University of Manitoba - Department of Statistics

Summer 2022

STAT 1150: Introduction to Statistics and Computing

Course Details

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

Section & CRN: Section A01, CRN: 55911

Course Schedule: MTWR 10:45 am - 12:00 pm (May 09, 2022 - Jun 16, 2022)
& F 10:45 am - 12:00 pm (May 27, 2022)

Location: ARMES 205

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: 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.

Instructor Contact Information

Instructor Surani Matharaarachchi

Email: surani.matharaarachchigedona@umanitoba.ca

Office: 331 Machray Hall

Office Hours: Wednesday: 1:00 pm – 2:00 pm, or by appointment.

Course Materials and Web Pages

Course Notes: The first and foremost authority in this course will be my course notes. These notes will be presented to you in class, as well as made available online on UMLearn immediately following the lectures (if not earlier). These course notes were originally developed by Jenna Tichon. Lectures will be in person through out the semester.

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.

Computing: This course will expose you to Statistical Analysis and Computing using R computing language. R is a free software environment for statistical computing and runs on Windows, Linux, UNIX and Mac. You can download your own copy from R Project (CRAN) homepage at http://www.r-project.org/. RStudio can be downloaded from https://www.rstudio.com.

You will also have access to R through syzygy at https://intro.syzygy.ca/. Syzygy gives you direct interactive computing environment to R with Jupyter notebooks at a single access point. You can log into the syzygy service using your UoM account credentials at https://umanitoba.syzygy.ca/.

Web Pages: UMLearn: `https://universityofmanitoba.desire2learn.com/d2l/home`
Statistics: `http://umanitoba.ca/statistics`

Course Structure

Lectures: Lectures will take place weekdays (Monday to Thursday), from 10:45 am to 12:00 noon. A replacement for May, 23 (Holiday) will be on Friday, May 27. These lectures, in conjunction with the Labs (described below) will cover almost all most all 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.

Labs: In addition to the lectures, there will be labs twice a week, starting from Thursday, May 12. 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 quizzes, as described in the Lab Quizzes subsection below.

Short Quizzes: Once we complete a week, each Friday, I will post a 30-minute quiz on UMLearn, which you will have one week to finish. They will cover that week's material. They will all consist of multiple choice or short answer questions graded automatically by the system.

R Lab Quizzes: Throughout the term there will be two Lab quizzes to be completed by making an R script and reporting solutions. These will be held during two labs as per the course schedule. Further instructions will be provided at the time of the quizzes. If you cannot come to one R Lab quiz, the weight of the other R Lab quiz will become 15% and the weight of the Final Exam will become 45%. Note that in any of these cases, you have to provide documentation for your absence within 24 hours of the Quiz.

Mid Term Test: The in-class mid-term test is tentatively scheduled on May 30, 2022. There will be no makeup tests for any reason. If you miss the exam due to a legitimate reason, your exam weight will transfer to the final exam. The midterm will cover Unit 1 up to portions of unit 4 to be announced in class. It consists of long and short answer questions.

Practice Questions: Through out the course I will provide extra practice problems in pdf form. These are not for marks but you should complete them for the extra practice.

Final Exam: The course will have a cumulative final exam. 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.

- Attend the lectures. I will often cover in the lectures important details that do not make it into the course notes. 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.
- If you do not understand a step I have performed in class, 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.
- This is a short period course with enough materials to learn. So study daily!!! Do not wait until the last moment to catch up on everything. It is just six weeks of commitment, but the result can be remarkable.

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%)

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

UMLearn Quizzes (5)	15%
In Lab R Quizzes (2)	20%
In class Mid Term Test	25%
Final Exam	40%

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 June 7. By this point in the course, you will have received assessment on approximately 44% of your final grade.

Course Outline

- 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 $\times$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 σ known
  - selecting samples sizes
  - introduction to the t-distribution
  - confidence intervals for σ unknown
  - confidence intervals for $\hat{p}$
- Unit 5 – Tests of Significance for Single Populations
  - tests of significance for a single population mean (σ 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 β_0 and ρ
  - analysis of residuals
  - confidence intervals for μ_Y

Course Timetable

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
MAY 8 **WEEK 1**	9 First Class	10 Unit 1 No lab	11 Unit 1	12 Unit 1 Lab1: Intro	13	14
15 **WEEK 2**	16 Unit 2	17 Unit 2 Lab2: Unit 1	18 Unit 2	19 Unit 3 Lab3: Unit 2	20 Quiz 1 due	21
22 **WEEK 3**	23 Holiday	24 Unit 3 Lab4: R lab quiz	25 Unit 4	26 Unit 4 Lab5: Unit 3	27 Unit 4 Quiz 2 due	28
29 **WEEK 4**	30 Mid Term Test	31 Unit 5 Lab6: Unit 4	JUNE 1 Unit 5	2 Unit 5 Lab7: Unit 4	3 Quiz 3 due	4
5 **WEEK 5**	6 Unit 6	7 Unit 6 Lab8: Unit 5	8 Unit 6	9 Unit 7 Lab9: R lab quiz	10 Quiz 4 due	11
12 **WEEK 6**	13 Unit 7	14 Unit 7 Lab10: Unit 6	15 Unit 7	16 Review Lab11: Unit 7	17 Quiz 5 due	18

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

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.

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