

University of Manitoba - Department of Statistics

Winter 2022

STAT 2220: Contemporary Statistics for Engineers

Course Details

Course Number & Title: STAT 2220, Contemporary Statistics for Engineers

Section & CRN: Section A01, CRN: 50089

Course Schedule: M/W/F, 1:30 pm – 2:20pm, on-line through Zoom and UMLearn

Calendar Description: Descriptive statistics, basic probability concepts, special statistical distributions, statistical inference-estimation and hypothesis testing, regression, reliability, statistical process control. May not be held with STAT 1000, STAT 1001 or STAT 1150.

Prerequisites: One of MATH 1232, MATH 1690, the former MATH 1680, MATH 1700, MATH 1701, MATH 1710.

Instructor Contact Information

Instructor Keith Uzelmann

Email: uzelmank@myumanitoba.ca

Office Hours: Tuesday/Thursday: 11:30 am – 1:00 pm, Wednesday: 2:30pm-4:00pm, 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 Andrew Morris.

Textbook: There is no required textbook.

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 Monday, Wednesday, and Friday, from 1:30pm am to 2:20pm. These lectures, in conjunction with the Labs (described below) will cover 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: On Tuesdays and Thursdays, from 11:30 am – 1:00 pm, and on Wednesdays, from 2:30pm to 4:00pm, 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). The first 15 minutes of each lab will be dedicated to your Weekly Quiz (described below) and the remainder will be for exploring techniques in R.

Weekly Quizzes: As per the course schedule, there will be a 15-minute quiz in your lab every week, with the exception of Weeks 1, 2, 5, and 14. These quizzes will open up at the beginning of the lab, and will close 15 minutes thereafter. You must be attending the lab to write this quiz, and you must have your webcam and microphone on. The quiz will cover the previous week's material. The quizzes will be worth 4 points each.

Biweekly Tests: As per the course schedule, every two weeks there will be a Test on the previous two weeks' material. This test will either take place over UMLearn or Crowdmark - you will be informed at least 24 hours beforehand. The tests will take place on Mondays. The tests will open at 12:00am, and close at 11:59pm. You will have 90 minutes to complete the test once you begin. The tests will be worth 15 points each.

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.

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	15%
Biweekly Tests	60%
Final Exam	25%

In addition to this grading scheme, there is the following caveat: to receive a passing grade (a “D”) in this course, you must receive a grade of at least 50% on both the Weekly Quizzes (average of 50% across the Quizzes) and the Final Exam.

Deferrals

For the Tests and Quizzes, the following procedure will apply automatically:

- The lowest Weekly Quiz score is automatically dropped.
- Your lowest Biweekly Test score will be replaced by the final exam score, if the final exam score is higher.

For any further medical emergencies, contact me personally and, if appropriate, the weight of that assessment will be shifted to the final exam.

For a final exam deferral, you must follow the official deferral procedure located [here](#).

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 April 25.

Course Outline - Tentative List of Topics

- Unit 1 – Descriptive Statistics
 - types of variables: quantitative, categorical, nominal, ordinal
 - graphs for categorical variables: bar charts, pie charts
 - graphs for quantitative variables: stemplots, histograms
 - examining distributions, dealing with outliers
 - time plots
 - quantitative summaries: mean, weighted mean, median, quartiles, percentiles, interquartile range, range, variance and standard deviation five-number summary and boxplots
 - 1×5 IQR rule for suspected outliers, outlier boxplots
 - resistant measures
- Unit 2 – Scatterplots, Correlation and Regression
 - association, response variable, explanatory variable
 - examining scatterplots
 - correlation
 - least-squares criterion and least squares regression line
 - r^2
 - residuals, outliers, influential observations
 - cautions about correlation and regression
 - association vs. causation, lurking variables
 - extrapolation
- Unit 3 – Sampling Design
 - populations and samples
 - voluntary response sample
 - convenience sample
 - simple random sample
 - census
 - stratified random sample, multistage sample
 - undercoverage, nonresponse
- Unit 4 – Design of Experiments
 - observations vs. experiment
 - experimental units
 - factors, factor levels, treatments
 - placebo effect, control group, bias
 - principles of experimental design
 - completely randomized design
 - randomized block design

- matched pairs design
- Unit 5 – Probability Theory
 - sample space, outcomes, events
 - probability properties
 - mutually exclusive events, independence
 - conditional probability
 - Law of Total Probability, Bayes' Theorem
 - system reliability
- Unit 6 – Random Variables
 - discrete random variables (probability mass function, cumulative distribution function)
 - continuous random variables (probability distribution function, cumulative distribution function)
 - expectation and variance of a random variable
 - functions of random variables
- Unit 7 – Common Discrete and Continuous Distributions
 - Bernoulli random variables, binomial distribution
 - geometric and negative binomial distributions
 - hypergeometric distribution
 - Poisson distribution
 - continuous uniform distribution
 - exponential distribution (Poisson process)
 - normal distribution
- Unit 8 – Sampling Distributions
 - sampling distribution of a sample mean
 - bias and variability
 - Central Limit Theorem
- Unit 9 – Inferences on a Population Mean
 - confidence intervals (population standard deviation known), sample size determination
 - hypothesis testing (population standard deviation known)
 - confidence intervals (population standard deviation unknown)
 - hypothesis testing (population standard deviation unknown)

Course Timetable

See the Course Timetable file on UMLearn.

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.