics. This book is a VERY straightforward guide that will help you understand the conceptual and theoretical parts that underlie the statistics we cover in this class. It may also please you to know that this book is written entirely in comic book form, making it fun to read. This book only covers material from the first month of the course, but these

foundations remain applicable throughout the course. The book is relatively inexpensive,and there are copies available at the bookstore for purchase (though not many, since I anticipate that many students will not buy this book). I also have put two copies of the book onreserve in the Killam library.
https://www.amazon.ca/Cartoon-Introduction-Statistics-Grady-Klein/dp/0809033593

Software
The current class will make use of RShiny applications (https://shiny.rstudio.com/), which are created with R statistical software. These applications are point-and-click software that work through an internet web browser (e.g., Firefox, Safari) and will not require you to install anything. You will also need to use and access our course Brightspace page to access lecture slides,videos, and to submit quizzes.

Electronic Devices

Bringing an Internet-ready electronic device to class such as a laptop, tablet, or cell phone is strongly recommended (especially for the workshops). We will occasionally use online calculators and tools during class time. However, during exams, the only electronic device that is permitted will be a non-programmable calculator that does not store text. You may often find a dedicated calculator to be useful in the workshops as well, even if your phone has one.

Course Assessment

Component	**Weight (% of final grade)**	**Due Date(s)**
Midterm Exam 1	25%	B02 Lab Section: Oct 15 B01 Lab Section: Oct 16
Midterm Exam 2	25%	B02 Lab Section: Nov 19 B01 Lab Section: Nov 20
Final Exam	30%	TBA in exam period
9 Workshops	20% W3 & W4 (3% each) All others (2% each)	W1: Friday, Sept 18 W2: Friday, Sept 25 W3: Friday, Oct 2 W4: Friday, Oct 9 W5: Friday, Oct 23 W6: Friday, Oct 30 W7: Friday, Nov 6 W8: Friday, Nov 27 W9: Friday, Dec 4
Experimental Participation	1.5% Bonus	Until SONA closes early Dec

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)		

WORKSHOPS (36%)

The purpose of the workshops is to build up your skills for the exams. Doing so requires a safe space to make mistakes and figure things out through trial and error. Each workshop has an online Brightspace quiz associated with it that is worth a small amount of points to encourage you to practice prior to the exams. **These quizzes are pass/fail, and you can have unlimited attempts up until the deadline (11:59pm on Fridays). You must score a minimum of 85% (an A letter grade) to pass each quiz.**

The format of the workshops is as follows. You will be given a paper handout with numerous applied statistical problems. These may involve hand calculations, using online statistical tools, and/or interpreting output from statistical software. During these periods, the teaching assistants and I will be present to answer questions and assist and tutor you. In each workshop, the first questions will be self-graded practice questions that aren't worth points. After the practice questions, there will be assessment questions assessed using an online Brightspace quiz. The online quiz asks the same questions as in the handout, except adapted to a format suitable for automatic grading (e.g., multiple choice, multiselect).

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. History shows that students who work together learn more!

The intent is for most students to complete these questions on Brightspace in class before the end of each workshop. However, you may continue to work on them at home if you do not finish. To help facilitate different schedules, a .pdf copy of the workshop will be posted on Brightspace the day before the workshop happens. A paper copy will be handed out during the in-person lab sessions. The answer to these questions will always be due 11:59PM on the same day as the second workshop section (Fridays). See the sections below for policy on extensions needed for compassionate reasons.

Despite the quizzes being pass/fail, there are important reasons for having a deadline structure. The first is that memory is improved through distributed practice; without a deadline structure, many students would leave all the quizzes to the last minute and would most likely fail the exams. The second reason is that online quizzes don't test a student's mastery of course content because of access to external resources (e.g., looking things up online, getting someone else to help you). However, submitting quizzes by the deadline does test your capacity to be conscientious and disciplined. Thus, the points assigned to the quizzes are really testing these qualities, for which a deadline structure is valid.

WORKSHOP QUESTION TYPES

Aside from multiple choice questions (which you are familiar with from PSYO 1011/1012), examformats will also include two other question types: Select all that apply and number fill-in questions.

