PSYCH 213: Introduction to Data Analysis in Psychology I
B4 — Winter 2026

Instructor Information

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Class Information

Class Dates: January 5 - April 10
Lecture Days and Times: Monday, Wednesday, and Friday at 13:00 - 13:50
Classroom: NRE 2-001 (Natural Resources Engineering Facility, Markin/CNRL)
Course Website: https://jpisklak.github.io/courses/PSYCH_213_B4/index.html

Teaching Assistant

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1 Territorial Acknowledgement

The University of Alberta, its buildings, laboratories, and research stations are primarily located on the territory of the Néhiyaw (Cree), Niitsitapi (Blackfoot), Métis, Nakoda (Stoney), Dene, Haudenosaunee (Iroquois) and Anishinaabe (Ojibway/Saulteaux), lands that are now known as part of Treaties 6, 7 and 8 and homeland of the Métis. The University of Alberta respects the sovereignty, lands, histories, languages, knowledge systems, and cultures of all First Nations, Métis, and Inuit nations whose cultures continue to influence our vibrant community.

2 Course Calendar Description

Introduces basic analytical concepts and methods used in conducting and interpreting psychological research. Students will begin to learn how to summarize, interpret, and draw inferences from psychological data. This course covers quantitative and qualitative forms of data and data management; explores fundamental principles used in psychometric, neuroscientific, and behavioural analyses; and examines analytical techniques necessary for assessing frequency, associative, and causal claims. Fulfilment of the 1 hour lab component typically involves the completion of analysis assignments.

Prerequisites

PSYCH 104 or PSYCH 105. [Faculty of Science] Note: This course may not be taken for credit if credit has been obtained in STAT 151 or 161, KIN 109, PEDS 109, PTHER 352, or SOC 210.

3 Course Philosophy & Goals

This course is designed to introduce students to the fundamental analytical concepts and methods used by researchers in psychology. It emphasizes the use of these techniques as essential tools in the scientific process, focusing on mastering the concepts and logic underlying analyses to test frequency, association, and causal claims.

In addition to traditional statistical concepts, this course also introduces the equally important field of open-access statistical computing using the R programming language. Unlike many traditional statistics courses, which often treat statistical computing as an afterthought (or neglect it entirely), this course operates on the premise that statistical computing is not just a supplement to statistical theory but a vital complement of it that can enhance a student's understanding and appreciation of the theory.

The ability to analyse and interpret data is a critical skill across numerous disciplines, and statistical computing equips students with the tools necessary to handle complex data sets, draw meaningful conclusions, and make informed decisions. This approach is grounded in ethical principles and aligns with the ideals of "Open Science," ensuring that students are not beholden to expensive proprietary software and formatting schemes. Whether students are pursuing a career in science, business, social sciences, or technology, proficiency in statistical computing allows them to uncover patterns, test hypotheses, and present data compellingly. Moreover, as the demand for data literacy continues to grow, mastering statistical computing will not only enhance their academic pursuits but also significantly boost their prospects in an increasingly competitive job market.

3.1 By the end of this course, students should . . .

- Not be afraid of statistics or data - R will be your sword and shield.
- Be able to manage, summarize, and describe different forms of data with large data sets.
- Appreciate core principles of data analysis to better understand how human and non-human animal behaviour is studied.
- Be able to design a coherent and (most importantly) analyzable experiment/study.
- Have learned foundational skills needed to approach more advanced analytical methods in Psychology.
- Develop a growing sense of why "robustness" is an important concept in statistics and science.
- Feel more confident that you have the tools and background to *learn* new statistical concepts when the need arises.
- Have improved your computer literacy.
- Worship at the altar of R and understand the majesty that is open-access statistical computing — an essential element of all modern research.

4 Course Objectives/Outcomes

This course is organized into topics, each with a general learning outcome supported by specific learning outcomes. These can be found in the syllabus Appendix located at the end of this document. In addition, the Appendix also lists what portions of the textbook are required reading for students.

5 OMG! Why does this course use R?!

(My friend didn't have to learn that in their stats course!)

The decision to use R (a programming language) in a Psychology focused course may seem strange, but there are many compelling reasons to learn it in place of the kinds of proprietary software (e.g., SPSS) that have been traditionally employed (and justifiably disliked by students) in these types of courses.

- **Free and Open Source:** R is open-source software, meaning students can not only access it for free, there is a wealth of complementary open-source packages freely available for specialized analyses and tasks.
- **Versatility in Data Analysis:** R is a powerful tool and was literally developed for conducting statistical analysis, data visualization, and data manipulation. It is used widely across academia and various other fields such as business, healthcare, and government.
- **Strong Community Support:** R has a large and active community that contributes to a vast array of impressive packages, tools, and resources. This means students can easily source help, tutorials, and code examples for almost any task.
- **Reproducible Research:** Aligned with open-science principles, R is built for reproducible research—a crucial aspect in both academic and professional environments. It enables students to create scripts that can be easily shared, reviewed, and rerun, ensuring their work is transparent, accurate, and reliable.
- **Integration with Other Tools:** R can easily integrate with other software and programming languages, such as Python, SQL, HTML, LaTeX, and even (ugh) Excel. This makes it a valuable tool for working in diverse computational environments.
- **Growing Demand in the Job Market:** R is highly valued in the job market, especially in data science, analytics, and research roles. Learning R can open up numerous career opportunities for students.
- **Advanced Statistical Capabilities:** Many of R's packages make it easy to apply best practices in statistics (e.g., the use of robust methodologies) and can readily employ newer and more complex types of analyses.
- **Enhanced Data Visualization:** R offers powerful and intuitive packages like ggplot2 for sophisticated and customizable data visualizations, helping students communicate their findings effectively.
- **Learning Curve and Educational Value:** While R has a learning curve, it is no steeper than expensive proprietary point and click programs like SPSS. Moreover, working with R teaches valuable problem-solving and programming skills that generalize to (and thus are an excellent first step towards learning) other programming languages.

6 Math, Stats, and Programming Help

Learning is an active process, and seeking help when you need it is an important part of that process. Many resources are available to support you, but it is up to you to take the initiative to seek them out. Your primary point of contact is the instructor. If you are facing challenges, do not hesitate to attend office hours or send an email. It is important to address any issues, whether course-related or not, *as soon as they arise*. If you cannot attend office hours, reach out via email to arrange an alternative meeting time.

> The course content builds on itself. Concepts introduced early form the foundation for later material, so unresolved difficulties can accumulate and become harder to address over time. By seeking clarification promptly, you help prevent small gaps from becoming major obstacles to your progress.

With respect to R programming specifically, the most time efficient way to seek help is to email the instructor with a brief description of the problem you are having and ensure that you have shared a copy of your R code (i.e., the .IPYNB file). This will allow the instructor to quickly run and spot issues with the code.

7 Minimum Technology Requirements

This course introduces students to both statistics and statistical computing using the R programming language. To engage fully with course activities (including writing code, completing assignments, and interacting with course materials) students will need reliable access to a computer and internet connection capable of supporting the technologies used by the University of Alberta.

Students who do not have personal access to a suitable computer may use computers available in University library facilities and computer labs; these resources fully meet the course requirements. For more information on technology access through UofA Libraries, visit:
https://www.library.ualberta.ca/services/technology

For a smooth learning experience, please review the University's minimum technology specifications:
https://www.ualberta.ca/.../technology-requirements.html

Bringing a personal laptop to lectures is optimal for learning but not strictly required. Access to a computer, whether personal or through campus facilities, is sufficient for completing course work. Tablets and Chromebooks may be used, but they are not recommended, as they can restrict helpful functionality needed for programming and assessment. A computer running a updated version of Windows, MacOS (not iOS), or a Linux distribution is instead recommended.

If you have questions or anticipate difficulties meeting these requirements, please contact the instructor at the start of the term so we can explore available options. Delays in addressing technology access may interfere with your ability to complete assessments and may result in missed or zero grades.

