

University of Manitoba – Department of Statistics

STAT 2150 : Statistics and Computing

Fall Term 2020

Course Details

Course Number & Title	STAT 2150, Statistics and Computing
Section & CRN	Section A01, CRN: 17120
Class Schedule	T Th 1:00pm-2:15pm CST
Lab Schedule	B01: M 3:30pm – 4:20pm CST B02: Tu 8:30am – 9:20am CST B03: W 2:30pm – 3:20pm CST
Course Format	Asynchronous Remote Learning

Instructor Contact Information

Instructor	Dr. Katherine Davies
Email	Katherine.Davies@UManitoba.CA
Zoom Office Hours	T Th 1:00pm-2:00pm CST, or by appointment. Zoom Link: https://zoom.us/j/97403720113 Zoom Meeting ID: 974 0372 0113 Zoom Passcode: 241960

Calendar Description and Prerequisites

Calendar Description	(Lab required) This course is recommended for students in mathematically rich disciplines, including Statistics, Mathematics, Actuarial Science, Computer Science, and related interdisciplinary 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	[STAT 1150 (C) or STAT 2000 (B) or STAT 2001 (B)] and [a C or better in one of: MATH 1230, MATH 1500, MATH 1501, MATH 1510, MATH 1520, the former MATH 1530, or MATH 1690 (C)].

Course Objectives and Expectations

My primary objectives for this course are to teach you statistics and how to use statistical software and learn important statistical computing skills. In addition to these objectives, I want you to have a good experience. While we are not able to have the traditional classroom experience, I hope that my enthusiasm will inspire you and that you see how useful statistics can be in our everyday lives and see how valuable the skill of statistical computing is.

In order to achieve these goals, we can have the following agreements.

You can expect me to:

- plan the course and alter that plan as needed;
- provide you with class notes (slides) and opportunities to practice applying the course material;
- be respectful, courteous and provide a good learning experience;
- give you feedback as the course progresses, primarily by returning your quizzes and tests in a timely manner, posting test solutions and going over your quiz/test with you should you desire this;
- answer emails within 24-48 hours; if on the weekend, by next work day at 5pm.

What I expect from you:

- read the class slides. watch the class videos and go through the RMarkdown files in a timely manner;
- ask questions when you have any, to myself or your TA;
- be courteous and respectful to myself and your classmates;
- check your UM email regularly for course related communication;
- check [UM Learn](#) regularly for new course material and for any announcements and important information;

Course Materials, Online Tools and Supplemental Readings

Video Clips	Short video clips (typically 5-20 minutes) will be posted for you to view as we progress through the course. While I tried to minimize background noises, there may some in the videos and please forgive me. These videos will be posted in tandem with the course slides and there are indications in the course slides for appropriate times to view. For each video, a link will be embedded in the notes and also posted on the UM Learn system .
Course Slides	The course slides are the primary component of the course material and will contain statistical concepts and information on how R software can be used in tandem with these concepts. These slides will be posted on the UM Learn system .
R Files	These files (either R script files or RMarkdown files) will be for you to use in R (Studio) and will provide code as well as other worked through examples, including some from the course slides. These files will be posted on the UM Learn system . These files will be posted alongside the course slides and there are indications in the course slides for appropriate times to open and work with the files.

Zoom Zoom is an online platform for hosting and participating in meetings. My office hours will be held as online “meetings”. I will be available on Zoom during my office hours. At the scheduled times, I will login, begin the meeting and you can use that link to partake. During these times, on Zoom, you will be able to ask me questions, listen to other students questions, etc. If you prefer to meet with me one-on-one via Zoom, please contact me to arrange a time. You do not need have a Zoom account in order to use a link to a meeting (office hour), however you will be prompted to download the application. Please go here for proper [Zoom etiquette](#).

Statistical Software The course will make use of the R statistical software and you will be assessed on it throughout the course. You will need to download R for free (for Windows, Mac, UNIX or LINUX, including PDF documentation) from the *Comprehensive R Archive Network* (CRAN) at: <http://cran.r-project.org/>. You will also need to download RStudio, which can be downloaded from <https://www.rstudio.com/>.

Supplemental Readings I may from time to time ask you to read some additional material, possibly a chapter of a book or an online article. There is no required textbook for the course. However, the following books, all available in the form of e-books through the UM Libraries, are excellent resources:

- T1.** *Fundamentals of Data Visualization* by Claus O. Wilke, O’Reilly Media, Inc. (2019)
- T2.** *Modern Dive: Statistical Inference via Data Science* by Chester Ismay and Albert Y. Kim, CRC Press (2019).
- T3.** *Understanding Statistics Using R*, Randall Schumacker and Sara Tomek, Springer (2013)
- T4.** *Statistical Analysis and Data Display: An Intermediate Course with Examples in R*, Richard M. Heiberger and Burt Holland, Springer (2015)
- T5.** *Introduction to Statistics and Data Analysis*, Christian Heumann, Michael Schomaker and Shalabh, Springer (2016)

Course Assessments

Quizzes There will be three 45 minute quizzes, tentatively scheduled during class time (1:00-2:15pm CST) on **October 6**, **November 3** and **December 10, 2020**, to take place on [UM Learn](#). **There will be no make-up quizzes.** With legitimate reasons: if you miss Quiz #1, its weigh will be shifted to Term Test #1, If you miss Quiz #2, its weight will be shifted to Term Test #2 and if you miss Quiz #3, its weight will be shifted to the final exam. Please make sure your reason(s) for missing a quiz are legitimate in order to avoid academic consequences.

