STAT 2000 Section D01
Basic Statistical Analysis 2
Winter 2024

CRN 50650

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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://posit.co/download/rstudio-desktop/

Office Hours: Mondays 10:00 a.m. – 11:00 a.m. (in-person)
Wednesdays 10:00 a.m. – 11:00 a.m. (in-person)
Thursdays 12:00 p.m. – 1:00 p.m. (in-person)
Fridays 11:00 a.m. – 12:00 p.m. (Zoom)

(or by appointment, excluding university holidays, through April 10)

Office hours on Fridays will be conducted over Zoom at the following link:

https://umanitoba.zoom.us/j/98900097670?pwd=SUUxekxydVl5dzhIL0xaOGE5U2EwQT09

Meeting ID: 989 0009 7670 Passcode: stat2000

Office hours are drop-in. You do not need an appointment; simply come to my office or join the Zoom meeting at the indicated time if you'd like to meet with me.

If the above times are not convenient for you, please contact me to arrange an alternate time to meet. I will do my best to return all email or telephone 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

(Lab required) This course is not recommended for students in certain programs (see the description of STAT 2150). The study of estimation and hypothesis testing procedures for means and proportions in one, two and multiple sample situations, introduction to the analysis of variance; regression and correlation analysis; optional topics may include non-parametric procedures, design of experiments, probability models. Not to be held with STAT 1150, STAT 2001. Prerequisite: STAT 1000 (C), or STAT 1001 (C).

Teaching Philosophy and Goals

It is the desire of the Department of Statistics to present this course in a manner that emphasizes and illustrates the statistical analysis arising from "real-world" applications. Whenever possible, we will attempt to bring real-life examples and data into the classroom. Upon completion of this course students can proceed in many directions: to further intensive study of statistics, to one or more additional courses in statistics, to the use of statistical methods in other fields of study, or to being a consumer of statistical information in daily life. It is our objective to serve all of these diverse directions.

The course is designed to include basic topics deemed crucial for problem formulation and understanding of the foundations of statistical thinking and reasoning. The concepts of statistical analysis will be stressed. The course will place an emphasis on the development of critical thinking skills.

Evaluation

Assignments (best 3 of 4)	12%
Quizzes (best 3 of 4)	18%
Midterm Test	25%
Final Examination	45%

If you miss a second assignment or quiz due to illness or another valid reason, and **provided that you have submitted a self-declaration form to your instructor within 24 hours of both missed due dates**, the weight of the second assessment will be transferred to your final exam. (See Page 12 of the syllabus for an explanation and link to the required form.) A third missed assignment or quiz will be assigned a grade of zero.

Subject to the caveat in the paragraph below, 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%).

There is an **additional requirement** for obtaining a C in the course: **To get a grade of C or better, you must obtain at least 50% on the final exam or an average grade of at least 50% on the midterm and final exam**.

Software

This course will make use of the statistical software R and RStudio. Both of these programs are free to use and are available for both Windows and MacOS systems. R is one of the most popular statistical software programs, and throughout the course, we will utilize R to help with our data analysis. We will use R through the RStudio environment, which will neatly organize and display your work. Finally, RMarkdown (a component of RStudio) will be used to format the documents that you submit for your assignments.

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://posit.co/download/rstudio-desktop/

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

Exam Information

The midterm test will be held **Wednesday, March 6 from 6:00 p.m. to 8:00 p.m.** and will cover Units 1 – 3 in the course outline. It will consist of only multiple-choice questions. Students missing the midterm test for a valid reason will be permitted to write a deferred midterm at a later date.

The final exam will be 3 hours in duration and will be scheduled by the Registrar's Office. The final exam will cover Units 1 – 6, with emphasis on Units 4 – 6. The final examination will contain both multiple-choice questions (worth 70% – 75% of the exam) and a written component (worth 25% – 30% of the exam).

Students in this course are expected to write their midterm test and final exam in-person. Students who live at least a two-hour drive outside of Winnipeg may apply to write these assessments online. To apply, please complete this form: https://forms.office.com/r/K1PuZhBWFU. The deadline to complete the form is **January 29, 2024** and approval must be granted by the Faculty of Science before the assessment can be written.

