

STAT 2000 Section A01
Basic Statistical Analysis 2
Fall 2022

Time Mondays, Wednesdays & Fridays, 9:30 a.m. – 10:20 a.m.
Location 343 Drake
CRN 10099

Instructor Carrie Madden (She/Her)
322 Machray Hall
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Web Pages UM Learn: <http://umanitoba.ca/umlearn>
R Download (Windows): <https://muug.ca/mirror/cran/bin/windows/>
R Download (MacOS): <https://muug.ca/mirror/cran/bin/macosx/>
R Studio: <https://www.rstudio.com/products/rstudio/#download>
iClicker Reef: <https://app.reef-education.com>

Office Hours: **Room 312 Machray Hall** (If I am not there, check my office.)
Tuesday 11:30 a.m. – 12:30 p.m.
Wednesday 10:30 a.m. – 11:30 a.m.
Thursday 11:30 a.m. – 12:30 p.m.

Territory Acknowledgment

The University of Manitoba campuses are located on original lands of Anishinaabeg, Cree, Oji-Cree, Dakota and Dene peoples, and on the homeland of the Métis Nation. We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

Calendar Description

(Lab required) This course is not recommended for students in certain programs (see the description of STAT 2150). The study of estimation and hypothesis testing procedures for means and proportions in one, two and multiple sample situations, introduction to the analysis of variance; regression and correlation analysis; optional topics may include non-parametric procedures, design of experiments, probability models. Not to be held with STAT 1150, STAT 2001. Prerequisite: STAT 1000 (C), or STAT 1001 (C).

Teaching Philosophy and Goals

It is the desire of the Department of Statistics to present this course in a manner that emphasizes and illustrates the statistical analysis arising from “real-world” applications. Whenever possible, we will attempt to bring real-life examples and data into the classroom. Upon completion of this course students can proceed in many directions: to further intensive study of statistics, to one or more additional courses in statistics, to the use of statistical methods in other fields of study, or to being a consumer of statistical information in daily life. It is our objective to serve all of these diverse directions.

The course is designed to include basic topics deemed crucial for problem formulation and understanding of the foundations of statistical thinking and reasoning. The concepts of statistical analysis will be stressed. The course will place an emphasis on the development of critical thinking skills.

Evaluation

| | |
|---------------------------|------------|
| Participation | 5% |
| Assignments (best 3 of 4) | 10% |
| Quizzes (best 3 of 4) | 15% |
| Midterm Test* | 25% or 30% |
| Final Examination* | 40% or 45% |

*If your midterm grade is higher than your final exam grade, your midterm will be worth 30% and your final exam will be worth 40%. If your final exam grade is higher than your midterm grade, your midterm will be worth 25% and your final exam will be worth 45%.

If you miss a second quiz or a second assignment due to illness or another valid reason, and provided that you have submitted a self-declaration form to your instructor within 24 hours of both missed due dates, the weight of the second assessment will be transferred to your final exam. (See Page 13 of the course outline for an explanation and link to the required form.) A third or fourth missed assignment or third missed quiz will be assigned a grade of zero.

Subject to the caveat in the paragraph below, 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%).

There is an **additional requirement** for obtaining a C in the course: **To get a grade of C or better, you must obtain at least 50% on the final exam or an average grade of at least 50% on the midterm and final exam.**

Software

This course will make use of the statistical software R and RStudio. Both of these programs are free to use and are available for both Windows and MacOS systems. R is one of the most popular statistical software programs, and throughout the course, we will utilize R to aid in our data analysis. We will use R through the RStudio environment, which will neatly organize and display your work. Finally, RMarkdown (a component of RStudio) will be used to format the documents that you submit (both in the form of lab worksheets and your assignments).

To download R, follow one of the links below (depending on your operating system):

Windows systems: <https://muug.ca/mirror/cran/bin/windows/>

MacOS systems: <https://muug.ca/mirror/cran/bin/macosx/>

Once you have downloaded and installed R, you may access RStudio through the link below:

<https://www.rstudio.com/products/rstudio/#download>

Detailed installation instructions will be provided on your *UM Learn* page.

Exam Information

The midterm test will be held **Tuesday November 1 from 5:30 p.m. – 7:30 p.m.** and will cover Units 1 – 3 in the course outline. The final exam will be 3 hours in duration and will be scheduled by the Student Records Office. The final exam will cover Units 1 – 6, with emphasis on Units 4 – 6. Students missing the midterm test for a valid reason will be permitted to write a deferred midterm at a later date.