8 Required Course Materials

1. **Textbook: OpenIntro Statistics (4th Edition)**
    - This course uses an *open-access* textbook that is freely available online. The textbook provides essential readings and foundational materials to support your learning throughout the term. Note: in the interest of time, not all chapters of the textbook will be covered. The Appendix at the end of this document lists the required readings for each course topic.
    - Free PDF:
        - https://jpisklak.github.io/courses/PSYCH_213_B4/docs/OpenIntro_Statistics_Textbook.pdf
    - Purchasable Colour Paperback Version:
        - https://a.co/d/2WU1hIb
    - Book Webpage:
        - https://www.openintro.org/book/os/
2. **Achieve Online Assessments**
    - To complement the textbook, this course requires the use of Achieve, a third-party service that hosts related online assessments. These assessments are designed to encourage consistent engagement with the textbook and to help you apply the concepts covered in the readings. Completing these assignments will deepen your understanding and prepare you for other course activities and assessments.
    - Access Instructions:
        - https://sites.google.com/macmillan.com/psych213b4w26/home

8.1 On-Line Homework Disclaimer

The textbook provides the theoretical foundation for the course, while Achieve assessments are intended to reinforce your understanding of the textbook material through interactive exercises and assignments. The goal is to encourage regular reading and engagement with the textbook to maximize your learning.

The Achieve online assessments are an essential component of this course, provided by Macmillan Learning, a third-party organization. Please note that this platform will store assessment information, which may be linked to your account. If you have any concerns regarding the storage or use of your data, please contact the instructor promptly for assistance.

Students who are unable to afford the associated fees for the online homework must notify the instructor no later than January 16th to discuss alternative arrangements.

9 Tentative Lecture Schedule

See the current Calendar for the Academic Schedule, Dates, and Deadlines, which include the Registration Add/Drop deadline and Withdrawal date: https://calendar.ualberta.ca/content.php?catoid=56&navoid=17524

Week	Dates	Course Activities
1	Jan 05 - 09	- Course Overview - Getting Started with R
2	Jan 12 - 16	- Getting Started with R - Math Refresher - Core Concepts in Statistical Reasoning - *Add/drop deadline (Fri)*
3	Jan 19 - 23	- Describing Data with Measures of Central Tendency - Describing Variability and Transforming Data
4	Jan 26 - 30	- Describing Variability and Transforming Data - The Normal Distribution, Sampling, and Statistical Inference
5	Feb 02 - 06	- The Normal Distribution, Sampling, and Statistical Inference
6	Feb 09 - 13	- One-Sample t-Test
7	Feb 16 - 20	- *Reading Week*
8	Feb 23 - 27	- One-Sample t-Test - *Course Project I Instructions*
9	Mar 02 - 06	- Paired-Samples t-Test
10	Mar 09 - 13	- Independent samples t-test
11	Mar 16 - 20	- ***First 5 Achieve Assessments Due (Mar 18)*** - ***Midterm exam (March 18, 40 minutes)*** - Independent samples t-test cont'd *Course Project II Instructions*
12	Mar 23 - 27	- Correlation and Regression
13	Mar 30 - Apr 3	- Outlier Detection - Inference with Categorical Variables
14	Apr 06 - 10	- ***Last 4 Achieve Assessments Due (April 10)*** - Qualitative Research Methods Intro (Guest Lecture) - One-Way Independent ANOVA (Time Permitting)
	Apr 16	***Final Exam at 13:00 (120 minutes)***

Notes:

- Schedule is (very) tentative; topics and order may change.
- A listing of the topics and their associated learning outcomes can be found in the Appendix at the end of this document.
- Exams cover all material up to the exam date (unless noted otherwise in class).
- Midterm and final include multiple choice and numeric entry on Canvas; bring a laptop/tablet and basic or scientific calculator (see Section 11.1).
- Confirm final exam date and time on BearTracks once posted.

It is the student's responsibility to stay up to date with lectures to ensure they do not miss important announcements about upcoming assessments, deadlines, and schedule changes.

9.1 Midterm and Final Exam Conflicts with Regularly Scheduled Classes

Time conflicts between regularly scheduled class periods (as listed on BearTracks) and term exams from other courses will not be accommodated. If a term exam from another course overlaps with a scheduled class time, it is the student's responsibility to contact the instructor of the intruding course to request an accommodation. As noted in the University Calendar:

> "...Students have the right to attend regularly scheduled class activities. Therefore, if a student has a conflict between a regularly scheduled class and a scheduled term examination, the instructor of the class in which there was a scheduled term examination will be required to make an accommodation for the student."

10 Grade Evaluation

10.1 Minimum Criteria for a Passing Grade (D or higher)

To earn a passing grade in the course, students must satisfy both of the following requirements below. These criteria establish a fixed baseline of performance; meeting them does not guarantee a specific letter grade, but ensures that they will not receive an F.

1. Exam performance requirement

The weighted mean raw percentage score across the midterm and final exams must be ≥ 30%, calculated as:

$$\text{Pass} = \frac{(\text{Midterm\%} \times 30\%) + (\text{Final\%} \times 35\%)}{30\% + 35\%} \geq 30\% \tag{1}$$

The exam weights (30% midterm, 35% final) are taken from Table 3.

Note: Any weight adjustments applied elsewhere in the course (e.g., transfers from other assignments) do not change the calculation in Equation 1; passing requires meeting the threshold based on the original exam weights.

2. Homework completion and performance requirement

Students must complete at least 60% of homework assignments and obtain a weighted mean raw percentage score ≥ 50% across those completed assignments.

These requirements ensure that students demonstrate a minimum level of engagement and understanding in both cumulative exams and ongoing coursework before a passing grade can be assigned.

10.2 How Course Performance Is Evaluated

Meeting the minimum passing criteria stated above (see section 10.1) reflects the minimum achievement of the core learning outcomes. Grades above that threshold are assigned based on performance of a robust, difficulty-adjusted scale designed to correspond more faithfully and reliably to the University's letter-grade descriptors than traditional percentage cutoffs can.

Each assessment's raw percentage score is rescaled to a common standard that establishes a consistent centre and spread across assessments. This has the benefit of adjusting for differences in assessment difficulty and variability so that, when combined into a total score, each course component contributes fairly to the final grade (i.e., students are not penalized for overly difficult assessments nor rewarded for easy ones) and produces values that can be mapped, *a priori*, to the University's letter-grade descriptors in a principled way.

This process does not impose quotas, force a curve, or normalize scores to a fixed distribution; it is a method of scale alignment, not norm-referencing.

10.2.1 How raw percentages are rescaled

A student's raw score on each assessment (e.g., midterm, homework assignments, etc.) is converted to a standardized score using Equation 2:

$$\text{Standardized Score} = \frac{\text{Raw Score} - \text{Median}}{\text{MADN}} \tag{2}$$

"Raw Score" indicates a student's raw percent score on an assessment (e.g., the midterm). The "Median" and "MADN" summarize the statistical centre (i.e. average) and spread respectively for that assessment. Students may be less familiar with the notion of spread, but it matters because it shows how tightly or loosely scores are grouped around the average. This is information that helps interpret what a raw score really means.

On this scale, 0 represents the class average. Positive values indicate above-average performance, with scores near or above +1 reflecting clearly strong results. Negative values indicate below-average performance, with scores near or below –1 reflecting clearly weaker results. How these scores map to letter grades specifically can be seen in Table 2.

The standardized scores for each assessment are then combined as outlined in section 10.2.2 below.

Additional info for those interested:

- Students do not need to calculate their own standing in the course. Each student will have access to a personal gradebook page that displays their raw percentage score for every assessment, the corresponding weight, and the class median and MADN (which indicate overall performance and spread, respectively). Standardized scores for each assessment and for the total course grade will also be provided, along with visual summaries of the class distribution to help contextualize results in a "non-numeric" way.
- The median and MADN are used because they retain accuracy even in the presence of outliers or skewed distributions. MADN refers to the "normalized median absolute deviation" and is a *robust* measure of spread analogous to the standard deviation (and is the focus of one of the topics in the course).
- Conceptually, the transformation applied by Equation 2 is analogous to a common z-score, but replaces the mean and standard deviation with the median and MADN. This makes the re-scaling robust under skewed or irregular distributions.
- Applying Equation 2, the class median (i.e., average) of an assessment becomes fixed at 0, which is set to correspond to a B- letter grade in this class (see Table 2). The rationale being that, excluding

F, the University of Alberta's 12-letter grading scale places B- at the midpoint of performance expectations. Anchoring the standardized median at B- matches the University's formal meaning of the letter's broader category (i.e., "good" performance) and aligns typical achievement in this course with University norms for first- and second-year offerings.

