

University of Manitoba - Department of Statistics

Fall 2021

STAT 2150: Statistics and Computing

Course Details

Course Number & Title: STAT 2150, Statistics and Computing

Section & CRN: Section A01, CRN: 17120

Course Schedule: T/R, 1:00 pm – 2:15 pm, on-line through Zoom and UMLearn

Calendar Description: 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: [One of STAT 1150, STAT 2000 (B), STAT 2001 (B), or STAT 2220] and [one of MATH 1230, MATH 1500, MATH 1501, MATH 1510, MATH 1520, or MATH 1690].

Instructor Contact Information

Instructor Keith Uzelmann

Email: uzelmank@myumanitoba.ca

Office Hours: Friday: 2:00 pm – 4:00 pm, or by appointment.

Course Materials and Web Pages

Course Notes: The first and foremost authority in this course will be my course notes and (interchangeably) my lecture recordings unless explicitly stated otherwise. These notes will be presented to you in class, as well as made available online on UMLearn immediately following the lectures (if not earlier). Lectures will be hosted through Zoom and the recordings will be available to you for the duration of the course. These course notes are based on those used by Katherine Davies.

Textbook: There is no required textbook. However, the following texts are excellent resources, and are all available in the form of e-books through the UM Libraries:

- Fundamentals of Data Visualization by Claus O. Wilke, O'Reilly Media, Inc. (2019)
- Modern Dive: Statistical Inference via Data Science by Chester Ismay and Albert Y. Kim, CRC Press (2019).
- Understanding Statistics Using R, Randall Schumacker and Sara Tomek, Springer (2013)
- Introduction to Statistics and Data Analysis, Christian Heumann, Michael Schomaker and Shalabh, Springer (2016)

These textbooks are **not required**.

Other Materials: You will require a computer with a reliable internet connection so that you may access all course materials. I expect you to be aware of any updates I make on UMLearn or any emails I send within one business day, so make sure you are checking your email and the course page regularly.

Web Pages: UMLearn: <https://universityofmanitoba.desire2learn.com/d2l/home>
Statistics: <http://umanitoba.ca/statistics>
R Download: <https://cran.r-project.org/mirrors.html>
RStudio: <https://www.rstudio.com>

Course Structure

Lectures: Lectures will take place Tuesday and Thursday, from 1:00 pm to 2:15 pm. These lectures, in conjunction with the Labs (described below) will cover almost all, if not all of the material you are required to know in the course. Any material covered in the lectures will be testable, unless otherwise stated.

UMLearn Materials: This syllabus, course notes, and lab notes will be posted to UMLearn, in addition to important announcements. Further, I am not perfect, and I may make a mistake in class. If I do, I will post a correction to UMLearn as soon as I become aware of the error. Thus, please make sure you are checking UMLearn on a regular basis so that you are of any announcements or corrections.

Office Hours: From 2:00pm to 4:00 pm on Fridays, I will be available on Zoom for you to ask me any course-related questions you may have. During this time, feel free to drop in unannounced with any problems you are having relating to the course material. I am happy to spend however long it takes to help you understand any element of the course content. If these hours do not work for you, please feel free to email me to set up another time.

Labs: In addition to the lectures, there will be labs every Week (Starting Week 2). Some of these labs will contain instruction, and will mostly use R to explore concepts taught in class. Note that this lab material is also testable, in addition to the lecture material. Two of these labs will be used for the live components of the term tests, as described in the Term Tests subsection below.

Weekly Quizzes: There will be a short quiz on UMLearn every week, with the exception of Weeks 1, 6, 10, and 11. These quizzes will open up at 12:01am on Sunday, and will close at 11:59pm that same day. Once you begin the quiz, you will have a finite time (generally 25-35 minutes) to complete it.

R Project: There will be an end-of-term R Project. This will be completed in the final two weeks of class. Further instructions will be provided at the time of the assignment.

Term Tests: There will be two term tests in this course. These term tests have two components: a “take-home” component, and a live, proctored component. The “take-home” components will be given to you at 12:01am on Sunday (October 17th for Term Test 1, and November 21 for Term Test 2), and will be due back at 11:59pm that day. The corresponding live component will take place during your lab in the week following the take-home test. The content coverage of Term Test 1 will be everything up to October 7th, and the content coverage of Term Test 2 will be the content between October 12th and November 4th. Note that these dates and content coverage lists are tentative, and may be changed by me if I feel this to be appropriate. I will give you a reasonable amount of notice for any changes I make.

Final Exam: The course will have a cumulative final exam. This will be a live, proctored assessment, and will be held over UMLearn. The exact time and date is TBD and depends on the scheduling by the registrar.

Tips for Success

Below are some tips that will help you to be successful in this course.