Both the midterm and the final examination will contain multiple-choice questions (worth 70% – 75% of the exam) and a written component (worth 25% – 30% of the exam).

The midterm and final exam are **closed book**. However, for the midterm, you will be permitted to prepare one page of notes (one regular 8.5” x 11” piece of paper with writing only on one side). For the final exam, you can prepare **two** pages of notes (two regular 8.5” x 11” pieces of paper with writing only on one side, or one regular 8.5” x 11” piece of paper with writing on both sides). You can write notes, formulas, examples, or anything else you want on these pages. The notes you write must be hand-written, and must be prepared by you – you are not permitted to use notes written by another student or anyone else.

For quizzes and exams, you will also need a **non-programmable scientific calculator**, and any statistical tables provided by your instructor. For quizzes, you should print these tables and have them with you. For the midterm and final exam, the tables will be provided to you.

Quizzes

There will be four quizzes throughout the term, which will be written on *UM Learn*. Each quiz will consist only of multiple-choice questions. Quizzes will be open from **12:01 a.m. on Thursday until 11:59 p.m. on Friday** on the dates below. **You can enter the quiz any time during these two days**, and once you begin, you will have **45 minutes** to write the quiz.

Quizzes are scheduled for the following dates, and will tentatively cover the material in the units listed below:

| | Dates | Coverage |
|--------|-------------------|-----------------|
| Quiz 1 | September 22 & 23 | Unit 1 (review) |
| Quiz 2 | October 6 & 7 | Unit 1 |
| Quiz 3 | October 20 & 21 | Unit 2 |
| Quiz 4 | December 1& 2 | Unit 5 |

The quizzes are worth 15% of your final grade, and **only the best 3 of 4 quizzes will count towards your final grade** (i.e., your lowest quiz mark will be dropped). **There will be no make-up quizzes – if you have to miss a quiz, for any reason, that will count as your lowest quiz mark, which will be dropped.**

For the quizzes:

- You will need a non-programmable scientific calculator.
- During your quiz, you may consult your course notes or any other material posted online by your instructor (i.e., the quizzes are “open book”).
- You may **not** consult any outside resources (online or otherwise) while writing the quiz.
- You must complete the quiz **individually**. You may **not** consult with anyone while writing the quiz. In particular, communicating with your classmates by phone, email or social media during the test, as well as accessing online tutoring websites are considered academic misconduct.
- For any students who are members on an online chat group: During the two-day period when quizzes are held, you may use these rooms to communicate with each other about the course, but you are **not** permitted to discuss specifics of the quiz until everyone has finished writing it (Friday at 11:59 p.m.). We also ask that any student joining a chat group uses their real name.

Tutorials

Your tutorial will be held once a week, beginning the week of September 12 – 16. (There are no tutorials the first week of classes, the week of the midterm, or during the Fall Term break.) In the first tutorial, your TA will introduce you to R and RStudio, and show you what the software looks like. However, it is expected that you will have R and RStudio installed prior to your first tutorial, and that you have RMarkdown set up. There will be a detailed installation and setup guide on your *UM Learn* page.

During the tutorials you will be provided with a worksheet (these will be posted in your B-Section on UMLearn). It is expected that you work along with the TA to answer the questions in the worksheets. This will help you understand the coding if you are working along with them. You will have until 11:59p.m. on YOUR TUTORIAL DAY to submit your worksheet. You will complete your worksheet on your computer through RMarkdown and submit it electronically through a Crowdmark link which will be provided to you.

If you can, you should **bring a laptop to your tutorials**. Note that whatever machine you bring must be able to run R and RStudio: this means that most tablets and Chromebooks will not be sufficient. If you do not have access to must be a Windows/MacOS machine, there are libraries on campus (Dafoe) that will rent out laptops.

Worksheets will be marked on a pass/fail basis. So long as you have made a reasonable effort on the worksheet, you will receive a grade of 1/1 for that tutorial. These weekly grades will comprise your 5% participation grade in the course. Note that only the best 7 of 10 weekly grades will be considered (i.e., the lowest three grades will be dropped, meaning that you can miss three tutorials with no penalty).

Assignments

There will be four assignments in the course, which will make use of of the R statistical software. Your final submission will be formatted with RMarkdown, and submitted to Crowdmark for grading. Only the best three of four assignments will count towards your final grade (i.e., your lowest assignment mark will be dropped). See the course schedule for assignment due dates.

Practice Questions

You will be provided with many practice questions in this course. In the **Practice Problems** folder on *UM Learn*, you will find written-answer questions for each unit, as well as detailed solutions. These problems will help you practice and learn the course material, and to prepare for the long-answer questions on the midterm and final exam.