- Unsubmitted course-work (i.e., non-submissions) are not included in the determination of the median and MADN, since the lack of an attempt provides no information about the difficulty of the assessment.

10.2.2 Combining assessments

The standardized scores of all the assessments are combined using a weighted mean (weights are listed in Table 3) to produce an overall course total. Because applying different weights to components may shift the centre and spread of the combined scores away from 0 and 1 respectively, this total is also converted to a standardized score (see Equation 2) so that the class median is again anchored at 0 (B–) with the same spread convention. This final step ensures that a student's overall score remains directly interpretable using the letter-grade boundaries in Table 2.

Because a weighted mean is sensitive to extreme values, standardized assessment scores are capped at ± 3.5 to ensure that no single assessment overwhelms the final grade. The value ± 3.5 corresponds to the range within which virtually all standardized scores fall under typical performance variation (i.e., beyond this point differences are no longer educationally meaningful), providing a clear limit on both unusually high and unusually low results. Unexcused non-submission is recorded as a zero and, after standardization, receives the lowest capped score.

If a student withdraws from the course, performance on assessments completed prior to withdrawal continues to inform the statistical calibration of those assessments (e.g., median and MADN), as it reflects completed work and assessment difficulty. After withdrawal, the student is removed from subsequent assessments and course-total calculations.

10.2.3 Assigning letter grades

Final letter grades are determined by comparing the overall course total described above (see section 10.2.2) to a fixed set of grade boundaries (see Table 2). These boundaries were established in advance, informed by historical student performance, instructor judgment, and the realities of aggregating values with comparable centres and spreads. They **do not** and **cannot** enforce a predetermined distribution of grades. Each student's grade depends only on their own performance relative to the class median and spread, not on how many classmates fall into each category.

Standardized Score	Interpretation	Grade Points	Letter Grade
$1.96 < \infty$	Outstanding	4.0	A+
$1.44 < 1.96$	Excellent	4.0	A
$1.036 < 1.44$	Very Good	3.7	A–
$0.674 < 1.036$	Good	3.3	B+
$0.253 < 0.674$	Above Average	3.0	B
$-0.253 < 0.253$	Average	2.7	B–
$-0.674 < -0.253$	Satisfactory	2.3	C+
$-1.036 < -0.674$	Acceptable	2.0	C
$-1.44 < -1.036$	Marginal	1.7	C–
$-1.96 < -1.44$	Poor	1.3	D+
$-\infty < -1.96$	Minimal Pass	1.0	D
NA (see section 10.1)	Failure	0.0	F

Table 2: Letter Grade Boundaries. Each grade covers scores from its listed lower limit up to (but not including) the upper limit. Table values are displayed rounded to three decimal places. Actual cutoffs are more precise.

This table contains an approximate guideline for the course; however, the instructor reserves the right to adjust this table to correspond to University-suggested ranges and assign appropriate grades based on relative performance.

Grades are unofficial until approved by the Department and/or Faculty offering the course.

🤔 FAQ about Grade Evaluation

- **Q: Why don't you just use the percentage scores like most classes?**

  A: Raw percentages can be misleading because the same number can reflect very different levels of performance depending on the difficulty of the assessment. For example, 60% might be excellent on a challenging exam, whereas 85% might be average on an easier one.

  Assigning letter grades directly from raw percentages requires the instructor to accurately anticipate the centre (average) and spread (variability) of each assessment, as well as how those distributions will combine when course components are aggregated. Outside of a course that is taught and assessed in exactly the same way every term, making these predictions with meaningful precision is extremely difficult. As a result, most instructors rely on traditional percentage cut-offs (e.g., 90% = A) as a practical convention rather than the outcome of a carefully calibrated, course-specific grading model. This means that raw percentage scales can drift unpredictably from one assessment to the next, and from one course offering to the next, making their letter-grade interpretations inconsistent. An A in one course (or section) can therefore represent a very different level of difficulty, effort, or learning than an A in another.

  Standardization avoids these problems. After standardization, the scale is consistent and interpretable across all assessments:

  - 0 always represents the class median (i.e., average performance)
  - Positive values reflect above-median performance (around +1 = clearly strong performance).
  - Negative values reflect below-median performance (around –1 = clearly weaker performance)

  This approach prevents a hard exam or assignment from dragging down the entire class and stops an easy one from inflating grades. i.e., the meaning of a score stays tied to performance, not difficulty.

  From the instructor's perspective, standardization also supports principled and transparent grade boundaries. Because each assessment is on a common scale with a known centre and spread, combining components yields overall scores with predictable structure (even though the distribution of letter grades is not predetermined). This makes grade boundaries easier to set and interpret and helps align final grades more closely with their intended meaning.

- **Q: I don't understand any of this! Can you just give a simple example of why you believe standardization is beneficial?**

  A: Yes. Imagine two quizzes worth the same weight in the course. One turns out to be very difficult, with a class average of 55%; the other is much easier, with a class average of 85%.

  If we used raw percentages directly, a score of 72% on the difficult quiz would appear worse than a score of 80% on the easy quiz, even though earning 72% on a hard assessment likely reflects stronger understanding than earning 80% on an easy one. Standardization corrects for this mismatch by placing both results on a common scale that reflects how each score compares to the class.

  After standardization, the two results become directly comparable:

  - The 72% score would appear above the standardized centre (0), indicating stronger performance.
  - The 80% score would fall below the standardized centre (0), indicating weaker performance relative to peers.

  This makes averaging across assessments more meaningful because you are combining values expressed on the same scale, not raw percentages influenced by how forgiving or demanding a particular assessment happened to be.

- **Q: Is this the same as "grading on a curve"?**

  A: No. While both standardization and curving involve thinking about how student scores relate to the rest of the class, they are fundamentally different. Grading on a curve typically ranks students by performance and then assigns a fixed number of each letter grade (e.g., only the top 2.5% receive an A+), regardless of how well the class actually performed. This creates a zero-sum allocation: for one student to move up, another must move down, and the amount of each letter is capped in advance. Instructors using this approach impose a curve on the grade distribution rather than allowing the grade distribution to reflect the class's actual performance.

  In contrast to that, this course does not use quotas or predetermined distributions. Instead, standardized scoring helps ensure fairness across assessments, and the actual number of A's, B's, C's, etc. *emerge*s from how the class performs, not from an imposed formula — fully in line with University policy prohibiting mandatory curves. See University of Alberta Assessment and Grading Policy.

- **Q: Is this grading system competitive?**

  A: Only in a limited and generally healthy sense. Standardized scores are interpreted relative to the class median, so your performance is understood in relation to the class rather than in isolation. In that way, there is a mild competitive element: performing well relative to the class raises your standardized score, and performing below the class median lowers it.

  However, this does not mean that grades are capped or that students are ranked against one another. There are no quotas, no predetermined number of high grades, and no requirement that some students must receive lower grades for others to receive higher ones. If many students perform strongly, many students can earn strong grades.

  Put simply: your performance is interpreted in the context of the class, but your success does not come directly at someone else's expense.

- **Q: Can everyone get an A?**

  A: Not realistically. An A or A+ is meant to signal *extra*ordinary performance. i.e., achievement that clearly stands out from the rest of the class. If everyone earned the same top grade, then by definition no one's performance would be extraordinary (it would be ordinary), and the grade would lose its meaning. Because scores are standardized around the class median, only those who perform well above that benchmark end up in the A range. In practice, this means that while many students can do well, top grades remain a mark of truly exceptional achievement.

- **Q: If the median is always 0 (B-), does that mean half the class will fail?**

  A: No. The median is simply a sensible anchor point for the scale. Students above 0 are above average and may receive grades ranging from B- to A+; students below 0 are below average but may still earn passing grades (C's and D's). In most classes, the majority of students pass. The exact distribution of grades depends on how the whole class performs, not on a fixed quota.

- **Q: Does this system disadvantage strong students?**

  A: No. Standardization preserves performance differences: students who perform well compared to their peers will always receive higher standardized scores and thus higher letter grades.

