STAT 3380
Introduction to Nonparametric Statistics
Winter 2024

Time	Mondays, Wednesdays & Fridays, 12:30 p.m. – 1:20 p.m.
Location	100 Fletcher Argue
CRN	63002

Instructor	Dr. Zeny Mateo (She/Her) 372 Machray Hall Email: Zeny.Mateo@umr.umanitoba.ca

Web Pages	UM Learn: http://umanitoba.ca/umlearn R Download (Windows): https://muug.ca/mirror/cran/bin/windows/ R Download (MacOS): https://muug.ca/mirror/cran/bin/macosx/ R Studio: https://www.rstudio.com/products/rstudio/#download
Office Hours:	Monday 1:30 p.m. – 2:30 p.m. Wednesday 1:30 p.m. – 2:30 p.m.

If the above times are not convenient for you, please email me to arrange an alternate time to meet. I will do my best to return all email messages within 24 hours.

Territory Acknowledgment

The University of Manitoba campuses are located on original lands of Anishinaabeg, Cree, Oji-Cree, Dakota and Dene peoples, and on the homeland of the Métis Nation. We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

Calendar Description

Parametric versus nonparametric inference, inference using ranks and order statistics, contingency tables, goodness-of-fit tests, applications in the social and physical sciences. Prerequisite: one of STAT 1150, STAT 2000, STAT 2001, or STAT 2220.

Evaluation

Quizzes (3)	30%
Midterm Test	25%
Final Examination	45%

There will be no make-up quizzes. If you miss Quiz 1 or Quiz 2 due to illness or another valid reason, half of the weight will be transferred to your midterm and half will be transferred to your final exam. If you miss Quiz 3 due to illness or another valid reason, the entire weight will be transferred to your final exam.

Note that if you miss an assessment for a valid reason, **you must submit a self-declaration form to your instructor within 24 hours of the due date of the assessment.** (See Page 9 of the course outline for an explanation and link to the required form.)

The following are the minimum percentage grades required to receive each of the various letter grades: A^+ (90%), A (80%), B^+ (75%), B (70%), C^+ (65%), C (60%), D (50%).

Textbook

Applied Nonparametric Statistics by Wayne W. Daniel, second edition, Brooks/ Cole, Duxbury Thompson Learning 1990 IBSN 0 –534 –38194 – 4. You can secure this by buying on the **website of Amazon.ca** There are two to three copies of the book available in the Science Library of the University of Manitoba.

References

- Practical Nonparametric Statistics by W. J. Conover, Third edition, John Wiley and Sons, Inc. 1999 ISBN 0 471-16068-7
- Nonparametric Statistical Methods by Myles Hollander and Douglas A. Wolfe, Second edition, John Wiley and Sons, 0 - 471 1945

Exam Information

The midterm test will be held **Thursday March 7 from 6:00 p.m. – 8:00 p.m.**. The topics to be covered on the midterm will be announced at least one week in advance. Students missing the test for a valid reason will be permitted to write a deferred test at a later date. The final exam will be 3 hours in duration and will be scheduled by the Student Records Office. The final exam will be cumulative, with an emphasis on material covered after the midterm test.

The quizzes, the term test and the final exam are **closed book**. However, you will be provided with a formula sheet.

For quizzes and exams, you will also need a **non-programmable scientific calculator**. (Graphing calculators are **not** permitted.)

Software

The software R- Studio software will be used sometimes in this course to show the analysis and solutions of some problems. However, the interpretation of the output is the most important thing that we need to understand in this course. So please download the and installed R and R- Studio programs depending on your operating system where the links are found in the first page.

To download R, follow one of the links below (depending on your operating system):

Windows systems: https://muug.ca/mirror/cran/bin/windows/
MacOS systems: https://muug.ca/mirror/cran/bin/macosx/

Once you have downloaded and installed R, you may access RStudio through the link below:

https://www.rstudio.com/products/rstudio/#download

Detailed installation instructions will be provided on your *UM Learn* page.

Quizzes

There will be three quizzes during the term, which will be written in class, and are scheduled for the following dates: **Monday January 29**, **Friday February 16** and **Wednesday March 27**. The coverage of each quiz will be announced in class at least one week in advance.

ROASS Schedule A

Schedule A of the Responsibilities of Academic Staff with regards to Students (ROASS) policies of the University of Manitoba lists resources and policies for students. It is important that you familiarize yourself with these resources and policies. Schedule A will be posted on your instructor's UM Learn page.

Course Outline

Unit 1 – Review of Statistical Inference

- parameter vs. statistic
- sampling distribution of $\bar{X}$, Central Limit Theorem
- normal quantile plots
- confidence interval for a population mean (σ known)
- hypothesis test for a population mean (σ known)
- P-value method, critical value method, confidence interval method, statistical significance
- confidence intervals and hypothesis tests for a population mean (σ unknown)

Unit 2 – Important Preliminary Concepts

- Some Important Terminology
- decisions in inference – Type I and Type II error, power, efficiency
- power relationships
- Measurement scales: Nominal, Ordinal, Interval and Ratio
- Nonparametric Statistics : History, Advantages and Disadvantages, When to use Nonparametric Procedures.

