

University of Manitoba – Department of Statistics

**STAT 2150 : Statistics and Computing**

Winter Term 2021

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**Course Details**

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<b>Course Number &amp; Title</b>	STAT 2150, Statistics and Computing
<b>Section &amp; CRN</b>	Section A01, CRN: 55928
<b>Class Schedule</b>	T Th 10:00am-11:15am CST
<b>Lab Schedule</b>	B01: M 3:30pm – 4:20pm CST B02: Tu 8:30am – 9:20am CST B03: W 2:30pm – 3:20pm CST
<b>Course Format</b>	Remote Learning

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**Instructor Contact Information**

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<b>Instructor</b>	Dr. Katherine Davies
<b>Email</b>	Katherine.Davies@UManitoba.CA
<b>Zoom Office Hours</b>	T 10:00-11:15am, Th 1:00-2:00pm CST, or by appointment. Zoom Link: <a href="https://zoom.us/j/95859960472">https://zoom.us/j/95859960472</a> Zoom Meeting ID: 958 5996 0472 Zoom Passcode: 768102

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**Calendar Description and Prerequisites**

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<b>Calendar Description</b>	(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.
<b>Prerequisites</b>	[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)].

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**Course Objectives and Expectations**

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My primary objectives for this course are to teach you statistics and how to use statistical software alongside statistical concepts. 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;

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### Lecture Delivery and Technological Requirements

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This course will be delivered remotely and will use a combination of synchronous and asynchronous learning components. With the exception of a live introductory lecture on January 19 during the scheduled class time, there will be **no** synchronous lectures. However, you are expected to be online during the scheduled lab and class times for any live components (including lab activities, review sessions and assessments). You are also expected to regularly monitor the course [UM Learn](#) to constantly keep up with the latest course-related developments. Your computer or device, and Internet connection must meet the recommended minimum technology requirements (see below) to ensure you have a good experience in the course. It is important that you keep up with these videos to ensure that you do not fall behind. Your ability to keep up with the pace of the course will be crucial here as the course format makes you much more responsible for your learning experience than you would be with regular in-person course delivery.

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.

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## Course Materials, Online Tools and Supplemental Readings

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- Videos** Videos going over the course slides will be made available via [UM Learn](#). These videos will be posted in tandem with the course slides. In addition, there are indications in the slides to watch additional videos on selected topics or examples; there are clickable links for these. While I tried to minimize background noises, there may some in the videos and please forgive me.
- Course Slides** The course slides, in conjunction with the lecture videos, 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 [UM Learn](#).
- RMarkdown Files** These files will be for you to work through in RStudio and will provide code as well as other worked through examples, including some from the course slides. These files will be posted on [UM Learn](#) alongside the course slides and there are indications in the course slides for appropriate times to open and work with the files. They may also be incorporated into your assessments on UM Learn.
- Zoom** Zoom is an online platform for hosting and participating in meetings. Our first lecture, as well as office hours, will be held as online “meetings” in Zoom. At the scheduled times, I will login, begin the meeting and you can use that link to partake. During office hours, 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](#).
- Piazza** Piazza is an online discussion platform and this term I am using it for the first time. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. Rather than emailing questions to myself or your TA (which you are always welcome to do), I encourage you to post your questions on Piazza. Piazza used to be completely free, but just recently has moved to a paid model. I plan on accessing it through their contribution-support model; this means there will be prompts to make a financial contribution. You **do not** need to make a contribution. If you have any problems or feedback for the developers, email [team@piazza.com](mailto:team@piazza.com). Find our class signup link at: <https://piazza.com/umanitoba.ca/winter2021/stat2150>. I will regularly check in, likely every few days or so.

**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** 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 and I may from time to time suggest readings.

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

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## Course Assessments

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**Project** Before reading week, there will be a project assigned. The goal of the project is to apply many of the statistical concepts you will learn in the course, and especially how they can be carried out in R. Specific instructions will be provided on [UM Learn](#). The final project must be produced using RMarkdown and submitted by its due date (which will be in the last week of classes) using Dropbox on [UM Learn](#), where specific submission instructions will be provided. **No late projects will be accepted.** You are expected to work independently on the project; copying, in whole or in part, the work of another will not be tolerated and will result in disciplinary action (see Academic Integrity section).

**Quizzes** There will be two 45 minute quizzes, tentatively scheduled during class time on **February 11, 2021** and **April 8, 2021**. They will take place on [UM Learn](#). **There will be no make-up quizzes.** If you know you will miss a quiz, or have missed a quiz, you need to inform me within 48 hours of the end of the quiz or a grade of 0 will be assigned. With legitimate reasons: if you miss Quiz #1, its weight will be shifted to the midterm test and if you miss Quiz #2, 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.

**Midterm Test** There will be one 75 minute term test, tentatively scheduled on **March 16, 2021** to take place during class time. It will take place on [UM Learn](#). **There will be no make-up test.** If you know you will miss the midterm, or you missed the midterm, you need to inform me within 48 hours of the end of the test or a grade of 0 will be assigned. With legitimate reasons, the weight of a missed midterm will be shifted to the final exam. Please make sure your reason(s) for missing the test are legitimate in order to avoid academic consequences.

**Final Exam** Your final exam will be 3 hours and take place during the April/May 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. More details about your TA and the labs will be provided on [UM Learn](#).

**Important Note:** During online assessments (quizzes, test and final exam), you are permitted to open R or RStudio (in fact, you may need to) and 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. However, during these assessments, you not permitted to access the internet (other than to access our course materials), 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.)

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### Course Evaluation and Grading Scheme

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

Project	15%
Quizzes (2)	20% (equally weighted)
Midterm Test	25%
Final Exam	40%

**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

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## Important Dates

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January 19	First class: Introduction on Zoom
January 29	Last day to drop courses in revision period
February 1	Last day to add courses in revision period
February 15-19	Winter break
<b>February 11</b>	<b>Quiz #1</b>
<b>March 16</b>	<b>Midterm Test</b>
March 31	Last day to VW
<b>April 8</b>	<b>Quiz #2</b>
April 16	Last day of classes

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

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## Class Communications

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

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## Academic Integrity

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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](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](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 February 5 at noon. Failure to do so may restrict you from doing your quizzes, test and/or final exam.

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.

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### Use of Copyrighted Material

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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/>

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### Student Accessibility Services

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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.

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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 at:

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

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## Tentative List of Topics

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### 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
- Additional visualization tools in R

### 3. Probability Distributions and Data Simulation

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

### 4. Estimation

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

### 5. Hypothesis Tests

- Hypothesis tests
- Cross-tabulation and tests of association
- Goodness-of-fit tests



## 6. Resampling Methods and Assessments of Inferential Methods

- Jackknife
- Bootstrap
- Permutation Tests
- Monte Carlo Methods
- Assessing inferential methods via simulation

## 7. Regression

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

## 8. Introduction to Data Science