- **Q: What does it mean that the grading method is "robust"?**

  A: In statistics, "robust" means that the method is not thrown off by unusual values or outliers. For example, if one student happens to score extremely low or extremely high, a robust method won't let that single score shift the whole class's average or spread. That's why this system uses the median (the middle score) instead of the mean (the arithmetic average), and the MADN (a spread measure based on the median) instead of the standard deviation. These choices make the standardized scale more stable and fair, especially in classes where exams or assignments occasionally produce extreme results.

- **Q: How can I estimate my standing during the term?**

  A: After an assessment has been marked, you will receive both your raw score and your standardized score on your personal gradebook page. The standardized score is the one that counts toward your final grade. By comparing your standardized score to the published letter grade boundaries in Table 2, you can track your progress throughout the term. Additional stats and graphs will be provided as well to give you a sense of your standing as well.

- **Q: Can you show how to convert a raw score to a standardized score?**

  A: Yes. The standardized score is calculated in a way similar to a z-score, but it uses the class median and the normalized median absolute deviation (MADN). The formula is:

$$s = \frac{x - m}{\text{MADN}}$$

  where x is the raw score of an assessment (e.g., the midterm), m is it's class median, and MADN is a measure of its spread.

  1. Suppose a student gets a raw score of $x = 88\%$.
  2. Suppose the class median on an assignment is $m = 72\%$.
  3. Suppose MADN $= 11.9\%$, we therefore compute:

$$s = \frac{88 - 72}{11.9} \approx 1.34$$

  So in this example, a raw percent score of 88% converts to a standardized score of about 1.34. This value indicates performance well above the class average (0), and it would then be compared to the fixed letter grade boundaries in Table 2, which shows this is an A- level of performance.

- **Q: What if I have questions or concerns about the grading system?**

  A: If you have questions, uncertainties, or well-reasoned concerns about how grading works in this course, I strongly encourage you to talk with me (your instructor) about them. The grading system is designed to be principled, transparent, and fair, but it is also unfamiliar to many students at first. Conversations are often helpful for clarifying how standardized scores are interpreted, how different components contribute to the final grade, and how this approach differs from traditional percentage cutoffs.

10.3 Components of Course Grade

Assessment	Percentage Weight
Homework Assignments (all)	10%
Course Projects (all)	15%
Achieve Assessments (all)	10%
Midterm	30%
Final	35%

Table 3: Assessment weights.

- The relative weight of individual homework assignments and course projects may vary based on the estimated workload involved.

10.4 Re-examination

There is no possibility of a re-examination in this course.

11 Format of Assessments

11.1 Format of Exams

This course is designated as in-person, and both the midterm and final exams will be administered accordingly. Outside devices or notes are not permitted during exams, except for those explicitly approved by the instructor.

Exams will be administered through the Canvas learning management system (LMS) and will consist of a combination of multiple-choice and numeric entry questions. Paper copies will be available for students who do not have access to a suitable device; however, writing on paper is strongly discouraged, as completed paper exams cannot be reviewed online and may only be viewed later during instructor office hours.

Unless otherwise specified by the instructor, the exams will cover all content completed up to the date of the exam. Questions will assess content from lectures and assigned textbook chapters and may be weighted based on their importance in differentiating levels of student understanding or the relative amount of work involved in solving a question.

11.1.1 Calculators

For exams, only basic or scientific calculators are permitted. Graphing calculators or programmable calculators, as well as calculators on phones or test-taking devices, are strictly prohibited.

If you are uncertain whether your calculator is permissible, please consult the instructor well in advance of an exam. A list of some approved calculators can be found here: https://jpisklak.github.io/courses/PSYCH_213_B4/calculators.html

Students are responsible for bringing their own appropriate calculator, as none will be provided during the exam. If you do not bring an eligible calculator, you will be required to complete the exam without one.

> *Using an unauthorized calculator, such as a programmable or graphing model, will be considered a violation of academic integrity and will result in a report for academic misconduct.*

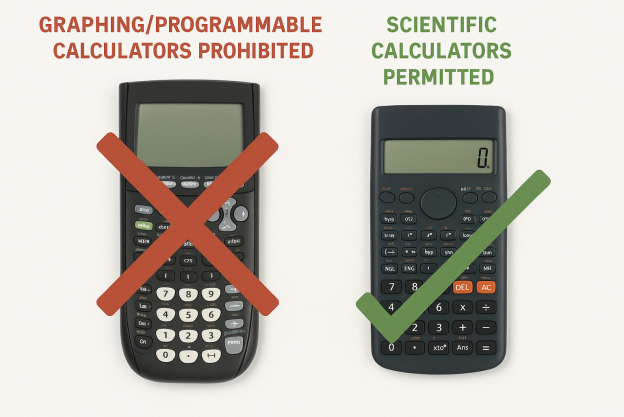

Figure 1: Calculator policy: Graphing/programmable calculators are prohibited; scientific calculators are permitted.

11.1.2 Exam Conduct

Please refer to the Examinations section of the Academic Calendar for more details on Conduct of Exams. Some key points to be aware of:

- Your student photo ID is required at exams to verify your identity.
- Students must arrive at the specified time to take the exam. Once the exam has started, students must remain in the physical in-person or remote environment for at least 30 minutes. Students who arrive more than 30 minutes late for an in-person exam will not be permitted to take the exam. Students who arrive more than 30 minutes late for an online exam may have their exam attempt removed or disqualified by the instructor. In both cases, students may apply for a deferred examination.
- All cell phones must be turned off and stored in your bags.
- If using a tablet or laptop to write the exam, the device must be positioned upright (not flat on the desk) with the screen brightness set high enough for proctors to monitor effectively.
- If using a tablet or laptop to write the exam, no other applications or tabs may be open. The exam window must remain fully maximized, occupying the entire screen at all times.
- Any student who leaves the examination room for a washroom break must record their name, departure time, and return time on the designated exam log. Prior to exiting, the student must deposit their mobile phone at the front of the room; students without a phone will be required to present empty pockets for verification. Time spent outside the examination room will not result in any extension of the allotted examination period.

Failure to comply with these requirements may result in the disqualification of your exam and could be reported as academic misconduct in accordance with university policies.

11.1.3 Representative Evaluative Material

Homework assignments and Achieve assessments are essential for familiarizing students with the types and style of questions that will appear on exams. A few days before each exam, practice questions will be provided to reflect the content and format of the numeric entry questions included on the exam.

These resources collectively offer the most accurate preview of the question formats and material that students can expect on both the midterm and final exams.

11.2 Format of Term Work

Mastering statistics requires active, hands-on engagement. Homework, Achieve assessments, and course projects are carefully designed to help you apply lecture and textbook concepts, identify areas for improvement, and solidify your understanding. Completing these tasks isn't just beneficial—it's essential for success in this course.

The weight of each individual assignment may vary based on its workload. For instance, a more intensive homework task might carry greater weight than a shorter one. This structure ensures that your effort is aligned with the challenges presented, rewarding thorough and thoughtful work.

11.2.1 Homework Assignments

Most course topics (see Appendix) will have a corresponding homework assignment designed to reinforce your understanding, with a focus on applying concepts using the R programming language. These assignments will consist of multiple-choice and numeric-entry questions submitted through Canvas LMS.

Key details about homework assignments:

- **Announcement and access:** Assignments will be announced in class, with links provided on the course webpage.
- **Timeline:** Students will have two weeks from the in-class announcement to complete and submit their work. Due dates will be posted on the course website as they become available. *Completing assignments promptly is strongly encouraged.*
- **Attempts and scoring:** Unlimited attempts are allowed within the two-week period, and your highest score will count. After each attempt, you will receive immediate feedback, including the correct answers and solutions.

These assignments are an essential part of the course, helping you solidify your skills and identify areas that need improvement. Take full advantage of the resources and feedback provided!

11.2.2 Course Projects

Two course projects will be assigned at various points in the semester once the instructor is certain that the requisite material has been covered. Each course project will come with written instructions available on the course website, and submissions will require file uploads to Canvas LMS.

11.2.3 Achieve Assessments

Carefully extracting information from textbooks, and other written content, constitutes a crucial skill in academia that is often overlooked by many students. The required textbook as an associated online service called "Achieve," which will be employed to provide targeted low-stakes learning assessments that correspond specifically to the required textbook content. These assessments will serve the purpose of encouraging active engagement with the textbook, reinforcing concepts presented in the lecture, and introducing additional information that may not receive ample coverage during class time. They also assist students in identifying areas that need improvement, helping them better prepare for higher-stakes assessments, such as the midterm.

