STAT 2220
Contemporary Statistics for Engineers
Fall 2019

Time	MWF 11:30 a.m. – 12:20 p.m.
Location	200 Armes
CRN	10100

Instructor	Andrew Morris 324 Machray Hall Telephone: 204-480-1073 Email: Andrew.Morris@umanitoba.ca

Web Pages	UM Learn: `http://umanitoba.ca/umlearn` iClicker Registration: `https://app.reef-education.com`
Office Hours:	Monday 12:30 p.m. – 1:30 p.m. Tuesday 11:30 a.m. – 12:30 p.m. Wednesday 12:30 p.m. – 1:30 p.m.

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

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.

Evaluation

i▶clicker Questions/Participation (Tutorial)	15%
Midterm Test	35%
Final Examination	50%

Marks for tutorials and the midterm test 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 is tentatively scheduled for **Wednesday October 30, 2019 from 5:30 p.m. to 7:30 p.m.** The material to be covered on the midterm will be announced in class. 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 or final exam for a valid reason (and with documentation) will be permitted to write a deferred midterm or final exam at a later date.

Both the midterm and the final exam will consist of multiple-choice and long answer questions. For the exams: (i) nonprogrammable handheld calculators are permitted (graphing calculators are **not** permitted), (ii) electronic devices, such as cell phones or headphones, are prohibited, (iii) statistical tables will be provided, if required, and (iv) a formula sheet with selected formulas will be provided.

Tutorial

Thursdays, 8:30 a.m. – 9:45 a.m., 205 Armes (B02) & 201 Armes (B03)

Tutorials will begin Thursday September 19. In the tutorial, extensive use of the i▶clicker classroom response system will be made in order to enhance your understanding of the material and promote classroom participation. Your T.A. will go through i▶clicker questions covering material from the previous week's classes. For every i▶clicker response that you give, you will be awarded one mark. If you get the correct answer, one additional mark will be awarded. Each tutorial will be weighted equally and your lowest tutorial mark will be dropped.

i▸clickers

You are required to bring your i▸clicker or an internet enabled device that runs a web browser or the REEF app to each class. If you are using a physical clicker, it is your responsibility to ensure that it has functional batteries. You can either purchase a remote at the bookstore or borrow a remote from UMSU's Answer's booth (with a deposit), or you may use a laptop, iPhone/iPad (iOS 10+), or Android (OS 5.0+) device.

You will need to make a free REEF account either through their app or at the website, `https://app.reef-education.com`. Once registered you will need to add my class in your app or web profile. It is **very** important that you register using your U of M email and your 7-digit student ID. If you are using a physical i▸clicker remote, you will have to add your clicker ID number (found on the back under the barcode) to your profile page in REEF.

The use of another student's i▸clicker constitutes impersonation and is strictly forbidden under the University of Manitoba's academic dishonesty policy. (See page 4.)

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

The latest version of Microsoft Excel (2016) can be downloaded to your computer by logging into your university email at `http://365.myumanitoba.ca`, clicking on the gear icon ⚙ in the top right corner, and then selecting Office 365. On the webpage that opens in a new tab, click on Software in the Settings group and follow the instructions from there.

Voluntary Withdrawal

The voluntary withdrawal date is **November 18** (by which time you will have received your marks for the midterm test and several tutorials).

Academic Integrity

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 integrity and academic dishonesty (including plagiarism, cheating, inappropriate collaboration and examination impersonation, as well as typical penalties) can be found at:

`http://www.sci.umanitoba.ca/undergraduate-students/academic-resources/academic-integrity-2/`

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.

Recording of Class Lectures

Your instructor and the University of Manitoba hold copyright over the course materials, presentations and lectures which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from your instructor.

Use of Electronics 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. A student may use technology in the classroom setting only for educational purposes approved by the instructor and/or the University of Manitoba Accessibility Services. Students should not engage in electronic messaging/posting activities (e-mail, texting, video or voice chat, social networking (e.g. Facebook)) or electronic gaming during scheduled class time.

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.

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/saa/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 $1.5 \times$ 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
- sampling distributions for proportions

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)