A "select all that apply" question is like a multiple-choice question, but works like this example:

1. Which of the following are a measure of central tendency in statistics (select all that apply)?

A. Mean
B. Median
C. Mode
D. Standard Deviation
E. Interquartile range

In this case, A, B & C are correct answers. The question is worth 5 points total, and you get 1 point for each correct answer correctly indicated. For example, if you only selected "A & B" you would get 4 out of 5 points. If you selected every option, you'd get 3 out of 5 points. If you selected only "E", you'd get 1 out of 5 points. In other words, it is possible to get full or partial value for these kinds of questions. There will always be at least 1 option to select (i.e., the fully correct answer will never be to leave EVERY option blank).

Fill in the number questions typically involve mathematical calculations. You will not be showing your work but will instead just be typing your final answer into a blank space. This means these kinds of questions will not have partial value awarded. For example:

2. What is 2 divided by 3? (round to two decimal places) _____

Answers should be written as decimal numbers, not fractions. In this case, the answer is 0.67.

The question will always specify how many decimal places to round to. Moreover, each question will have a "tolerance" to account for rounding. For instance, I might accept any answer from .66 to .68 as a correct answer. This is because I am not so concerned with small rounding errors in this course.

EXAMS (80%)

There will be three exams: One midterm and a final. Given the nature of material in statistics, all exams are cumulative (i.e., some material from prior exams is necessary to solve more complex problems later in the course). This is especially true for the material covered up to Exam 1, as this material is central to everything that follows. That said, there will often be much more emphasis on the new material learned for each exam. Midterms will be multiple choice with around 36 questions and you will have the full class period (80min). Exams are held during the lab sessions, so there are two sessions held for exams. So, make sure to show up in the room and lab section you are signed up for (B01 or B02). The final exam will be a little longer and you will have 2 hours to complete it.

EXPERIEMENTAL CREDIT BONUS POINTS (1.5%)

Up to **1.5** bonus credit points are available by participating in research at Dalhousie University. Typically, 1 credit point is awarded for each hour of experiment participation, up to a maximum of 1 point. This is a great way to boost your grade and learn about real research that is ongoing at Dalhousie, and students are encouraged to participate. Any credit points that will contribute to a student's final grade in PSYO 2501 must be assigned by the last day of classes. To sign up for a SONA account and view available studies go to this weblink: https://www.dal.ca/faculty/science/psychology_neuroscience/research/credit-point-information.html

PRACTICE QUESTIONS (0%)

Each week, there is a file with practice questions that will be posted in a .pdf file. You can work on these practice problems for extra practice. Some practice problems are created by me, while others are in the OpenIntro textbook. In all cases, there is an answer key provided for these questions. They are self-study questions and are not worth points. However, they are good practice for the quizzes and exams.

The free OpenIntro textbook also has 100s of practice questions. The odd-numbered questions have an answer key you can access in Appendix A. Each week in the "Practice Questions" document, I have selected out a subset of those questions that you can try on your own time for practice. I tried to select questions that (a) cover material from class; (b) are relatively close to the style of questions I create; and (c) are more likely to use examples relevant to psychology.

A few frequently asked questions regarding the practice questions:

Q: Where are the practice questions?
A: At the end of each chapter in the OpenIntro textbook in the sections labeled "Exercises." For example, question 1.5 is found at the end of Chapter 1, and question 3.1 is found at the end of chapter 3. There will be a list of practice questions as a pdf file called "Week X PSYO 2501 Practice Questions" for each week of the course posted on Brightspace.

Q: Should I do every practice question in the book?
A: No. I provide a smaller list of practice questions you can try each week. I have tried to omit questions I do not think are relevant for our course.

Q: Where are the answers?
A: The answers to odd-numbered questions (1.5, 1.7, etc.) are found in Appendix A in the OpenIntro textbook. The even-numbered questions (1.6, 1.8. etc.) are not open-access and arenot provided to students. The answers to the questions I create are in the same .pdf as the questions.

Q: Why can't you just post all the even-numbered answers?

A: Because the answer key for the even-numbered questions are protected by copyright law,and I do not have permission to share them. Here are the reasons given by OpenIntro: "OpenIntro's mission is to increase access to high-quality, low-cost education materials. Without teachers choosing to use our resources, we cannot fulfill our mission, and many teachers have told us it is critical to have some exercises for graded homework or exam questions where no solutions are not readily available to students. Without a large collection of such exercises, many teachers would drop OpenIntro and instead require a more expensive and lower-quality textbook. For this reason, we do not permit sharing of this solution manual. We know this creates challenges for some students and self-study learners who could benefit from a full solution guide, and this decision was not made lightly."