These assessments can be completed any time prior to their due date which will is viewable on the course website and the Achieve platform itself, as well as section 9 of this syllabus.

11.2.4 Late Penalties

Be aware that there are no late penalties in this course. Failing to submit before a due date will result in a mark of 0. For details surrounding missed deadlines, see section 13 of the syllabus.

The homework assignments are intentionally designed to be relatively easy so that students can practice applying the material and build confidence through repeated success. They carry marks so students have a clear incentive to complete them regularly. Consistent practice is essential for mastering the skills covered in the course. Because of this design, high homework scores are expected from most students and should not be interpreted as evidence of exceptional or "A" level performance. Rather, strong homework results indicate typical, competent engagement with the material, which is exactly their purpose.

12 Statement of Expectations for the use of Artificial Intelligence (AI)

In this course, the use of AI tools (e.g., GPT-5, DALL-E, Stable Diffusion) is permitted, provided it is **ethical, transparent, and responsible**. If AI has contributed in a *significant* way to your submitted work—such as drafting text, generating substantial code, or outlining a problem solution—you must acknowledge that contribution. Minor or incidental uses (e.g., asking for a syntax reminder, checking a small calculation) do not require formal citation, but you are still responsible for the accuracy and integrity of the result. For guidance on formal citation when needed, see the U of A Library's page on How to Cite AI.

Using AI to gain an unfair advantage undermines both your learning and the integrity of the academic community, and may violate U of A policy. See Section 3, Student Academic Integrity Policy Appendix A: Academic Misconduct.

Be appreciative of the fact that, while AI is a powerful and highly useful tool, it does have many limitations. It may not always fully "understand" context or nuance, often follows the most popular practices (as opposed to the best practices) and all its outputs should be critically reviewed to ensure accuracy and relevance to the task at hand. This means that, while AI can enhance our capabilities, it should be used judiciously to maintain the integrity and quality of a persons academic work. Please note that students will be held responsible for any confusing, erroneous, false, offensive, plagiarised, or unethical content provided by AI within their work, so exercise caution and diligence in its use.

12.1 Using AI in This Course: Guidelines and Best Practices

AI can support and enhance your learning if used wisely. It should **complement** your own thinking, not replace it.

The Wrong Way to Use AI

Relying on AI solely to "get the answer" for coding, math problems, or other assignments will:

- Create gaps in your understanding, making future learning harder.
- Leave you unprepared for exams or other assessments where AI is not permitted.
- Prevent you from spotting or correcting AI-generated mistakes.
- Constitute a form of academic misconduct.

Your focus should be on ***learning***, not just earning a grade.

The Right Way to Use AI

AI works best as a tutor or guide. For example:

> *"Can you explain how to create a dataframe in R?"*

Such targeted questions can clarify concepts, reinforce understanding, and help you develop problem-solving skills.

Use AI to deepen your engagement with the material. The more you practice independently, the more confident you will be when it matters.

*AI use is permitted in this course, but with important conditions: all submitted work must reflect your own understanding and abilities. Occasional, well-judged use of AI to support your learning is fine; relying on it to produce your work is not. If it appears that AI has completed most or all of a submission, marks may be reduced, potentially to zero. If you believe this determination is incorrect, you may request a reassessment by meeting with the instructor or marker **in person** to demonstrate your grasp of the material. This ensures you can explain and apply the concepts independently.*

13 Policies for Missed Term Work

Failure to attend the midterm or submit homework assignments, Achieve assessments, or course projects through the designated channels by the specified due dates will result in a raw score of 0. However, students unable to complete these tasks due to incapacitating illness, severe domestic circumstances, or other compelling reasons may apply for an excused absence. To apply for an excused absence, a student must contact the instructor in a timely manner (see section 13.1 and 13.2 below). IF an excused absence for the midterm is granted, students will be required to write a deferred version of the exam (for details, see section 14). IF an excused absence for any non-exam course assessment is granted, then the weight of the assessment will be transferred to the final exam. Should a shift in weighting to the final exam increase its weight to $\geq$ 40%, this does not change the original 'syllabus weight', meaning the student does not now qualify for possible re-examination.

Please be aware that transferring the weight of missed work to the final exam might disqualify a student from being eligible for a deferred final examination if they have not completed at least 50% of the term's coursework.

In all cases, instructors may request adequate documentation to substantiate the reason for the absence, at their discretion. Deferral of term work is a privilege and not a right; there is no guarantee that a deferral will be granted. Misrepresentation of Facts to gain a deferral is a serious breach of the Student Academic Integrity Policy.

Deferral of term work/tests is under the discretion of the instructor; however, deferral of a final exam is determined at the Faculty level. A student must apply to their home Faculty for a deferral of a final exam, not the Faculty the course is listed in (see section 17).

13.1 Exemption Requests Relating to Non-technical Issues

Baring extreme circumstances (e.g., unexpected hospitalization or immediate death in the family), requests for exemptions related to known chronic or prolonged conditions and events (e.g., mourning, recuperation, general illness, etc.) must be submitted to the instructor at least **48 hours** before the specified due date for consideration. i.e., students are expected to be proactive about notifying the instructor in a timely manner when the circumstances allow it.

With rare exception, requesting exemptions moments before or after a deadline is unacceptable behaviour. People are rarely so incapacitated that they cannot send an email.

It is important to note that it is neither within the purview nor the responsibility of the instructor to verify or handle claims related to enduring physical or psychological medical conditions (e.g., ADHD, clinical anx-

iety, etc.). Students seeking accommodations for such reasons must do so through appropriate university channels (i.e., Academic Success Centre).

13.2 Exemption Requests Relating to Technical issues

If students experience technical issues in the process of submitting an assignment, they are expected to document the issue by taking an appropriate video or photo with their phone or computer. Do not expect clemency for technical issues without providing at least this. They must ensure that the photo or video provides reasonable evidence of the date and time in addition to the technical issue.

A generous time frame is allotted for assignment submissions. Exemption requests related to technical issues made within the last 24 hours before a deadline will not be deemed reasonable, regardless of circumstances such as internet outages, computer crashes, or hardware failure. Assignments are expected to be completed in a timely fashion with due precautions taken, such as file backups.

> *Procrastination and last-minute completion carry inherent risks, for which responsibility rests with the student.*

14 Missed Midterm

Students are required to complete the midterm exam as scheduled. If a student is unable to attend the midterm for any reason, they will be required to write a deferred version of the exam pending approval from the instructor (see section 13). The date, time, and location for the deferred exam will be listed on the course website once a suitable time and location can be procured. This date is non-negotiable. By missing the midterm, the means to avoid scheduling conflicts with other classes was forfeited. Failure to attend the deferred exam will result in a score of 0 for the midterm exam's full original weight, as specified in Table 3 of the syllabus.

15 Missed Term Work or Final Exam Due to Non-medical Protected Grounds (e.g., religious beliefs)

When a term assessment or final exam presents a conflict based on non-medical protected grounds, students can register with the Academic Success Centre for accommodations via their Register for Accommodations website. Students can review their eligibility and choose the registration process specific for **Accommodations Based on Non-medical Protected Grounds**.

It is imperative that students review the dates of all course assessments upon receipt of the course syllabus, and register **AS SOON AS POSSIBLE** to ensure the timely application of the accommodation. Students who register later in the term may experience unavoidable delays in the processing of the registration, which can affect the accommodation.

16 Re-evaluation of Term Work

Students who wish to request a re-evaluation of their graded term work must do so in a timely manner (e.g., within one week) after the grade has been posted and *before* final course grades are submitted.

Requests must include a clear and specific justification. Re-evaluations will only be considered if the rationale provided is deemed reasonable by the marker. General requests for "another look" without a substantive explanation will not be granted.

17 Deferred Final Examination

A student who cannot write the final examination due to incapacitating illness, severe domestic affliction, or other compelling reasons can apply for a deferred final examination. Such an application must be made to the student's home Faculty Office within two working days of the missed exam and must be supported by appropriate documentation or a Statutory Declaration (see calendar on Attendance). Deferred examinations are a privilege and not a right; there is no guarantee that a deferred examination will be granted. The Faculty may deny deferral requests in cases where less than 50% of term work has been completed. Misrepresentation of facts to gain a deferred examination is a serious breach of the Student Academic Integrity Policy.

