# University of Manitoba - Department of Statistics
# Winter 2021
# STAT 1150: Introduction to Statistics and Computing

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## Course Details

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**Course Number & Title:** STAT 1150, Introduction to Statistics and Computing

**Section & CRN:** Section A01, CRN: 55911

**Course Schedule:** M/W, 2:30 pm – 3:45 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: summarizing and displaying large datasets, sampling, estimation and significance tests, probability calculations, random variables and probability distributions, introduction to regression and correlation analysis, statistical software.

**Prerequisites:** Minimum of 70% in Pre-calculus Mathematics 40S or a grade of B or better in MSKL 0100 or equivalent.

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## Instructor Contact Information

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**Instructor** Keith Uzelmann

**Email:** `uzelmank@myumanitoba.ca`

**Office Hours:** Friday: 2:00 pm – 3:30 pm, or by appointment.

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## Course Materials and Web Pages

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**Course Notes:** The first and foremost authority in this course will be my course notes and (interchangeably) my lecture recordings unless explicity 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 were originally developed by Jenna Tichon.

**Textbook:** The following is an important reference material for the course:

- Statistics: 13th Edition by James T. McClave and Terry T Sincich. ISBN-13: 9780134080215

This textbook is **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`

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## Course Structure

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**Lectures:** Lectures will take place Monday and Wednesday, from 2:30 pm to 3:45 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 3:30 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, with the exceptions of Weeks 1 and 5. 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.

**Reflections:** After each Monday class, there will be a short question posted on UMLearn which requires you to post a short, but thoughtful answer regarding the content of that class. You will be required to give you answer in full sentences, and will be due by the following Wednesday class. Your mark on this will be either 0: for a completely unsatisfactory answer, 1: for a partially satisfactory answer but something that is not fully correct, or 2: for a fully satisfactory answer.

**Weekly Quizzes:** There will be a short quiz on UMLearn every week, with the exception of Weeks 1, 5, and 13. These quizzes will be made available to you at 4:00pm on Thursdays, and will be due at 4:00pm the following Sunday. The quiz should take no more than 25 minutes to complete.

**R Assignments:** Throughout the term there will be two assignments to be completed by making an R Markdown document using my template and answering the contained questions. Each student will have a unique dataset to work with that is determined by their student ID number. The assignment will be available on R Studio Cloud and students are to submit their completed PDF to the dropbox on UMLearn under Assessments ¿ Assignments. Further instructions will be provided at the time of the assignments.

**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 2:00pm on Friday (February 19th for Term Test 1, and March 26 for Term Test 2), and will be due back at 2:00pm the following Sunday. The corresponding live component will take place during your lab in the week following the take-home test (February 23 – 25 for Term Test 1, March 30 – April 1 for Term Test 2). The content coverage of Term Test 1 will be Units 1 – 2, and the content coverage of Term Test 2 will be Units 1 – 5.

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

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## Tips for Success

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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 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 ask a friend.

- 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.

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## Course Evaluation and Grading Scheme

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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:

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|---:|:---|
| Weekly Quizzes | 20% |
| Reflections | 10% |
| R Assignments | 20% |
| Term Test 1 | 10% |
| Term Test 2 | 15% |
| Final Exam | 25% |

If you cannot write Term Test 1, the weight of Term Test 2 will become 20% and the weight of the Final Exam will become 30%. If you cannot write Term Test 2, Term Test 1 will become worth 15% and the Final Exam will become worth 35%. If you cannot write both Term Tests, the Final Exam will become worth 50%. Note that in any of these cases, you have to provide documentation for your absence within 24 hours of the test.

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### ROASS Schedule A

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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

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### Voluntary Withdrawal

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The Voluntary Withdrawal (VW) date for this course is March 31st. By this point in the course, you will have received assessment on approximately 44% of your final grade.