- Do as I say, not as I write. I have a (bad) habit of speaking aloud important elements of solutions without writing them down. Occasionally, when solving problems, I will explain out loud a skipped step that I expect you to replicate on a test. I will try to make this clear whenever I can, but if you are ever unsure, please ask.
- Attend the lectures. As stated above, I will often cover in the lectures important details that do not make it into the course notes (though I will try to put these details in the notes as often as I can). This means that if you skip lectures, you are likely to miss some course content. If you have to miss a lecture due to some legitimate reason, I suggest you watch the lecture recording.
- Reading a solution is not the same as performing the solution yourself. Mathematics is not a spectator sport. A solution to a problem will often make sense in your head, but if you do not practice, you will not be able to replicate that solution on a test or exam. Thus, make sure you are actually solving all the problems you attempt. If you are unable to solve a question, and you have to check an outside resource to find the solution, my advice is to wait a few hours (or a full day) and try the question **again**. This may seem superfluous, but I will say that it is the most effective study technique I've learned.
- If you do not understand a step I have performed in class, or if you think I have made a mistake, please let me know. I am not immune to performing errors, and I sometimes will skip a step that is familiar to me, but might be new to you. In either of these cases, please do not hesitate to let me know! I am more than happy to explain any steps in greater detail, or correct any errors that arise.
- If you are stuck, please come to my office hours. As stated above, I am happy to spend as long as it takes to help you understand a concept (within reason, of course). If you cannot attend my office hours, and we cannot set up an alternative office hour, you may attempt to email me the problem. However, typesetting math problems over email is more trouble than it's worth, so you will likely get a very terse reply. I strongly suggest that you talk to me during class or the office hours as opposed to emailing me if you need help with solving a problem.

Course Evaluation and Grading Scheme

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%)

I may use lower grade thresholds, if I believe this to be appropriate. However, I will not use higher grade thresholds.

The final mark for the course will be obtained by the following scheme:

Weekly Quizzes	30%
R Project	25%
Term Test 1	10%
Term Test 2	10%
Final Exam	25%

If you cannot write Term Test 1, the weight of Term Test 2 will become 20%. If you cannot write Term Test 2, Term Test 1 will become worth 20%. If you cannot write both Term Tests, the Final Exam will become worth 45%. Note that in any of these cases, you have to provide documentation for your absence within 24 hours of the test.

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 [here](#)

Voluntary Withdrawal

The Voluntary Withdrawal (VW) date for this course is November 23.

Course Outline - Tentative List of Topics

- Unit 1 – Using R
 - What is R?
 - Syntax and R objects
 - In-built functions in R
 - Reading data from various sources and writing data
 - Basics of writing R functions
 - Loops, if-else statements, and other control-flow constructs
 - Libraries and packages
- 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 – Estimation
 - Methods of estimation
 - Measures of efficiency and accuracy
 - Pivots and confidence intervals
- Unit 5 – Hypothesis Tests
 - Hypothesis tests
 - Cross-tabulation and tests of association
 - Goodness-of-fit tests
- Unit 6 – Resampling Methods and Assessments of Inferential Methods
 - Jackknife
 - 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

Course Timetable

<u>WEEK</u>	<u>DATE</u>	<u>Content</u>	<u>Important Dates</u>
Week 1	September 9 September 14	Intro + Unit 1 Unit 1	
Week 2	September 16 September 19	Unit 1 Weekly Quiz 1	
Week 3	September 21 September 23 September 26	Unit 1 Unit 1 + Unit 2 Weekly Quiz 2	Sept. 21 - Course Revision Period Ends
Week 4	September 28 September 30 October 3	Unit 2 <i>Reconciliation Day - No Class</i> Weekly Quiz 3	
Week 5	October 5 October 7 October 10	Unit 3 Unit 3 Weekly Quiz 4	
Week 6	October 12 October 14 October 17	Unit 3 Unit 3 Term Test 1 - Take-Home Comp.	
Week 7	October 19 October 21 October 24	Unit 3 Unit 3 Weekly Quiz 5	Oct. 19/20/21 - Term Test 2 Live Comp.
Week 8	October 26 October 28 October 31	Unit 4 Unit 4 Weekly Quiz 6	
Week 9	November 2 November 4 November 7	Unit 5 Unit 5 Weekly Quiz 7	
Week 10	November 9 November 11	<i>Fall Term Break</i>	
Week 11	November 16 November 18 November 21	Unit 6 Unit 6 Term Test 2 - Take-Home Comp.	
Week 12	November 23 November 25 November 28	Unit 6 Unit 6 Weekly Quiz 8	Nov. 23 - Voluntary Withdrawal Date Nov. 23/24/25 - Term Test 2 Live Comp.
Week 13	November 30 December 2 December 5	Unit 7 Unit 7 Weekly Quiz 9	
Week 14	December 7 December 9 December 12	Unit 7 Unit 7 Weekly Quiz 10	Dec. 10 - R Project Due
TBD		Final Exam	

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 [here](#)

Technology in the Classroom

It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. Students should restrict their use of technology to those approved by the instructor for educational purposes only. Electronic messaging, email, social networking, gaming, etc. should be avoided during class time. If a student is on call for emergencies, their cell phone should be on vibrate mode and the student should leave the classroom before using it.

Student Accessibility Services

If you are a student with a disability, please contact 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.

The SAS website may be found [here](#)

Academic Dishonesty

It is important that you understand what constitutes academic dishonesty and that you are familiar with the very serious consequences. Links to resources that describe academic dishonesty (including plagiarism, cheating, inappropriate collaboration and examination impersonation, as well as typical penalties) can be found [here](#)

Use of Copyrighted Material

Please be mindful and respect copyright throughout this course. All course notes, assignments, tests, exams, practice exams, and solutions are either my own intellectual property or that of the Department of Statistics. If I use any copyrighted material in my lectures I will properly source and follow copyright guidelines and I expect you to do the same. The copyrighted works are made available for your personal use and study and must not be distributed in any format without express permission.

You do not have permission to upload any course notes, tests, assignments, or handouts to any note sharing websites. Please see [this website](#) for more information:

The recordings made available of my lectures are for your personal use only, and you may not distribute them in any way, or upload them to any websites without my explicit permission.