18 Respect Policy

18.1 I Respect Your Time:

- *Preparedness:* I will come to each class prepared to help you understand the course material and prepare you for quizzes and exams.
- *Communication:* Communication is key. If something is unclear or you are facing challenges, please let me know. I cannot assist you if I am unaware of your concerns.
- *Support:* I am here to help you succeed. This is your time, so please communicate how I can best support your learning.
- *Flexibility:* If there is something you would like me to do differently, please share your feedback. I am open to working with you to make this class the best it can be.

18.2 Respect My Time:

- *Punctuality:* Be on time to class. Arriving late disrupts the learning process for everyone.
- *Attention:* Pay attention when I am speaking to you. Your focus is essential for your success.
- *Preparation:* Come to class prepared by completing the required work and utilizing office hours when you need additional help.

18.3 Respect Each Other:

- *Minimize Disruptions:* Do not be disruptive in class. If you need to take a call or send a text, please step outside to do so.
- *Embrace Mistakes:* Allow one another to make mistakes—this is a vital part of the learning process.
- *Respectful Communication:* Use respectful language when speaking with one another, both in and out of class.

19 Student Responsibilities

19.1 Guidelines for Respectful Engagement

Students from many different backgrounds participate in courses at the University of Alberta. Sexist, racist, homophobic comments and other inflammatory remarks are not conducive to learning in our courses, and are absolutely not permitted. All participants are governed by the Student Academic Integrity Policy. Be mindful when discussions involve controversial topics or issues, and consider the possibility that members of our community have themselves experienced some of these issues and/or very different realities because of these issues. Participate in a respectful and considerate manner.

If you are witness to or the target of abusive or offensive behaviour in any course, please inform your instructor immediately. You may also contact the Psychology Undergraduate/Graduate Advisor, Associate Chair Undergraduate, Academic Director of Graduate Studies, or Chair.

19.2 Academic Integrity and Student Conduct

The University of Alberta is committed to the highest standards of academic integrity and honesty, as well as maintaining a learning environment that fosters the safety, security, and inherent dignity of each member of the community, ensuring students conduct themselves accordingly. Students are expected to be familiar with the standards of academic honesty and appropriate student conduct, and to uphold the policies of the University in this respect.

Students are particularly urged to familiarize themselves with the provisions of the Student Academic Integrity Policy and the Student Conduct Policy, and avoid any behaviour that could potentially result in suspicions of academic misconduct (e.g., cheating, plagiarism, misrepresentation of facts, participation in an offence) and non-academic misconduct (e.g., discrimination, harassment, physical assault). Academic and non-academic misconduct are taken very seriously and can result in suspension or expulsion from the University.

All students are expected to consult the Academic Integrity website for clarification on the various academic offences. All forms of academic dishonesty are unacceptable at the University. Unfamiliarity of the rules, procrastination or personal pressures are not acceptable excuses for committing an offence. Listen to your instructor, be a good person, ask for help when you need it, and do your own work – this will lead you toward a path to success. Any academic integrity concern in this course will be reported to the College.

Suspected cases of non-academic misconduct will be reported to the Office of Student Success and Experience. The College, the Faculty, and the Dean of Students are committed to student rights and responsibilities, and adhere to due process and administrative fairness, as outlined in the Student Academic Integrity Policy and the Student Conduct Policy. Please refer to the policy websites for details on inappropriate behaviours and possible sanctions.

The College of Natural and Applied Sciences (CNAS) has created an Academic Integrity for CNAS Students website. To access this website, students must be signed in to their UAlberta account. Website content includes the importance of academic integrity, examples of academic misconduct and possible sanctions, and the academic misconduct and appeal process. Students can also access this material as an online, self-directed Canvas course and complete assessments to test their knowledge.

"Integrity is doing the right thing, even when no one is watching" – C.S. Lewis

19.3 Inappropriate Collaboration:

Students need to be able to recognize when they have crossed the line between appropriate collaboration and inappropriate collaboration. If students are unsure, they need to ask instructors to clarify what is allowed and what is not allowed. Here are some tips to avoid copying on assessments:

- Do not write down something that you cannot explain to your instructor.
- When you are helping other students, avoid showing them your work directly. Instead, explain your solution verbally. Allowing your work to be copied is also considered inappropriate collaboration.
- It is also possible that verbally discussing the solution in too much detail may result in written responses that are too similar. Try to keep discussions at a general or higher level.
- If you find yourself reading another student's solution, do not write anything down. Once you understand how to solve the problem, remove the other person's work from your sight and then write up the solution to the question yourself. Looking back and forth between someone else's work and your own work is almost certainly copying and considered inappropriate collaboration.

- If the instructor or TA writes down part of a solution in order to help explain it to you or the class, you cannot copy it and hand it in for credit. Treat it the same way you would treat another student's work with respect to copying, that is, remove the explanation from your sight and then write up the solution yourself.
- There is often more than one way to solve a problem. Choose the method that makes the most sense to you rather than the method that other students happen to use. If none of the ideas in your solution are your own, there is a good chance it will be flagged as copying.

19.4 Contract Cheating and Misuse of University Academic Materials or Other Assets

Contract cheating describes the form of academic dishonesty where students get academic work completed on their behalf, which they submit for academic credit as if they had created it themselves. Contract cheating may or may not involve the payment of a fee to a third party, who then creates the work for the student.

Examples include:

- Getting someone to write an essay or research paper for you.
- Getting someone to complete your assignment or exam for you.
- Posting an essay, assignment, or exam question to a tutorial or study website; the question is answered by a "content expert", then you copy it and submit it as your own answer.
- Posting your solutions to a tutorial/study website, public server, or group chat and/or copying solutions that were posted to a tutorial/study website, public server, or group chat.
- Sharing your login credentials to the course management system (e.g., Canvas) and allowing someone else to complete your assignment or exam remotely.
- Using an artificial intelligence bot or text generator tool to complete your essay, research paper, assignment, or exam solutions for you (without the instructor's permission).
- Using an online grammar checker to "fix" your essay, research paper, assignment, or exam solutions for you (without the instructor's permission).
- Contract cheating companies thrive on making students believe that they cannot succeed without their help; they attempt to convince students that cheating is the only way to succeed.

Uploading the instructor's teaching materials (e.g., course outlines, lecture slides, assignment, or exam questions, etc.) to tutorial, study, or note-sharing websites or public servers is a copyright infringement and constitutes the misuse of University academic materials or other assets. Receiving assignment solutions or answers to exam questions from an unauthorized source puts you at risk of receiving inaccurate information.

20 University Policy

20.1 Withdrawals

See the University Calendar for the relevant add/drop deadlines for each term.

20.2 Course Outlines

Policy about course outlines can be found in the Academic Regulations, Evaluation Procedures and Grading section of the University Calendar.

20.3 Student Academic Integrity

The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Student Academic Integrity Policy and the Student Conduct Policy (on the University of Alberta Policies and Procedures Online (UAPPOL) website) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

20.4 Recordings

Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan. Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the content authors.

20.5 Accommodations for Students

In accordance with the University of Alberta's Accommodation Policy and Discrimination and Harassment Policy, accommodation support is available to eligible students who encounter limitations or restrictions to their ability to perform the daily activities necessary to pursue studies at a post-secondary level due to medical conditions and/or non-medical protected grounds. Accommodations are coordinated through the Academic Success Centre, and students can learn more about eligibility on the Register for Accommodations website.

It is recommended that students apply **AS SOON AS POSSIBLE** in order to ensure sufficient time to complete accommodation registration and coordination. Students are advised to review and adhere to published deadlines for accommodation approval and for specific accommodation requests (e.g., exam registration submission deadlines). Students who request accommodations less than a month in advance of the academic term for which they require accommodations may experience unavoidable delays or consequences in their academic programs, and may need to consider alternative academic schedules.

21 Student Supports

21.1 The Student Service Centre

The Student Service Centre provides students with information and access to services to support academic, financial, mental, and physical well-being. Information about various student resources, including academic, financial, and health and wellness, can also be found on the Campus Life website.