Q: What do I do if the answer key is wrong?
A: It is always possible that there are typos in the answer key. If you think this is the case, please email me at mackinnon.sean@dal.ca and I will review it. If there is an error in the key, I will update the document so everyone is aware (or alternatively, will explain the answer to you if the answer key is actually correct).

Q: Are these worth points?
A: No. They are for practice and studying only.

Q: Are these questions exactly like your exam and workshop questions?
A: No, but they will still be helpful practice.

POLICY REGARDING EXTENSIONS AND MISSED QUIZZES/EXAMS

Life happens sometimes, and you may miss a quiz or an exam due to unexpected circumstances. Here is the procedure you should follow if you experience short-term illness, distress or other extenuating circumstances that affects your ability to complete quizzes:

a) The Student Declaration of Absence form must be submitted to the course instructor **online through Brightspace**. I only accept forms submitted via Brightspace, not in person or by email.

b) The Declaration may only be used for a **maximum of 3 times throughout the term.**

Here are the specific rules for each assessment component:

Missed Exams: You will complete a make-up exam in-person in a similar fashion to the regular exam at a mutually convenient time for all coordinated by email once we have a full list of who has missed the exam. Regardless, make-up exams will generally need to be no later than one week after the original exam deadline, as late exams will delay feedback for the rest of the class. In extraordinary circumstances, the weight of one midterm may be moved to the final exam.

Missed Workshop Quiz: If you miss an online workshop quiz, submit a student declaration of absence on Brightspace and indicate which workshop you missed. **You will be given a one-week (7 day) extension to complete the quiz**. If you cannot complete a missed quiz by the corresponding extended deadline, in general you will receive a zero on the workshop missed quiz.

Missed Final Exam: The student declaration of absence cannot be used for missed final exams in any class at Dalhousie. If you miss the final exam, please contact me by email as soon as you are able.

If you have circumstances that you feel are not adequately accommodated by the above procedures, please email me and we will talk, and potentially work out something on a case-by-case basis.

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.

ACADEMIC INTEGRITY

You are allowed to work with colleagues during the workshops (and in fact, are encouraged to do so!) and can compare and contrast your results and even do your quizzes together with other students in the class, if that is your preference. In general, because the quizzes are pass/fail with unlimited attempts up until the deadline, the workshops can be collaborative and working with other students in the class doesn't violate academic integrity.

Use online resources (e.g., websites, YouTube videos, ChatGPT) at your own risk. There are a wide variety of different formulas and approaches in statistics, and what you find online may not match the way I am teaching you. Though using online resources for the workshop quizzes is not an academic integrity violation, relying on them too much is often an act of self-sabotage that will hurt your critical thinking ability and capacity to do well on exams. Ask me (Sean) or the teaching assistants for help instead!

Exam questions will not be released or shared in digital format, so if they are ever found anywhere online it is an academic integrity violation. You can maintain personal copies of workshops for your own educational purposes under fair use, but I would ask that you do not share them outside the class without asking me first.

Finally, please do not copy/upload my course materials to generative Artificial Intelligence (AI) resources such as ChatGPT because it has a negative impact on student learning and the development of critical thought (in addition to having high rates of misinformation, like all online resources). Moreover, when you upload my course materials to AI, companies will plagiarize my course materials without attribution for their own corporate interests. In exchange, I and the teaching assistants commit to avoiding generative AI in the creation of all course materials and in the grading of any student work.

Exams are completed on an individual basis during class time, and you will not be able to collaborate or talk with others while completing the exams. You will have no access to the internet and will not be permitted to talk to anyone during exams. The only extra resources permitted will be a calculator (no internet access permitted) and your self-created reference sheet (see Exams above). Taking unauthorized materials to the exam period would be an academic integrity violation.

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

Course Content and Schedule

Dates	General Topic	Readings
Mon., Sep. 7	Labour Day (University Closed)	
Thu., Sep. 10 & Fri Sept 11	Getting Acquainted (Lecture)	
Mon., Sep. 14	Introduction to Data, Data Visualization,& Descriptive Statistics	OpenIntro: 1.1, 1.2, 2.1, 2.2 (Skip 2.1.7, 2.1.8, 2.2.4) Cartoon Guide: Ch 1-5
Thu., Sep. 17 & Fri Sept 18	Workshop 1: Descriptive Stats	
Mon., Sep. 21	The Normal Distribution & z-scores	OpenIntro: 4.1
Thu., Sep. 24 & Fri Sept 25	Workshop 2: Normal Distribution	
Mon., Sep. 28	Variability, Confidence Intervals and the Central Limit Theorem	OpenIntro: 5.1, 5.2 Cartoon Guide: Ch 6-8
Thu., Oct. 1 & Fri Oct 2	Workshop 3: Variability	
Mon., Oct. 5	Hypothesis testing	OpenIntro: 5.3 Cartoon Guide: Ch 9-13
Thu., Oct. 8 & Fri Oct 9	Workshop 4: Hypothesis testing	

