

STAT 2220 Section A01
Contemporary Statistics for Engineers
Winter 2021

Time MWF 1:30 p.m. – 2:20 p.m.
Location Virtual Delivery
CRN 50089

Instructor Elham Afzali
Email: Elham.afzali@umanitoba.ca

Web Pages UM Learn: <http://umanitoba.ca/umlearn>
Statistics: <http://www.sci.umanitoba.ca/statistics/>

Office Hours: Office hours will be held on Zoom at the following times:

Tuesday 1:30 p.m. – 2:30 p.m.
Friday 11:30 a.m. – 12:30 p.m.

Zoom Link for Class/Office hours: <https://zoom.us/j/6707400152>
Zoom Link for Tutorials: <https://zoom.us/j/98269221029>
Zoom Passcode for both: 2220

If the above times are not convenient for you, please email to arrange an alternate time to meet. I will do my best to return all email messages within 24 hours.

When joining Zoom meetings (whether for office hours or your tutorials), please use your full name as it appears on Aurora.

Calendar Description

(Lab Required) Descriptive statistics, basic probability concepts, special statistical distributions, statistical inference-estimation and hypothesis testing, regression, reliability, statistical process control. Not to be held with STAT 1000, STAT 1001 or STAT 1150. Prerequisite: a “C” or better in one of MATH 1232, MATH 1690, the former MATH 1680, MATH 1700, MATH 1701, MATH 1710.

Course Objectives

Upon completion of this course, the student will have an understanding of the fundamental concepts of statistics and an appreciation for the application of statistics in the field of Engineering.

Software will be used in this course to aid in the analysis of data. The computer program that has been selected for this course, Microsoft Excel, is easy to use and is available free for use with Macintosh or Windows systems. The program also has many advanced statistical features that you will find useful in subsequent courses.

Evaluation

Quizzes(4)	40%
Midterm Test	25%
Final Examination	35%

All quizzes and exams will be done in UM Learn. All marks will be posted on the UM Learn gradebook.

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%).

Exam Information

The midterm test will be held on **Wednesday March 10, 2021 from 5:30 p.m. to 7:30 p.m.** and cover **Units 1 - 5** in the course outline. The final exam will be **3 hours** in duration and will be scheduled by the Registrar's Office. The final exam will be **cumulative**, with an emphasis on material covered after the midterm. Students missing the midterm test for a valid reason will be permitted to write a deferred midterm at a later date.

All **quizzes** and **exams** will consist of multiple-choice and long answer questions.

Quizzes and exams in this course require the use of LockDown Browser and a webcam (using a program called Respondus Monitor). The webcam can be built into your computer or can be the type that plugs in with a USB cable. More detail about the use of LockDown Browser and Respondus Monitor will be given by your instructor.

Quizzes and exams in this course are **closed book**. You cannot use the course notes or access any websites, books or any other resources while writing. For the quizzes and midterm you will be permitted to prepare one (one sided) page of notes and two (one sided) pages for the final exam. The notes you write must be prepared by you - you are not permitted to use notes written for you by another student or anyone else. You can write notes, formulas, or anything else you want on the one sided page(s).

For quizzes and exams, you are also permitted to use a non-programmable scientific calculator, and any statistical tables provided by your instructor.

Students failing to abide by these regulations will be subject to penalties as laid out in the university's academic dishonesty policy. (See below)

Academic Integrity

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

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

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 **Wednesday February 3 at noon**.

For any student that creates a Telegram chat group (or any other chat group), we ask that you disable the room during tutorial and exam times. We also ask that any student joining a chat group uses their real name.

Tutorial

TA: Keren Chheang
Email: chheangk@myumanitoba.ca

Tutorials will be held on Zoom once a week and will begin **Thursday February 4 at 1 p.m. to 2:15 p.m.** Your T.A. will go through practice questions, which will be posted in advance on UM Learn. It is recommended that you try the questions in advance.

There will be four quizzes throughout the term, which will be written during the scheduled class time. The quizzes are scheduled for **Wednesday February 10, Wednesday February 24, Wednesday March 24 and Wednesday April 7**. All quizzes will be written

from **1:30 p.m. – 2:20 p.m.** (50 minutes in duration). The material to be covered on each quiz will be posted on UM Learn. The quizzes are worth 40% of your final grade (10% each). There will be no make-up quizzes. If you miss Quiz 1 or 2 (with a valid reason), the weight will be transferred to your midterm. If you miss Quiz 3 or 4 (with a valid reason), the weight will be transferred to your final exam.

Technology Requirements

You will require the following minimum technological requirements for this course:

- A computing device where one can create and edit documents
- An internet connection capable of streaming videos and downloading software
- Access to a webcam and microphone

Textbook

There is no required textbook for this course. All of the reading material is in the form of course notes, which are posted on UM Learn.

Assignments

There will be no formal assignments in this course. However, numerous practice problems (with solutions) will be posted for each unit. Students are strongly encouraged to try these practice problems on a regular basis.

Software Download

If you already have an older version of Microsoft Excel on your computer, you don't need to download it again.

To download Excel, log into your university email at <http://365.myumanitoba.ca>, click on your initials in the top right corner, select My Account, then select Office Apps in the left panel, and then click Install Office.

Voluntary Withdrawal

The voluntary withdrawal date is **March 31** (by which time you will have received your marks for the midterm test and several tutorials).

Copyrighted Material

All course notes, assignments, tests, exams, practice exams and solutions are the intellectual property of your instructor or the Department of Statistics. Reproduction or distribution of these materials is strictly forbidden without their consent.

You do not have permission to upload any course notes, tests, assignments, or handouts to any note sharing websites. Please see the following site for more information: https://umanitoba.ca/admin/vp_admin/ofp/copyright/media/Note_sharing_Web_sites.pdf

No video or audio recording of lectures or tutorials is allowed in any format, openly or surreptitiously, in whole or in part without my permission.

Respectful Behaviour in an Online Classroom

All live components of this course will be conducted over Zoom. It is expected that you conduct yourself professionally and do not distract your fellow students with unnecessary or inappropriate chat messages, sounds, or images if you are ever on web camera. If you appear on web camera, it is expected that you will be dressed appropriately for a classroom environment and that your background does not contain distracting or offensive materials.

Class Communication

The University requires all students to activate an official University email account. Please note that all communication between your instructor and you as a student must comply with the Electronic Communication with Students Policy. Please see

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

You are required to obtain and use your U of M email account for all communication between yourself and the university.

In addition, there will also be discussion forums available. I will open up a discussion forum where I will post any announcements, and suggestions for the next class. Please be in the habit of checking it after every class. If you have questions about anything during the lecture or any announcements, you can ask directly on the forum for the relevant section. There will also be a discussion forums opened up for general class/technology questions, for questions on assignments/tutorials, and a student forum.

All discussion will be monitored closely by me. Please be courteous in posing questions and replying to questions on the board. Your best effort should be made to make clear questions in complete English sentences.

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.

<http://umanitoba.ca/student-supports/accessibility>

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. Schedule A will be posted on your instructor's UM Learn page.

Course Outline

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
- describing distributions with numbers: mean, weighted mean, median, quartiles, percentiles, interquartile range, range, variance and standard deviation
- five-number summary and boxplots
- the $1.5 \times \text{IQR}$ 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)