21.2 Academic Success Centre

The Academic Success Centre provides professional academic support to help students strengthen their academic skills and achieve their academic goals. Individual advising, appointments, and group workshops are available year round in the areas of Accessibility, Communication, Learning, and Writing Resources. Modest fees may apply for some services.

21.3 Writing Services

Writing Services offers free one-on-one writing support to students, faculty, and staff. Students can request a consultation for a writing project at any stage of development. Instructors can request class visits and presentations.

21.4 First Peoples' House

First Peoples' House provides an environment of empowerment for First Nations, Métis, and Inuit learners to achieve personal and academic growth.

21.5 Student Self-Care Guide

This Self-Care Guide, originally designed by the Faculty of Native Studies, has broader application for use during students' learning. It provides some ideas and strategies to consider that can help navigate emotionally challenging or triggering material.

21.6 Feeling Stressed, Anxious, or Upset?

It's normal for us to have different mental health experiences throughout the year. Know that there are people who want to help. You can reach out to your friends and access a variety of supports available on and off campus at the Need Help Now webpage or by calling the 24-hour Distress Line: 780-482-4357 (HELP). The Health and Wellness Support for Students website also contains mental and physical health resources, which are offered on-campus and in the community.

22 Learning and Working Environment

The Department of Psychology, Faculty of Arts, and Faculty of Science are committed to ensuring that all students, faculty, and staff are able to work and study in an environment that is safe and free from discrimination, harassment, and violence of any kind. It does not tolerate behaviour that undermines that environment. This includes virtual environments and platforms.

The Department of Psychology believes that organizational diversity and excellence go hand-in-hand. We are committed to identifying our limitations as a department in terms of equity, diversity, and inclusion and making actionable changes to overcome these limitations. We want all our constituents to feel welcome, safe, and valued in the core activities of teaching, research, and administration. Please visit our Commitment to EDI and Indigenization in Psychology website for more information.

If you are experiencing harassment, discrimination, fraud, theft or any other issue and would like to get confidential advice, please contact any of these campus services:

- Office of Safe Disclosure & Human Rights: A safe, neutral and confidential space to disclose concerns about how the University of Alberta policies, procedures or ethical standards are being applied. They provide strategic advice and referral on matters such as discrimination, harassment, duty to accommodate and wrong-doings. Disclosures can be made in person or online using the Online Reporting Tool.
- University of Alberta Protective Services: Peace officers dedicated to ensuring the safety and security of U of A campuses and community. Staff or students can contact UAPS to make a report if they feel unsafe, threatened, or targeted on campus or by another member of the university community.
- Office of the Student Ombuds: A confidential and free service that strives to ensure that university processes related to students operate as fairly as possible. They offer information, advice, and support to students, faculty, and staff as they deal with academic, discipline, interpersonal, and financial issues related to student programs.
- Office of Student Success and Experience: They can assist students in navigating services to ensure they receive appropriate and timely resources. For students who are unsure of the support they may need, are concerned about how to access services on campus, or feel like they may need interim support while they wait to access a service, this office is there to help.

22.1 Course Outlines

Policy about course outlines can be found in the Academic Regulations, Evaluation Procedures and Grading section of the University Calendar.

23 Document Information

This syllabus was Compiled with LuaLaTeX (LuaTeX 1.21.0) on 2026-01-03 at 01:50:06

23.1 Typos and Errors

Any typographical errors in this syllabus are subject to change and will be announced in class and/or posted on the course website. The date of final examinations is set by the Registrar and takes precedence over the final examination date reported in the syllabus.

23.2 Copyright

Appendix: Course Topics and Learning Outcomes

This course is organized into topical units, each with a general learning outcome supported by specific outcomes. Specific outcomes articulate what students are expected to learn and be able to demonstrate upon successful completion of the course.

T1 - Getting Started with R (via Google Colab)

General Outcome: Students will develop foundational fluency with R within a cloud-based environment called Google Colab, enabling them to write, execute, and interpret basic R code to support data-driven coursework.

Specific Outcomes: By the end of this topic, students will be able to:

- Navigate and run R code in a Google Colab notebook environment.
- Create and manipulate basic R objects, including vectors, variables, and data frames.
- Use core tools for inspecting and analyzing data sets, including functions (e.g., `length()`, `sum()`, `round()`) and subsetting/indexing operations (e.g., `x[1:3]`).
- Import external data files (e.g., `.csv`) into R and verify successful data loading.
- Explain what a comma-separated values (CSV) file is and generate one using common spreadsheet software.

Textbook Readings: NA

T2 - Math Refresher

General Outcome: Students will review and reinforce foundational mathematical skills essential for understanding quantitative methods, ensuring they can confidently perform core numerical operations used throughout the course.

Specific Outcomes: By the end of this topic, students will be able to:

- Apply the correct order of operations (PEMDAS/BEDMAS) when evaluating numerical expressions.
- Recognize the distinction between ratios, proportions, probabilities, and percentages.
- Convert between ratios, percentages, and probabilities.
- Convert very large or very small numbers between standard decimal form and scientific notation, and explain when scientific notation is useful for working with data.
- Use summation notation ($\sum$) to represent and compute sums of values in a dataset.
- Perform arithmetic operations on corresponding values with variables/vectors (e.g., addition, subtraction, multiplication).

Textbook Readings: NA

T3 - Core Concepts in Statistical Reasoning

General Outcome: Students will gain a foundational understanding of how data are classified, interpreted, and collected in research, including how these core concepts support valid inferences and strengthen the design and interpretation of studies.

Specific Outcomes: By the end of this topic, students will be able to:

- Differentiate between populations and samples, and explain why samples are used to draw inferences.
- Classify variables by type (e.g., categorical, ordinal, continuous) and describe how variable type influences summary and analysis.
- Distinguish random sampling from random assignment and describe the role each plays in supporting generalizability and causal inference.
- Explain the concepts of internal and external validity and identify threats that can weaken each.
- Evaluate simple research scenarios and identify (a) the type of variables involved, (b) whether random sampling or random assignment was used, and (c) which form of validity is primarily affected.

Textbook Readings: Chapter 1

T4 - Describing Data with Measures of Central Tendency

General Outcome: Students will come to appreciate how measures of central tendency summarize distributions and support meaningful comparisons across data sets, including how visualization complements numerical summaries.

Specific Outcomes: By the end of this topic, students will be able to:

- Calculate the mean, median, and mode of a data set both by hand and using R.
- Explain what each measure of central tendency represents and when each is most informative.
- Identify situations in which a measure (e.g., the mean) may be misleading due to skew or outliers, and justify the choice of an alternative summary.
- Create and use barplots to visualize central tendency and relate patterns in the plot to numerical summaries.
- Interpret measures of central tendency in context (e.g., research examples, classroom data sets) to draw basic conclusions about group differences or typical values.

Textbook Readings: Chapter 2

T5 - Describing Variability and Transforming Data

General Outcome: Students will come to understand how measures of variability and data transformations characterize the spread and structure of distributions, and how visualization and standardization support meaningful comparison across data sets.

Specific Outcomes: By the end of this topic, students will be able to:

- Calculate common measures of variability (range, interquartile range, standard deviation) by hand and using R.
- Describe what each measure of variability represents and how it complements measures of central tendency.
- Interpret box plots, histograms, and error bars to assess distribution shape, variability, and potential outliers.
- Define quartiles, quantiles, and percentiles, and describe how quartiles and percentiles represent specific cases of quantiles used to summarize distributional position.
- Explain how standardization and linear transformations (e.g., z-scores) change the scale of data while preserving relationships.
- Apply standardization to compare scores across different scales or variables, and interpret these comparisons in context.
- Evaluate how variability and transformations affect the choice of summary statistics and the interpretation of results in research scenarios.

Textbook Readings: Chapter 2

T6 - The Normal Distribution, Sampling, and Statistical Inference

General Outcome: Students will come to understand how probability distributions and sampling processes give rise to sampling error, and how the Central Limit Theorem and related concepts (standard error, confidence intervals) allow researchers to use samples to make inferences about populations.

Specific Outcomes: By the end of this topic, students will be able to:

- Explain how sampling variability arises and why different samples from the same population produce different estimates.
- Illustrate the Central Limit Theorem and describe its role in approximating sampling distributions of the mean.
- Calculate and interpret the standard error as a measure of precision for sample estimates.
- Construct and interpret confidence intervals to quantify uncertainty when estimating population parameters.

