STAT 2000 Section A04
Basic Statistical Analysis II
Winter 2024

Time	T, 7:00 p.m. – 9:45 p.m.
Location	200 Armes
CRN	50088
Instructor	Aleksandra Newton (She/Her)
	357 Machray Hall
	Email: ciochona@myumanitoba.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://posit.co/download/rstudio-desktop/
	iClicker Student: https://student.iclicker.com
Office Hours:	Tuesday 5:30 p.m. – 6:30 p.m.
	Thursdays 11:30 a.m. – 12:30 p.m.

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

iClicker Questions/Participation	5%
Assignments (best 3 of 4)	10%
Quizzes (best 3 of 4)	15%
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 13 of the course outline for an explanation and link to the required form.) A third missed assignment or quiz will be assigned a grade of zero.

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%).

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. Students missing the midterm test for a valid reason will be permitted to write a deferred midterm at a later date. 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).

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)

iClickers

Throughout the course, extensive use of the iClicker classroom response system will be made in order to enhance your understanding of the material and promote classroom participation. iClicker questions are multiple-choice questions that you vote on using an internet-enabled device. You may participate with the iClicker Student app on an iPhone/iPad (iOS 10+) or Android (OS 5.0+) device or you may participate with the iClicker Student web app (from your laptop or tablet). Note that iClicker participation constitutes a portion of your grade in this course and as such you are required to bring your device to each class and to ensure that it has functional batteries or is charged.

You will need to make a free iClicker Student account either through their app or their website, https://student.iclicker.com/. When you create your account, use your U of M email address (not your Gmail or other personal email account) and your 7-digit student ID number. Once registered, you will need to add my class. **Make sure you register for the correct section, STAT 2000 A04.**

For every iClicker response you give, you will be awarded 1 point. For questions with a correct answer, an additional point will be awarded for selecting the correct response. Full marks (5/5) will be given if you receive at least 75% of the total possible iClicker points. The purpose of this is twofold: (1) These iClicker questions are intended to help you learn the material and encourage you to participate in class, and (2) we acknowledge that you may have to miss a class from time to time for legitimate reasons, so you won't be penalized for missing a small number of questions. Partial marks (3/5) will be given if you receive between 50% and 75%. No marks (0/5) will be given if you receive less than 50%.

The use of another student's iClicker account constitutes impersonation and is strictly forbidden under the University of Manitoba's academic integrity policy. (See page 11.) You may discuss iClicker questions with students seated next to you, but electronic communication is forbidden. You must be present to participate in the iClicker questions; answering the questions from another location constitutes academic dishonesty. (The reason that we only require 75% of the possible iClicker marks to get 5/5 is because we acknowledge that students may have to miss a few classes for legitimate reasons.)

Quizzes

There will be four **open book** quizzes throughout the term, which will be written during the tutorial time. Your T.A. will distribute a handout at your first tutorial with the quiz dates for your section. The material covered on each quiz will be announced in advance in class and on UM Learn. Quizzes will consist of multiple-choice questions and long answer. The quizzes are worth 15% 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. You must attend and write the quizzes **in the tutorial section in which you are registered.**

    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.).

Tutorials and Assignments

Tutorials will begin the week of January 15 – 19. (There are no tutorials the first week of classes, during Winter Term Break, the week of February 26 – March 1, the week of the midterm, or on April 8 – 10.) Other than the four weeks in which a quiz takes place in the tutorial, 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 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 the week of January 15 – 19 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. (Note that this includes the questions done by the TA in your tutorial – if a student misses a tutorial, they can either go to the help centre, or find similar code in their course notes and practice problems.)

- 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 the schedule on the next page.)

Textbook

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

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 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

			STAT 2000 Course Schedule			
Week	Dates	Course Material	Midterm	Tutorials	Assignment Release Dates	Assignment Due Dates
Week 1	Mon, Jan 8 -- Fri, Jan 12	Introduction		No Tutorial		
Week 2	Mon, Jan 15 -- Fri, Jan 19	Unit 1		Tutorial 0: Introduction	Assignment 0 Released Fri, Jan 19	
Week 3	Mon, Jan 22 -- Fri, Jan 26	Unit 1		Tutorial 1	Assignment 1 Released Fri, Jan 26	Assignment 0 Due Fri, Jan 26
Week 4	Mon, Jan 29 -- Fri, Feb 2	Unit 1/2		Quiz 1 (Unit 1)		Assignment 1 Due Thu, Feb 1
Week 5	Mon, Feb 5 -- Fri, Feb 9	Unit 2		Tutorial 2	Assignment 2 Released Fri, Feb 9	
Week 6	Mon, Feb 12 -- Fri, Feb 16	Unit 2		Quiz 2 (Unit 2)		Assignment 2 Due Thu, Feb 15
Winter Term Break				No Tutorial		
Week 7	Mon, Feb 26 -- Fri, Mar 1	Unit 3		No Tutorial		
Week 8	Mon, Mar 4 -- Fri, Mar 8	Units 3	Midterm (Units 1 - 3) Wed, Mar 6 6:00pm -- 8:00pm	No Tutorial		
Week 9	Mon, Mar 11 -- Fri, Mar 15	Unit 4		Tutorial 3	Assignment 3 Released Fri, Mar 15	
Week 10	Mon, Mar 18 -- Fri, Mar 22	Unit 4/5		Quiz 3 (Unit 4)		Assignment 3 Due Thu, Mar 21
Week 11	Mon, Mar 25 -- Fri, Mar 29*	Unit 5/6		Tutorial 4	Assignment 4 Released Fri, Mar 29	
Week 12	Mon, Apr 1 -- Fri, Apr 5	Unit 6		Quiz 4 (Unit 5)		Assignment 4 Due Thu, Apr 4
Week 13	Mon Apr 8 -- Wed, Apr 10	Unit 6		No Tutorial		

* Students with Friday tutorials will have a pre-recorded online tutorial made available to them in lieu of the in-person tutorial on Friday, March 29 (Good Friday)

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.

In some instances, medical or compassionate circumstances arise in a student's life that prevent them from performing as they would in normal circumstances. If you are in this position, please contact a Faculty academic advisor to discuss your options. Be prepared to provide documentation, which supports your situation.

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.