STAT 2150
Statistics and Computing
Winter 2024

Time	Tuesdays/Thursdays, 10:00 a.m. – 11:15 a.m.
Location	172 Agriculture
CRN	55928

Instructor	Dr. Ankit Doshi (He/Him)
	320 Machray Hall
	Email: Ankit.Doshi@umanitoba.ca
	Telephone: 204-474-8205

Web Pages	UM Learn: http://umanitoba.ca/umlearn

Office Hours:	Mondays 10:00 a.m. – 11:00 a.m.
	Wednesdays 10:00 a.m. – 11:00 a.m.
	Thursdays 12:00 p.m. – 1:00 p.m.
	(or by appointment, excluding university holidays, through April 10)

Office hours are drop-in. You do not need an appointment; simply come to my office 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.

Calendar Description

(Lab required) This course is recommended for students in mathematically rich disciplines, including Statistics, Mathematics, Actuarial Science, Computer Science, and related inter-disciplinary programs. Topics to be covered include: exploratory data analysis and visualization, graphical methods, random number generation, random variables, simple statistical models and computing, Monte Carlo methods, large sample and simulation-based inference, statistical software packages. Prerequisites: [one of STAT 1150, STAT 2000 (B), STAT 2001 (B), or STAT 2220] and [one of MATH 1230, MATH 1500, MATH 1501, MATH 1510, the former MATH 1520, or MATH 1524].

Textbook

There is no required textbook for this course. However, the following textbooks, all available in the form of e-books through the UM Libraries, are excellent resources to learn the basics of statistical computing.

Understanding Statistics Using R, Randall Schumacker and Sara Tomek, Springer (2013).

Statistical Analysis and Data Display: An Intermediate Course with Examples in R, Richard M. Heiberger and Burt Holland, Springer (2015).

Introduction to Statistics and Data Analysis, Christian Heumann, Michael Schomaker and Shalabh, Springer (2016).

Data Wrangling with R, Bradley C. Boehmke, Springer (2016).

Software

This course will make use of the R statistical software in both lectures and labs. You can download R for free from the *Comprehensive R Archive Network (CRAN)* at: https://cran.r-project.org. The preferred interface for R is RStudio, which can be downloaded from https://posit.co/download/rstudio-desktop/.

Evaluation

Assignments (3)	15%
Lab Work	10%
Term Tests (2)	40%
Final Exam	35%

Each Term Test is worth 20% of the overall grade. If you miss either term test, documentation will be required to transfer the weight of the test. If you miss Term Test #1, then Term Test #2 will be worth 30% and the Final Exam will be worth 45%. If you miss Term Test Test #2, then the Final Exam will be worth 55%.

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%).

Assignments

There will be three assignments during the term. Assignments will be submitted via a Crowdmark link. See the Tentative Course Schedule on UM Learn for due dates. Late submissions will be subject to a 20% penalty for submission within 24 hours after the deadline. No late submissions will be accepted thereafter. You are expected to work independently on the assignments: copying, in whole or in part, the work of another student will not be tolerated and will result in disciplinary action (see Academic Integrity section).

Tutorials

You will attend tutorials once per week for 10 weeks*, beginning the week of January 15-19, in 311 Machray Hall. No tutorials will be held on the weeks of February 12-16 and March 25-29. You will work on a lab worksheet on your own, but you are free to discuss with classmates and seek help from the TA. The worksheet will be distributed at the beginning of each tutorial session via a Crowdmark link; it must be submitted electronically by the end of the session.

*The tutorial on the week of April 8-10 will be asynchronous. The questions will be distributed at the same time for all tutorial sections, on Monday, April 8 at 8:30 a.m., and the work will be due on Wednesday, April 10 at 11:59 p.m. For this week only, the tutorials taking place on Tuesday and Wednesday (Tuesday, 8:30 – 9:20 a.m.; Wednesday, 2:30 – 3:20 p.m.; and Wednesday, 3:30 – 4:20 p.m.) will have drop-in help on the lab work open to any student from any tutorial section. The Thursday section will not be available for drop-in as the term ends on April 10.

You may use the computers in 311 Machray Hall or you may bring your own laptop. Attendance at the tutorial is not mandatory; however, if you require assistance with the lab work, you must attend. You may only attend the tutorial in which you are registered (with the exception of the week of April 8-10).

For each question or question part on the worksheet, as long as you make a reasonable effort, you will receive at least 50% of the mark. To receive full marks on each question or question part, you must complete the question correctly. Only the best 7 of 10 weekly grades will count toward your final grade. If you miss a tutorial for any reason, it will count as one of the three grades that are dropped.

Exam Information

There will be two 75-minute term tests, tentatively scheduled for **Tuesday, February 13** and **Tuesday, March 26**, to take place during the scheduled class time.

The final exam will be 3 hours in duration and will be scheduled by the Registrar's Office during the April exam period.

The term tests and the final exam are **closed book**. You may need a **non-programmable scientific calculator** (graphing calculators are **not** permitted). Statistical tables and a formula sheet will be provided, if required.

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.

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 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.

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.

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.

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 Term Test 1, Assignment 1, and several lab worksheets). 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.

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.

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); 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.

Course Outline

Unit 1 – R Software

- What is R and downloading instructions
- Syntax and R objects
- In-built functions in R
- Reading data from various sources and writing data
- Basics of writing R functions
- Loops/if/while and other control-flow constructs
- Libraries and packages
- R Markdown

Unit 2 – Exploratory Data Analysis

- Types of variables and data
- Summarizing data and identifying characteristics
- Additional visualization tools in R

Unit 3 – Probability Distributions and Data Simulation

- A review of probability
- Conditional probability
- Random variables
- Probability distributions: continuous and discrete
- Generating samples from probability distributions

Unit 4 – **Statistical Inference**

- Methods of estimation
- Measures of efficiency and accuracy
- Pivots and confidence intervals

Unit 5 – **Hypothesis Tests**

- Terminology and notation
- Size and power
- Cross-tabulation and tests of association
- Goodness-of-fit tests

Unit 6 – **Resampling Methods and Assessments of Inferential Methods**

- Bootstrap
- Permutation tests
- Monte Carlo methods
- Assessing inferential methods via simulation

Unit 7 – **Regression**

- A review of simple linear regression
- Regression on categorical variables
- Multiple regression
- Residuals and other diagnostic checks