Please note, false information submitted in the form constitutes a breach in academic integrity (2.5f Academic Fraud) and will be handled according to the Student Academic Misconduct Procedure.

The midterm and the final exam are **closed book**. You will need a **non-programmable scientific calculator** (graphing calculators are **not** permitted). A formula sheet will be provided and you will need to bring with you a **clean** booklet of statistical tables (i.e. no markings on the pages).

Textbook

There is **no required textbook** for this course. You will be provided with detailed notes and all the material you need.

Quizzes

There will be four **open book** quizzes throughout the term, which will be written on UM Learn. The material covered on each quiz will be announced in advance. Quizzes will consist of both multiple-choice questions and a short-answer component which will require typing your response. You will be provided guidance on how to type mathematical expressions. The quizzes are worth 18% of your final grade, and **only the best 3 of 4 quizzes will count towards your final grade** (i.e., your lowest quiz mark will be dropped). **There will be no make-up quizzes – if you have to miss a quiz for any reason, that will count as your lowest quiz mark, which will be dropped.**

Quizzes will be open from **12:00 a.m. until 11:59 p.m.** on the dates below. You can enter the quiz any time during the quiz day, and once you begin, you will have 45 minutes to write the quiz.

	Date
Quiz 1	Fri, Feb. 2
Quiz 2	Fri, Feb. 16
Quiz 3	Fri, Mar. 22
Quiz 4	Fri, Apr. 5

Although there are different versions of the quiz questions, you are **not** permitted to discuss the quiz with students who have not yet written it. For any students who are members on an online chat group: During the week when quizzes are held, you may use these rooms to communicate with each other about the course, but you are not permitted to discuss specifics of the quiz until everyone has finished writing it (Friday at 4:30 p.m.).

You may **not** consult any outside resources other than the course material provided by the instructor or your personal notes while writing the quiz. You must complete the quiz **individually**. You may **not** consult with anyone while writing the quiz. In particular, communicating with your classmates by phone, email or social media during the quiz, as well as accessing online tutoring websites are considered academic misconduct.

The use of LockDown Browser and a webcam (using a program called Respondus Monitor) will be required for quizzes and for any students approved to write the midterm or final exam online. The webcam can be built into your computer or can be the type that plugs in with a USB cable. More detail about the use of LockDown Browser and Respondus Monitor will be given by your instructor.

Tutorials and Assignments

Tutorials will be held over Zoom beginning on Thursday, January 18. See Page 7 for the tutorial schedule and Zoom link. The tutorials will be recorded and posted on UM Learn if you are unable to attend. Tutorials will consist of the T.A. going over the application of the R statistical software to course material that has been recently covered in class.

Assignments will consist of two parts. The first part will be released prior to your tutorial and will be partly demonstrated by your T.A. The second part will be released on Friday evenings. Both parts will be submitted together by Thursday on the week after your tutorial takes place. See the Course Schedule on Page 7 for exact dates.

In the first tutorial, your T.A. will introduce you to R and RStudio, and show you what the software looks like. However, it is expected that you will have R and RStudio installed prior to your first tutorial, and that you will have RMarkdown set up. There will be a detailed installation and setup guide on your UM Learn page.

An introductory tutorial will take place on January 18 to help ensure that all software is set up properly on your computer. Assignment 0 will be associated with this tutorial, which is meant to make sure you understand how to format your R-based assignments correctly. If you submit Assignment 0 by **Friday, January 26 at 11:59 p.m.** and you receive a score of 100%, you will receive a 1% bonus towards your final grade in the course.

Note that the device you bring to the tutorial must be able to run R and RStudio. This means either a Windows computer (running Windows 10/11) or a MacOS computer (running MacOS 10.15 or higher); most tablets and Chromebooks will not be sufficient. If you do not have access to a machine that can run RStudio, you may either use one of the computers in 311 Machray Hall or borrow a laptop from the lending locker at the Elizabeth Dafoe Library (see https://umanitoba.ca/libraries/laptops).

There will be four assignments in the course using the R statistical software. Your final submission will be formatted with RMarkdown, and submitted to Crowdmark for grading. Only the **best 3 of 4** assignment grades will count towards your final grade (i.e., the lowest grade will be dropped, which means you can miss one assignment with no penalty).