Unit 3 – Procedures that Utilize Data from a Single Sample

- Making Inferences about a Location Parameter: One– sample Sign Test, Wilcoxon Signed–Rank Test
- Making Inferences about a Population Proportion: Binomial Test
- One–Sample Run Test for Randomness
- Cox–Stuart Test for Trend

Unit 4 – Procedures that Utilize Data from Two Independent Samples

- Making Inferences about the difference between two location parameters: Median Test, Mann–Whitney Test

Unit 5 – Procedures that Utilize Data from Two Related Samples

- Procedures for Testing Hypotheses about Location Parameters: Sign Test for Two Related Samples, Wilcoxon Matched–Pair Signed Rank Test
- Confidence Interval Procedures for the Median Difference
- Test for Two Related Samples When Data Consists of Frequencies

Unit 6 – Chi–Square Tests of Independence and Homogeneity

- Mathematical Properties of the Chi–square Distribution
- Chi–square Test of of Independence
- Chi–square Test of Homogeneity

Unit 7 – Rank Correlation and other Measures of Association

- Spearman Rank Correlation Coefficient
- Kendall's Tau
- Point Biserial Coefficient of Correlation

Unit 8 – Procedures that Utilize Data from Three or More independent Samples

- Extension of the Median Test
- Kruskall–Wallis One–Way Analysis of Variance by Ranks
- Multiple Comparison

Unit 9 – Procedures that Utilize Data from Three or More Related Samples

- Friedman Two–way Analysis of Variance by Ranks
- Multiple–Comparison Procedure for use with Friedman Test
- Durbin's Test for Incomplete Block Design

Unit 10 – Optional Topics (if time permits)

- Making Inferences about the Equality of Two Dispersion Parameters: Ansari– Bradley Test
- Cochran's Test for Related Observations
- Test for Normality: Lilliefors Test, Kolmorov– Smirnov Test and Goodness–of–Fit Test

Academic Integrity

It is important that you understand what constitutes academic dishonesty and that you are familiar with the very serious consequences. The following link describes various types of academic dishonesty (including plagiarism, cheating, inappropriate collaboration and examination impersonation), and offers several resources to help students understand and avoid academic dishonesty:

http://umanitoba.ca/student-supports/academic-supports/academic-integrity

The Student Discipline Bylaw, which describes the potential consequences of academic dishonesty, can be found at the following link:

https://umanitoba.ca/governance/sites/governance/files/2021-09/Student%20Discipline%20Bylaw%20-%202021_09_01.pdf

An academic integrity and student conduct tutorial can be found at the following link. For this course, it is recommended in particular that you view the parts on Tests & Exams and Inappropriate Collaboration.

http://umanitoba.ca/student/resource/accessibility/files/AI-Student-Conduct-Tutorial/story_html5.html

The use of generative artificial intelligence (genAI) tools and apps is strictly prohibited for all assessments (including assignments) in this course. This includes ChatGPT and other AI writing and coding assistants. Use of genAI in this course constitutes an act of academic dishonesty.

Voluntary Withdrawal

The voluntary withdrawal date is **March 20** (by which time you will have received your marks for the first two quizzes and the term test). If you are unlikely to be successful in the course, or are not achieving the grade that you are aiming for, you should consider a VW from the course. Students enrolled in the course after the VW deadline will be assigned a final grade.

Copyrighted Material

All course notes, assignments, tests, exams, practice questions and solutions are the intellectual property of your instructor or the Department of Statistics. **The reproduction, posting or distribution of these materials is strictly forbidden without their consent**. It is **illegal** to upload any course material to any website. For more information, see the University's Copyright Office website at http://umanitoba.ca/copyright.

Recording of Class Lectures

Your instructor holds copyright over the course materials, presentations and lectures which form part of this course. **No audio or video recording of lectures or presentations is allowed in any format** without permission from your instructor.

Class Communication

The University requires all students to activate an official University email account. Please note that all communication between you and your instructor must comply with the Electronic Communication with Students Policy. Please see

http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html

You are required to obtain and use your U of M email account for all communication between yourself and the university.

Academic Accommodations

Student Accessibility Services

Students who have, or think they may have, a disability (e.g., mental illness, learning, medical, hearing, injury-related, visual) are encouraged to contact Student Accessibility Services to arrange a confidential consultation. Instructors are notified by Student Accessibility Services what accommodations their registered students require, which will help the instructor determine fair, feasible and reasonable academic accommodations without compromising academic standards. This takes time and planning, so reach out at the start of term.

SAS students can write their exams and tests in spaces organized by the SAS Exam Centre; however, they must register with the SAS Exam Centre a few weeks in advance. Please be sure to do so to receive the accommodations.

Student Accessibility Services
http://umanitoba.ca/student-supports/accessibility
520 University Centre
204-474-7423
Student_accessibility@umanitoba.ca

Medical Notes and Other Documentation

The Self-Declaration for Brief and Temporary Absences Procedure and Policy will be effective on September 1, 2022 and therefore students will not be required to present medical or other documentation for absences due to extenuating circumstances of five days (120 hours) or less; however, you must complete the form at the following link:

https://umanitoba.ca/sites/default/files/2022-09/Self%20Declaration%20Fillable%20Form-%20FINAL%20for%20Website.pdf

You must submit the form to your instructor in lieu of any medical or other documentation. Please note that further documentation may be requested from students who claim multiple temporary absences or absences for more than five days. You only need to submit this form if you miss an assessment. You do **not** need to fill out this form if you are missing a lecture or a tutorial. Note that personal vacations or work obligations are **not** considered valid excuses to miss assessments.

Final Exams

If you have conflicting scheduled final exams, or if you miss a final exam due to illness or some other valid reason, **you must contact an academic advisor in your home faculty** (http://umanitoba.ca/academic-advisors/) as soon as possible to apply for a deferred exam. Deferred final exams are **not** arranged through your instructor or the department. Note that the granting of a deferred exam is not necessarily guaranteed.