In the **Practice Multiple Choice Questions** folder on *UM Learn*, you will find many multiple choice questions for each unit. The letter answers for these questions are at the end of each file. These questions will help you practice and learn the course material, and to prepare for the multiple choice questions on the quizzes, midterm and final exam.

Although they are not for marks, students are strongly encouraged to try these practice problems on a regular basis.

Textbook

There is **no required textbook** for this course. You will be provided with detailed notes and all the material you need.

Statistics Help Centre

In Room 311 Machray Hall (which contains a number of computers), graduate students and senior undergraduate students in statistics are available to help you with any questions you have about the course, as well as the installation of R and RStudio. The Help Centre is open at the following times (from September 7 to December 12):

| | |
|-----------|-----------------------|
| Monday | 9:00 a.m. – 2:30 p.m. |
| Tuesday | 9:00 a.m. – 7:00 p.m. |
| Wednesday | 9:00 a.m. – 5:00 p.m. |
| Thursday | 9:00 a.m. – 5:00 p.m. |
| Friday | 9:00 a.m. – 5:00 p.m. |

The Help Centre will be closed on holidays and during the Fall term break (Nov. 7 – 10).

| Course Schedule | | | | | | |
|-----------------|---------------------------|---------------------------------|---|--------------|--|-------------------------------|
| | Dates | Course Material | Assessments | Tutorials | Tutorial Schedule | Tutorial Assessments |
| Introduction | September 7 --9 | Course outline and expectations | | No Tutorial | | |
| Week 1 | September 12 -- 16 | Unit #1 | | Tutorial #1 | R, Rmarkdown, Latex Setup | |
| Week 2 | September 19 -- 23 | Unit #1 | Quiz #1 - Unit #1 September 22 & 23 | Tutorial #2 | Hist/CLT/pnorm/qnorm pt, qt | |
| Week 3 | September 26 -- 30 | Unit #1/Unit #2 | | Tutorial #3 | t.test/Quality Control | |
| Week 4 | October 3 -- 7 | Unit #2 | Quiz #2 - Unit #1 October 6 & 7 | Tutorial #4* | t.test/matched pairs | Assignment #1 DUE October 7 |
| Week 5 | October 10 -- 14 | Unit #2 | | Tutorial #4 | two-sample t | |
| Week 6 | October 17 -- 21 | Unit #2/Unit #3 | Quiz #3 - Unit #2 October 20 & 21 | Tutorial #5 | pooled/ANOVA | |
| Week 7 | October 24 --28 | Unit #3 | | Tutorial #6 | ANOVA/Review | Assignment #2 DUE October 28 |
| Week 8 | October 31 -- November 4 | Unit #4 | NOVEMBER 1 -- MIDTERM 5:30 -- 7:30pm | No Tutorial | | |
| Week 9 | November 7 -- 11 | Fall Break | Fall Break | No Tutorial | | Fall Break |
| Week 10 | November 14 -- 18 | Unit #5 | | Tutorial #7 | Probability Simulations | |
| Week 11 | November 21 -- 25 | Unit #5/Unit #6 | | Tutorial #8 | Chi-Square/homogeneity Independence | Assignment #3 DUE November 25 |
| Week 12 | November/December 28 -- 2 | Unit #6 | Quiz #4 -- Unit #5 December 1 & 2 | Tutorial #9 | Goodness of Fit/SLR | |
| Week 13 | December 5 -- 9 | Unit #6 | | Tutorial #10 | MLR | Assignment #4 DUE December 9 |

Note: this schedule could change at any time, the Instructor will provide all necessary details in advance and no changes would penalize the students in any way

Course Outline

Unit 1 – Inference for the Mean of a Single Population

- Review of principles of statistical inference: testing and estimation, confidence intervals
- Statistical decisions: Type I and Type II errors and their probabilities, power of a test
- Review of t -distribution (comparison with normal distribution), tests and confidence intervals, robustness of t -procedure

Unit 2 – Inference for the Means of Two Populations

- Matched pairs t procedures
- Inference for the equality of means in two populations when population variances are equal and when population variances are unequal, assumptions of normality and independence

Unit 3 – Inference for the Means of Two or More Populations

- Graphical comparison of distributions
- Inference for the equality of means in two or more populations: introduction to ANOVA
- The F -distribution
- Equivalence of pooled two-sample t -test and F -test

Unit 4 – Probability and Discrete Distributions

- Review of probability concepts and rules
- Conditional probability
- Random variables, probability distributions, mean and variance of a random variable
- Review of binomial distribution