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### Course Outline

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- Unit 1 – Examining Data

    - obtaining data: samples, types of variables
    - representative samples and data quality
    - displaying data: frequency distributions, histograms
    - describing data with numbers: mean, weighted mean, median, quartiles, interquartile range, range, variance and standard deviation
    - five-number summary and boxplots
    - the 1.5 ×IQR rule for suspected outliers, outlier boxplots
    - resistant measures
    - introduction to R with descriptive statistics

- Unit 2 – Random Variables and Probability Distributions

  - randomness, the language of probability
  - long term proportion
  - discrete random variables and probability distributions
  - continuous random variables, density curves
  - uniform distribution
  - statistics vs. parameters
  - the normal distribution

- Unit 3 – Sampling Distributions

  - simple random samples
  - sampling distribution of a sample mean
  - bias and variability
  - Central Limit Theorem
  - sampling distributions for proportions

- Unit 4 – Confidence Intervals for a Single Population Mean

  - confidence intervals for $\sigma$ known
  - selecting samples sizes
  - introduction to the $t$-distribution
  - confidence intervals for $\sigma$ unknown
  - confidence intervals for $\hat{p}$

- Unit 5 – Tests of Significance for Single Populations

  - tests of significance for a single population mean ($\sigma$ known and unknown)
  - tests of significance for population proportions

- Unit 6 – Inference for the Means of Two Populations

  - matched pairs $t$-procedure
  - inference when population variances are equal
  - inference when population variances are unequal

- Unit 7 – Regression

  - association versus causation
  - response variable, explanatory variable
  - scatterplots
  - correlation
  - least-squares criterion, least squares regression line and $r^2$
  - residuals, outliers, influential observations
  - lurking variables
  - extrapolation
  - inference on $\beta_0$ and $\rho$
  - analysis of residuals
  - confidence intervals for $\mu_Y$

## Course Timetable

| WEEK | DATE | Lecture Content | Lab Content | Important Dates |
|------|------|-----------------|-------------|-----------------|
| **Week 1** | January 18 | First Class | NO LAB | |
| | January 20 | Unit 1 | | |
| **Week 2** | January 25 | Unit 1 | Intro to R | *Jan 29 - Last day to drop classes* |
| | January 27 | Unit 1 | | |
| **Week 3** | February 1 | Unit 2 | Unit 1 | |
| | February 3 | Unit 2 | | |
| **Week 4** | February 8 | Unit 2 | Unit 2 | *Feb 8 - Assignment 1 STARTS* |
| | February 10 | Review | | |
| **Week 5** | February 15 | | | |
| | February 17 | WINTER TERM BREAK | | |
| | February 19 | **Term Test 1 - Take Home** | | |
| **Week 6** | February 22 | Unit 3 | **Term Test 1: Live** | *Feb 28 - Assignment 1 DUE* |
| | February 24 | Unit 3 | | |
| **Week 7** | March 1 | Unit 4 | Unit 3 | |
| | March 3 | Unit 4 | | |
| **Week 8** | March 8 | Unit 4 | Unit 4 | |
| | March 10 | Unit 4 | | |
| **Week 9** | March 15 | Unit 5 | Unit 4 | |
| | March 17 | Unit 5 | | |
| **Week 10** | March 22 | Unit 6 | Unit 5 | *March 24 - Assignment 2 STARTS* |
| | March 24 | Unit 6 | | |
| | March 26 | **Term Test 2 - Take Home** | | |
| **Week 11** | March 29 | Unit 6 | **Term Test 2: Live** | *March 31 - VW Deadline* |
| | March 31 | Unit 7 | | |
| **Week 12** | April 5 | Unit 7 | Unit 6 | *April 9 - Assignment 2 DUE* |
| | April 7 | Unit 7 | | |
| **Week 13** | April 12 | Unit 7 | Unit 6 / 7 | |
| | April 14 | Review | | |

## 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 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. Cell phones should be turned off. 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**

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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

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**Academic Dishonesty**

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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

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**Use of Copyrighted Material**

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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.