Mon., Oct. 12	Thanksgiving Day (University Closed) Virtual Lecture Uploaded: t-tests Part 1	OpenIntro: 7.1, 7.2
Thu., Oct. 15 & Fri Oct 16	**Exam 1 (during lab sessions)**	
Mon., Oct. 19	t-tests & effect size Part 2	OpenIntro: 7.3 (Skip 7.3.4)
Thu., Oct. 22 & Fri Oct 23	Workshop 5: t-tests	
Mon., Oct. 26	Categorical Data I: Test of Proportions	OpenIntro: 6.1, 6.2. (skip 6.2.4, 6.2.5) Grimes & Schulz (2008)
Thu., Oct. 29 & Fri Oct 30	Workshop 6: Comparing Proportions	
Mon., Nov. 2	Categorical Data II: Chi-Squares	OpenIntro: 6.3, 6.4. (skip 6.3.5)
Thu., Nov. 5 & Fri Nov 6	Workshop 7: Chi-squares	
Mon., Nov. 9	READING WEEK: NO CLASS!	
Thu., Nov. 12 & Fri Nov 13	READING WEEK: NO CLASS!	
Mon., Nov. 16	Exam Review	
Thu., Nov. 19 & Fri Nov 20	**Exam 2 (during lab sessions)**	
Mon., Nov. 23	One-way ANOVA	OpenIntro: 7.5
Thu., Nov. 26 & Fri Nov 27	Workshop 8: ANOVA	
Mon., Nov. 30	Linear Regression and Correlation	OpenIntro: 8.1, 8.2, 8.4 (omit 8.3)
Thu., Dec. 3 & Fri Dec 4	Workshop 9: Linear Regression	
Mon., Dec. 7	Exam Review	
Tues., Dec 8	Lieu Day (Monday Schedule) No Class!	

University Policies and Statements
(Generic statements for required for all university courses)

Use of Generative AI (Copilot Chat): According to Dalhousie and Nova Scotia privacy laws, instructors are not permitted to require students to use generative AI other than Microsoft 365 Copilot Chat, which is a free AI-powered tool included with all Dalhousie accounts. If generative AI is used in cases where it is not permitted, it will be considered an academic integrity offence, and you will be subject to appropriate disciplinary and/or corrective measures.

Accessibility: Refer to the Student Accommodation Policy for information on how Dalhousie instructors and staff work collaboratively with students to create and sustain an accessible educational environment.

- If there are aspects of this course, including but not limited to its design, teaching approaches, learning activities, and assessments, that result in barriers to your learning or do not align with your formal academic accommodations, reach out to me to collaboratively find a solution that meets your needs.
- You are eligible for accommodations based on protected characteristics such as religion. If you have religious, cultural, or community-significant observances that conflict with course requirements, reach out to me to collaboratively find alternatives for completing the course requirements.
- To begin the process of requesting a formal academic accommodation, contact the Student Accessibility Centre (or the Student Success Centre for Faculty of Agriculture courses).
- Your classroom may contain accessible furniture and equipment. It is important that these items remain in the classroom, undisturbed and unused, so that classmates who require their use will be able to fully participate in the course.

Academic Integrity: Dalhousie expects all students to be responsible learners, demonstrating the values of intellectual honesty, trust, fairness, and respect in your work. Key aspects of academic integrity include, but are not limited to: avoiding plagiarism, not engaging in cheating, submitting original work, and acknowledging sources of information and ideas when they are not your own. Refer to the Statement on Intellectual Honesty for definitions of various academic offences. Failure to meet Dalhousie's academic integrity standards will result in appropriate disciplinary and/or corrective measures.

Important Dates (e.g., holidays)
https://www.dal.ca/study/plan-your-degree/important-dates.html

Syllabus Appendix: Student Supports & University Statements, Policies, and Guidelines
Select the link below for student supports available to all Dalhousie students, and University-wide statements, policies, and guidelines applicable to your academic studies.
https://dalu.sharepoint.com/sites/learn-teach/SitePages/syllabus-appendix.aspx