Textbook Readings: Chapters 3, 4.1, 5.1

T7 - One-Sample t-Test

General Outcome: Students will learn how the one-sample t-test evaluates whether a sample mean differs meaningfully from a reference value, and how effect sizes quantify the magnitude of that difference beyond statistical significance.

Specific Outcomes: By the end of this topic, students will be able to:

- Explain when a one-sample *t*-test is appropriate and identify common research scenarios in which it is used.
- Formulate null and alternative hypotheses for a one-sample comparison and describe the logic of hypothesis testing in this context.
- Distinguish between one-sided and two-sided hypothesis tests and justify the use of each based on research questions or prior directional expectations.
- Conduct a one-sample *t*-test by hand.
- Conduct a one-sample *t*-test in R, including checking relevant assumptions and interpreting the output.
- Explain how confidence intervals and *p*-values can be used to evaluate significance, and articulate the rationale behind each.
- Calculate effect sizes (Cohen's *d*, Hedges' *g*) to quantify the magnitude of the observed difference and explain why effect sizes complement significance tests.
- Distinguish statistical significance from practical significance and describe how effect sizes inform real-world interpretation.
- Distinguish type I and II error and articulate what statistical power is and how it is impacted by sample size, experimental control, and decision criteria (α).

Textbook Readings: Chapter 7.1

T8 - Paired-Samples t-Test

General Outcome: Students will learn how paired (dependent) data are assessed using the paired-samples t-test, and how design choices, visualization, and effect sizes support the interpretation of change or difference within paired/matched observations.

Specific Outcomes: By the end of this topic, students will be able to:

- Distinguish between research scenarios/designs that yield paired or dependent measurements versus independent measurements.
- Formulate null and alternative hypotheses for paired comparisons and describe how the dependence structure requires a testing strategy identical to a one-sample t-test.
- Conduct one-tailed and two-tailed paired-samples *t*-tests by hand and in R.
- Evaluate whether the assumptions of the paired-samples *t*-test are reasonably met (e.g., normality of difference scores, independence across pairs) and describe how violations may affect interpretation or require alternative approaches.
- Distinguish between wide and tidy data formats and convert paired data between formats to support analysis and visualization in R.
- Use visualizations (e.g., barplots with errorbars) to illustrate within-unit change and relate it to descriptive and inferential calculations.
- Calculate and interpret effect sizes for paired data.

Textbook Readings: Chapter 7.2

T9 - Independent-Samples t-Test

General Outcome: Students will learn how the independent-samples t-test evaluates differences between group means when observations are independent, and how study design, visualization, assumptions, and effect sizes inform interpretation.

Specific Outcomes: By the end of this topic, students will be able to:

- Identify research scenarios that yield independent groups (e.g., between-subjects experiments, naturally occurring groups) and explain why an independent-samples *t*-test is appropriate for such comparisons.

- Formulate null and alternative hypotheses for independent-group comparisons and describe how the test is both similar and different from that used with paired designs.
- Explain why the variance sum law underpins the independent two-sample t-test.
- Conduct one-tailed and two-tailed independent-samples *t*-test by hand, including computing pooled standard errors when appropriate.
- Conduct one-tailed and two-tailed independent-samples *t*-test in R, including checking relevant assumptions and interpreting output.
- Evaluate whether the assumptions of the independent-samples *t*-test are reasonably met (e.g., independence of observations, approximate normality, homogeneity of variance) and describe how violations may affect interpretation or require alternative approaches.
- Use visualizations (e.g., box plots; histograms; barplots w/errorbars) to compare distributions across groups and relate visual features to summary statistics and test results.
- Calculate and interpret effect sizes (e.g., Cohen's *d* for independent groups, Hedges' *g*) and explain how effect sizes complement significance tests.
- Compare paired and independent designs in terms of variability, statistical power, and the kinds of research questions each design supports.

Textbook Readings: Chapters 7.3, 7.4

T10 - Correlation and (Simple) Ordinary Least-Squares Regression

General Outcome: Students will learn how correlation and OLS regression quantify relationships between variables, and how estimates, model fit, and inference support interpretation and prediction in research contexts.

Specific Outcomes: By the end of this topic, students will be able to:

- Articulate how Pearson's correlation coefficient measures the direction and strength of a relationships between two variables.
- Compute Pearson's correlation in R and interpret the coefficient in context.
- Describe the conceptual link between correlation and regression.
- Calculate (by hand) the slope and y-intercept of a regression model and interpret these values in real-world terms.
- Fit a simple linear regression model in R.
- Evaluate model fit using R^2 and explain what it reveals (and does not reveal) about predictive accuracy and explained variability.
- Formulate null and alternative hypotheses for regression slopes and evaluate statistical significance using a *t*-test methodology.
- Use appropriate visualizations (e.g., scatterplots with fitted lines, residual plots) to assess testing assumptions and model appropriateness.

Textbook Readings: Chapter 8

T11 - Principles and Methods of Outlier Detection

General Outcome: Students will learn what outliers are, how they affect statistical analyses, and how principled detection methods inform decisions about data cleaning, interpretation, and robustness.

Specific Outcomes: By the end of this topic, students will be able to:

- Describe conceptual reasons why outliers occur (e.g., measurement error, rare events, valid extreme values) and explain how outliers influence descriptive and inferential statistics.
- Apply and interpret Hampel's Identifier for robust outlier detection, and justify its necessity in the context of outlier masking.
- Apply and interpret the box plot rule as a convenient outlier detection heuristic and compare its assumptions and behaviour to robust alternatives.
- Use graphical displays (e.g., box plots, scatterplots) to identify potential outliers and relate visual observations to formal detection criteria.
- Evaluate how different outlier detection methods may yield different classifications and explain why not all methods are equally valid/appropriate.

- Assess the consequences of excluding and retaining outliers for subsequent analysis, and articulate transparent criteria for decision making.

Textbook Readings: Chapter 8.3

T12 - Inference with Categorical Variables

General Outcome: Understand how to use chi-square tests to evaluate whether observed categorical patterns differ from expectations based on chance or independence.

Specific Outcomes: By the end of this topic, students will be able to:

- Distinguish between research questions involving categorical variables that call for a chi-square goodness-of-fit test versus a chi-square test of independence.
- Formulate null and alternative hypotheses for chi-square tests and explain how expected frequencies represent the patterns predicted by chance or independence.
- Conduct chi-square goodness-of-fit and tests of independence by hand and using R.
- Evaluate whether the assumptions of chi-square tests are reasonably met (e.g., expected cell counts, independence of observations) and describe how violations may affect interpretation or require alternative approaches.

Textbook Readings: Chapter 6.3 - 6.4

T13 - Introduction to Qualitative Research Methods (Guest Lecture)

General Outcome: Understand how qualitative research generates knowledge through non-numeric data and how qualitative approaches both compliment and contrast quantitative approaches, of the kind covered within this course.

Specific Outcomes: By the end of this topic, students will be able to:

- Contrast qualitative and quantitative research approaches in terms of goals, data types, and assumptions about knowledge generation.
- Describe common qualitative data sources and how they support different research questions.
- Explain key methodological concepts in qualitative research and how they shape study design.
- Identify philosophical assumptions that underpin qualitative inquiry and relate these to decisions about data collection and interpretation.
- Describe strategies for ensuring quality in qualitative research.

Textbook Readings: NA

T14 - One-Way Independent Analysis of Variance (ANOVA)

(Time Permitting)

General Outcome: Recognize how multiple testing across several groups increases the likelihood of Type I Errors, and explain how the ANOVA F-test addresses this issue by evaluating group differences within a single unified model.

Specific Outcomes: By the end of this topic, students will be able to:

- Explain why conducting multiple independent *t*-tests increases familywise error and describe how the omnibus F-test addresses this problem.
- Formulate null and alternative hypotheses for multi-group comparisons and interpret the logic of the omnibus F-test.
- Conduct a one-way independent ANOVA's omnibus F-test both by hand and within R.
- Calculate η^2 as an effect size for a ANOVA F-test and recognize its equivalence to R^2.

Textbook Readings: Chapter 7.5