Unit 5 – Analysis of Categorical Data and Goodness-of-Fit Tests

- Inference for a population proportion
- Power calculations
- Inference for comparing two population proportions
- Inference for $(r \times c)$ two-way tables: tests of independence and homogeneity of proportions, chi-square test, expected values, degrees of freedom

- Equivalence of Z -test and Chi-square test
- Goodness-of-fit tests
- Binomial goodness-of-fit test

Unit 6 – Regression and Correlation

- Inference in simple linear regression (slope, confidence intervals)
- Analysis of residuals and use of diagnostic tools
- Multiple regression (time permitting)

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 tutorial 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 **Monday September 26 at noon**. You cannot receive credit for this course if you do not complete this quiz.

Voluntary Withdrawal

The voluntary withdrawal date is **November 22** (by which time you will have received your marks for the first three quizzes, the midterm test and the first two assignments). If you are unlikely to be successful in the course, or are not achieving the grade that you are aiming for, you should consider a VW from the course. Students enrolled in the course after the VW deadline will be assigned a final grade.

Authorized Withdrawal

In some instances, medical or compassionate circumstances arise in a student's life that prevent them from performing as they would in normal circumstances. If you are in this position, please contact a Faculty academic advisor to discuss your options. Be prepared to provide documentation, which supports your situation.

Copyrighted Material

All course notes, assignments, tests, exams, practice questions and solutions are the intellectual property of your instructor or the Department of Statistics. **The reproduction, posting or distribution of these materials is strictly forbidden without their consent.** It is **illegal** to upload any course material to any website. For more information, see the University's Copyright Office website at <http://umanitoba.ca/copyright>.

Recording of Class Lectures

Your instructor holds 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** without permission from your instructor.

Class Communication

The University requires all students to activate an official University email account. Please note that all communication between you and your instructor 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.

Professional Conduct

Students in the University community can freely express their thoughts, opinions, and beliefs; however, they must observe the Respectful Work and Learning Environment Policy (<https://umanitoba.ca/about-um/respectful-work-and-learning-environment-policy>) and treat each other, staff, and faculty with respect. Students who are alleged to have breached the Respectful Work and Learning Environment Policy will be investigated and disciplined according to the Student Non-Academic Misconduct and Concerning Behaviour Procedure.

Academic Accommodations

Student Accessibility Services

Students who have, or think they may have, a disability (e.g., mental illness, learning, medical, hearing, injury-related, visual) are encouraged to contact Student Accessibility Services to arrange a confidential consultation. Instructors are notified by Student Accessibility Services what accommodations their registered students require, which will help the instructor determine fair, feasible and reasonable academic accommodations without compromising academic standards. This takes time and planning, so reach out at the start of term.

SAS students can write their exams and tests in spaces organized by the SAS Exam Centre; however, they must register with the SAS Exam Centre a few weeks in advance. Please be sure to do so to receive the accommodations.

Student Accessibility Services

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

520 University Centre

204-474-7423

Student.accessibility@umanitoba.ca

Medical Notes and Other Documentation

The Self-Declaration for Brief and Temporary Absences Procedure and Policy will be effective on September 1, 2022 and therefore students will not be required to present medical or other documentation for absences due to extenuating circumstances of 72 hours or less; however, you must complete the form at the following link:

<https://umanitoba.ca/governance/sites/governance/files/2022-06/self-declaration-for-brief-and-temporary-student-absences-fillable-form-final-for-web-site.pdf>

You must submit the form to your instructor in lieu of any medical or other documentation. Please note that further documentation may be requested from students who claim multiple temporary absences or absences for more than 72 hours. You only need to submit this form if you miss an assessment. You do **not** need to fill out this form if you are missing a lecture or a tutorial. Note that personal vacations or work obligations are **not** considered valid excuses to miss assessments.

Final Exams

If you have conflicting scheduled final exams, or if you miss a final exam due to illness or some other valid reason, **you must contact an academic advisor in your home faculty** (<http://umanitoba.ca/academic-advisors/>) as soon as possible to apply for a deferred exam. Deferred final exams are **not** arranged through your instructor or the department. Note that the granting of a deferred exam is not necessarily guaranteed.

Health and Safety

The University of Manitoba is committed to maintaining a safe learning environment for all students, faculty, and staff. Should campus operations change because of health concerns related to the COVID-19 pandemic or other campus-wide emergency, it is possible that this course will move to a fully remote delivery format. Should the instructor be required to stay at home for an extended period and an alternate instructor not be available, the course may move temporarily to a remote delivery format.