Term Tests There will be two 75 minute term tests, tentatively scheduled on **October 20, 2020** and **November 24, 2020**, to take place during the scheduled class time (1:00-2:15pm CST). They will take place on [UM Learn](#). The weight of any missed term test, with legitimate reasons, will be shifted to the final exam.

Final Exam Your final exam will be 3 hours and take place during the December exam period, with the date and time to be scheduled by the Registrar's office. The exam will be administered on [UM Learn](#).

Labs There is a mandatory lab for this course and it is highly recommended that you follow along with the lab activities in order to better grasp the course material and get invaluable practice and guidance with R. Details about your TA and the format of the labs will be provided on [UM Learn](#).

Important Note: During online assessments (quizzes, tests and final exam), you are permitted to use: the course notes, a non-programmable scientific calculator, any material provided to you by me, and any notes you have made before the assessment. During these assessments, you are **not** permitted to: open R or RStudio, access the internet (other than UM Learn), communicate with any classmates, tutoring websites or any other person, nor use notes prepared by anyone else besides me or you.

Students failing to abide by these regulations will be subject to penalties as laid out in the university's academic dishonesty policy. (See the section in this course outline on Academic Integrity.)

Course Evaluation and Grading Scheme

Final Marks Your final mark for the course will be based on the following components:

Quizzes (3)	25% (equally weighted)
Term Tests (2)	40% (equally weighted)
Final Exam	35%

Letter Grades The following cutoffs will be used when assigning the letter grades.

Letter Grade	Mark out of 100
A+	90 – 100
A	80 – 90
B+	75 – 80
B	70 – 75
C+	65 – 70
C	60 – 65
D	50 – 60
F	below 50

Important Dates

Date	Event
September 10	(non-mandatory) Introduction on Zoom
September 22	Last day to drop courses in revision period
September 23	Last day to add courses in revision period
October 6	Quiz #1
October 12	Thanksgiving Day (holiday)
October 20	Term Test #1
November 3	Quiz #2
November 9-13	Fall break
November 24	Term Test #2
November 23	Last day to VW
December 10	Quiz #3

The dates for quizzes and term tests are tentative and are subject to change at my discretion. Changes are subject to Section 2.8 of the ROASS Procedure.

Class Communications

The University requires all students to activate an official U of M email account, which should be used for all communications between yourself and the university (including all your instructors). All these email communications should comply with the University's policy on electronic communication with students, which can be found at:

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

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:

http://umanitoba.ca/admin/governance/media/Student_Discipline_Bylaw_-_2018-09-01.pdf

An academic integrity and student conduct 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

All students are required to complete a short Academic Integrity quiz in [UM Learn](#). If you receive a score of 100% on this quiz, you will receive a 1% bonus towards your final grade in the class. The quiz must be completed by Friday September 28 at noon.

For any student that creates a Telegram chat group (or any other chat group), I ask that you disable the room during all online assessments. I also ask that any student joining a chat group uses their real name.

Use of Copyrighted Material

Please be aware of copyright laws during this course. All notes/slides, assessments and solutions are either my own intellectual property or that of the University. We may also use other copyrighted content in this course. I will ensure that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted material must not be distributed in any format without permission, and this implies that you do not have permission to upload any course material (or other copyrighted material) to any note sharing website.

As per copyright rules, special attention should be given to my videos. All of my video recordings belong to me and cannot be used for any other purposes by any other party without my permission.

More details are available online at: <http://umanitoba.ca/copyright/>

Student Accessibility Services

If you are a student with a disability, please contact Student Accessibility Services (SAS) for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Technological Requirements

You will require the following minimum technological requirements:

1. A computing device where one can create and edit documents,
2. An internet connection capable of streaming videos and downloading software, and
3. Access to a web-cam and microphone.

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. This document is available from the Department of Statistics web page at:

<https://www.sci.umanitoba.ca/statistics/wp-content/uploads/sites/4/2019/11/Schedule-A-ROASS-Statistics.pdf>

Tentative List of Topics

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
- RMarkdown

2. Exploratory Data Analysis

- Types of variables and data
- Summarizing data and identifying characteristics
- Summarizing distributional patterns
- Additional visualization techniques

3. Probability Distributions and Data Simulation

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

4. Statistical Inference

- Methods of estimation
- Measures of efficiency and accuracy
- Pivots and confidence intervals
- Hypothesis tests
- Cross-tabulation and tests of association
- Goodness-of-fit tests

5. Resampling Methods and Assessments of Inferential Methods

- Resampling methods
- Evaluating statistical procedures and understanding large sample results
- Assessing inferential methods via simulation

6. Regression

- Simple linear regression
- Regression on categorical variables
- ANOVA
- Residuals and other diagnostic checks

7. Introduction to Data Science