For the assignments:

- You may speak to your classmates, but you may not directly show your code/output to anyone.
- To be clear, you can help a classmate by directing them to a similar example in the notes or tutorial files, but you can not look directly at someone else's work or show them your work.
- Sharing your work or R code with someone, either directly or online (such as in a Telegram chat room) will be considered an act of academic dishonesty, as will copying someone else's work.

- Each student must submit their own assignment.
- If you need help with an assignment, please use the Statistics Help Centre, where there are graduate students in Statistics available to help you. (See below.)

Practice Questions

You will be provided with many practice questions in this course. In the **Practice Problems** folder on *UM Learn*, you will find written-answer questions for each unit, as well as detailed solutions. These problems will help you practice and learn the course material, and to prepare for the written-response questions on the quizzes and the final exam.

In the **Practice Multiple Choice Questions** folder on *UM Learn*, you will find many multiple-choice questions for each unit. The letter answers for these questions are at the end of each file. These questions will help you practice and learn the course material, and to prepare for the multiple-choice questions on the quizzes, midterm and final exam.

Although they are not for marks, students are strongly encouraged to try these practice problems on a regular basis.

Statistics Help Centre

In 107 Allen Building, graduate students and senior undergraduate students in Statistics are available to help you with any questions you have about the course, as well as the installation of R and RStudio. The Help Centre is open starting on January 10 (except on university closures and during the term break) at the following times:

Monday	10:00 a.m. – 5:00 p.m.
Tuesday	10:00 a.m. – 7:00 p.m.
Wednesday	10:00 a.m. – 5:00 p.m.
Thursday	10:00 a.m. – 5:00 p.m.
Friday	10:00 a.m. – 5:00 p.m.

The Help Centre will also have online access, which will take place in the form of an open Zoom call.

Saturday 1:00 p.m. – 5:00 p.m. https://umanitoba.zoom.us/j/63661229764

ROASS Schedule A

Schedule A of the Responsibilities of Academic Staff with regards to Students (ROASS) policies of the University of Manitoba lists policies and resources 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 Schedule

Week	Dates	Tutorials & Prep Sessions	Midterm & Quizzes	Assignments
Week 1	Mon, Jan. 8 - Fri, Jan. 12	**No Tutorial**		
Week 2	Mon, Jan. 15 - Fri, Jan. 19	**Tutorial 0: Introduction** **Thu, Jan. 18, 2:30 - 3:30 PM**		**Assignment 0 distributed on Fri, Jan. 19**
Week 3	Mon, Jan. 22 - Fri, Jan. 26	**Tutorial 1** **Thu, Jan. 25, 2:30 - 3:30 PM**		**Assignment 0 due on Fri, Jan. 26** **Assignment 1 distributed on Fri, Jan. 26**
Week 4	Mon, Jan. 29 - Fri, Feb. 2	**Quiz 1 Prep Session** **Tue, Jan. 30, 12:00 PM**	**Quiz 1 (Unit 1)** **Fri, Feb. 2**	**Assignment 1 due on Thu, Feb. 1**
Week 5	Mon, Feb. 5 - Fri, Feb. 9	**Tutorial 2** **Thu, Feb. 8, 2:30 - 3:30 PM**		**Assignment 2 distributed on Fri, Feb. 9**
Week 6	Mon, Feb. 12 - Fri, Feb. 16	**Quiz 2 Prep Session** **Tue, Feb. 13, 12:00 PM**	**Quiz 2 (Unit 2)** **Fri, Feb. 16**	**Assignment 2 due on Thu, Feb. 15**
Winter Term Break	Mon, Feb. 19 - Fri, Feb. 23	**No Tutorial**		
Week 7	Mon, Feb. 26 - Fri, Mar. 1	**No Tutorial**		
Week 8	Mon, Mar. 4 - Fri, Mar. 8	**No Tutorial**	**Midterm (Units 1 - 3)** **Wed, Mar. 6** **6:00 - 8:00 p.m.**	
Week 9	Mon, Mar. 11 - Fri, Mar. 15	**Tutorial 3** **Thu, Mar. 14, 2:30 - 3:30 PM**		**Assignment 3 distributed on Fri, Mar. 15**
Week 10	Mon, Mar. 18 - Fri, Mar. 22	**Quiz 3 Prep Session** **Tue, Mar. 19, 12:00 PM**	**Quiz 3 (Unit 4)** **Fri, Mar. 22**	**Assignment 3 due on Thu, Mar. 21**
Week 11	Mon, Mar. 25 - Fri, Mar. 29	**Tutorial 4** **Thu, Mar. 28, 2:30 - 3:30 PM**		**Assignment 4 distributed on Fri, Mar. 29**
Week 12	Mon, Apr. 1 - Fri, Apr. 5	**Quiz 4 Prep Session** **Tue, Apr. 2, 12:00 PM**	**Quiz 4 (Unit 5)** **Fri, Apr. 5**	**Assignment 4 due on Thu, Apr. 4**
Week 13	Mon, Apr. 8 - Wed, Apr. 10	**No Tutorial**		