Mask Wearing

In a face-to-face environment, our commitment to safety requires students to observe all COVID guidelines set by the University (<https://umanitoba.ca/coronavirus>). While on campus and in class, you must wear masks as stipulated in current University policies, procedures, and guidelines. The University highly recommends the use of KN-95 masks; the minimum requirement is a ATSM Level 2 Medical mask. Both mask types are available at many locations on campus. Students who fail to comply are subject to disciplinary action in accordance with the Student Discipline Bylaw and the Non-Academic Misconduct and Concerning Behaviour Procedure. If you do not follow masking requirements, you will be asked to leave the learning space and may only return to the class already in progress when you have complied with this requirement. Repeated issues will result in disciplinary action as previously noted. **Students should not eat or drink during class time.**

Illness

Remember: **STAY HOME IF YOU HAVE SYMPTOMS OR ARE ILL.** If you received a positive COVID test result, or if you have symptoms without testing, you must follow the instructions at <https://umanitoba.ca/covid-19/health-safety>. Specifically,

- You should **isolate for 5 days** after your symptoms started and until you have no fever and your other symptoms have improved over the past 24 hours.
- If you don't have symptoms and test positive, you should **isolate for 5 days** after your test date.

Recall that your participation mark consists of the best 8 of 11 tutorial grades, and only the best 3 of 4 quizzes and 3 of 4 assignments will count towards your final grade. **The purpose of this policy is that we know you may be unable to complete an assessment sometime during the term, either due to illness or some other valid reason.**

If you become ill while at the university, you should leave the classroom, lab, or workspace immediately. Once at home, complete the MB self-assessment and follow the directions that are provided. Please remain off-campus until cleared to return in accordance with self-assessment, testing results, and UM recommended isolation procedures.

Complete the COVID-19 case reporting form at <https://umanitoba.ca/covid-19/case-reporting>.

Mental Health Support

For 24/7 mental health support, you can contact the Mobile Crisis Service at 204-940-1781.

Student Counselling Centre

Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling.

Student Counselling Centre: <http://umanitoba.ca/student/counselling/index.html>

474 University Centre or S207 Medical Services

204-474-8592

Student Support Case Management

Contact the Student Support Case Management team if you are concerned about yourself or another student and don't know where to turn. SSCM helps connect students with on- and off-campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.

Student Support Intake Assistant: <http://umanitoba.ca/student/case-manager/index.html>

520 University Centre, Fort Garry Campus

204-474-7423

University Health Service

Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation.

University Health Service: <http://umanitoba.ca/student/health/>

104 University Centre, Fort Garry Campus

204-474-8411 (Business hours or after hours/urgent calls)

Health and Wellness

Contact the university's Health and Wellness Educator if you are interested in peer support from Healthy U or information on a broad range of health topics, including physical and mental health concerns, alcohol and substance use harms, and sexual assault.

Health and Wellness Educator:

<https://umanitoba.ca/student/health-wellness/welcome-about.html>

britt.harvey@umanitoba.ca

469 University Centre, Fort Garry Campus

204-295-9032

Live Well @ UofM

For comprehensive information about the full range of health and wellness resources available on campus, visit the Live Well @ UofM site: <http://umanitoba.ca/student/livewell/index.html>.

Your Rights and Responsibilities

As a student of the University of Manitoba, you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

The Academic Calendar (<https://umanitoba.ca/registrar/academic-calendar>) is one important source of information. View the sections of University Policies and Procedures and General Academic Regulations. While all of the information contained in these two sections is important, the following information is highlighted.

- If you have questions about your grades, talk to your instructor. There is a process for term work and final grade appeals. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including appeal deadline dates and the appeal form: <http://umanitoba.ca/registrar/>.
- You are expected to view the General Academic Regulation section within the Academic Calendar, and specifically read the **Academic Integrity** regulations. Consult the course syllabus or ask your instructor for additional information about demonstrating academic integrity in your academic work. Visit the Academic Integrity Site for tools and support <http://umanitoba.ca/academicintegrity/>. View the **Student Academic Misconduct** procedure for more information.
- The University is committed to a respectful work and learning environment. You have the right to be treated with respect and you are expected to conduct yourself in an appropriate respectful manner.

For information on regulations that are specific to your academic program, read the section in the Academic Calendar and on the respective faculty/college/school web site <http://umanitoba.ca/faculties/>

Contact an Academic Advisor within **your** registered faculty/college or school for questions about your academic program and regulations.

Contact **Student Advocacy** if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.

<http://umanitoba.ca/student/advocacy/>

520 University Centre

204-474-7423

student_advocacy@umanitoba.ca