Zoom link for tutorials:
https://umanitoba.zoom.us/j/63376657152?pwd=Z1JtWWNQdTRSeUh4bE02UUZNd05pUT09
Meeting ID: 633 7665 7152
Passcode: 784111

Zoom link for quiz prep sessions:
https://umanitoba.zoom.us/j/98900097670?pwd=SUUxekxydVl5dzhIL0xaOGE5U2EwQT09
Meeting ID: 989 0009 7670
Passcode: stat2000

Course Outline

Unit 1 – Inference for the Mean of a Single Population

- Review of principles of statistical inference: testing and estimation, confidence intervals
- Statistical decisions: Type I and Type II errors and their probabilities, power of a test
- Review of t-distribution (comparison with normal distribution), tests and confidence intervals, robustness of t-procedure

Unit 2 – Inference for the Means of Two Populations

- Matched pairs t procedures
- Inference for the equality of means in two populations when population variances are equal and when population variances are unequal, assumptions of normality and independence

Unit 3 – Inference for the Means of Two or More Populations

- Inference for the equality of means in two or more populations: introduction to ANOVA
- The F-distribution
- Equivalence of pooled two-sample t-test and F-test

Unit 4 – Probability and Discrete Distributions

- Review of probability concepts and rules
- Conditional probability

Unit 5 – Analysis of Categorical Data and Goodness-of-Fit Tests

- Inference for a population proportion
- Power calculations
- Inference for comparing two population proportions
- Inference for $(r \times c)$ two-way tables: tests of independence and homogeneity of proportions, chi-square test, expected values, degrees of freedom
- Equivalence of Z-test and Chi-square test
- Goodness-of-fit tests

Unit 6 – Regression and Correlation

- Review of correlation and regression
- Simple linear regression model
- Inference in simple linear regression (slope, confidence intervals)
- Analysis of residuals and use of diagnostic tools
- Confidence Intervals for the true mean
- Multiple regression

The final examination covers material from Units 1 – 6, with emphasis on Units 4 – 6. The exam is 3 hours in duration and will be scheduled by the Registrar's Office.

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 in all course assignments unless explicitly stated otherwise by the instructor in this course. This includes ChatGPT and other AI writing and coding assistants. Use of genAI in this course may be considered use of an unauthorized aid, which is a form of cheating. This course policy is designed to promote your learning and intellectual development and to help you reach course learning outcomes.

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.

Voluntary Withdrawal

The voluntary withdrawal date is **March 20** (by which time you will have received your marks for the first two quizzes, the midterm test and the first two assignments). 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.

Health and Safety

The University of Manitoba is committed to maintaining a safe learning environment for all students, faculty, and staff. Should campus operations change because of health concerns related to a pandemic or other campus-wide emergency, it is possible that this course will move to a fully remote delivery format. Should the instructor be required to stay at home for an extended period and an alternate instructor not be available, the course may move temporarily to a remote delivery format.

Illness

Remember: **Stay home if you are sick**. Your lowest quiz grade and your lowest assignment grade will be dropped. **The purpose of this policy is that we know you may be unable to complete an assessment sometime during the term, either due to illness or some other valid reason**. Please complete the self-declaration form (see Page 13) if you have to miss an assessment.

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 is effective as of 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 (i.e., you do not need to inform your instructor if you have to miss a lecture). 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.