

University of Manitoba - Department of Statistics
Summer Term, 2021
STAT 2400: Introduction to Probability

Course Details

Course Number & Title: Stat 2400, Introduction to Probability

Section & CRN: Section A01, CRN: 2194

Course Schedule: M/T/W/R 12:30 pm – 1:45 pm over Zoom

Lab Schedule: T/R: 2:15 pm – 3:45 pm over Zoom

Calendar Description: (Lab Required) Basic probability, discrete distributions including binomial, hypergeometric, geometric and Poisson, joint distributions, applications involving discrete random variables. This course is not available to any student who has previously obtained credit for the former STAT 3500.

Prerequisites: STAT 1150 (C), STAT 2000 (B), or STAT 2001 (B); and one of MATH 1232 (C), MATH 1690 (C), MATH 1700 (B), MATH 1701 (B), MATH 1710 (B), or the former MATH 1730 (B).

Instructor Contact Information

Instructor Keith Uzelmann

Email: uzelmank@myumanitoba.ca

Office Hours: Monday: 2:30 pm – 4:00 pm; Friday: 11:00am – 1:00pm; or by appointment.

Course Description

In this course, you will learn the foundations of probability. In particular, we will discuss the set theory underlying probability theory, combinatorial techniques, the notions of conditioning and independence, discrete random variables (both univariate and multivariate), and expectation. Future topics in both statistics and actuarial science will build strongly upon this course. Further, this course will serve as an introduction to writing mathematical proofs.

Course Materials

Course Notes: The first and foremost authority in this course will be my course notes, 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). Worked-out solutions to problems will often be separate from the notes themselves.

Textbook: This course and my lectures notes are based **strongly** on the textbook below:

- Weiss, N.A. (2006), A Course in Probability, Pearson.

This textbook is not required, though it is strongly recommended as it contains a plethora of exercises and will be a useful resource for you.

Other References: Below are other useful references that will also be available on reserve at the Science Library, though they are by no means required.

- Ross, S.M. (2006), A First Course in Probability,
- Ghahramani, S. (2005), Fundamentals of Probability with Stochastic Processes,
- Roussas, G. (2007), Introduction to Probability.

Other Materials: In addition to the materials above, you are required to have reliable access to a computer with a stable internet connection.

Course Structure

Lectures: Lectures will take place as per the schedule above. Note that the Tuesday Lab period will also be used for lectures. I will be introducing definitions, stating theorems, working out examples, and writing proofs in these lectures. Any material covered in the lectures will be testable, unless otherwise stated.

Labs: Labs will take place as per the schedule above. Note that the Tuesday Lab will be used for Lectures. In the Thursday labs, the TA will be working through exercises in detail, as well as occasionally covering some content I was not able to cover in my lecture.

UMLearn Materials / Emails: 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. I will assume that you are checking either UMLearn or your email once every 24 hours in case there is an urgent update to make. In return, I will respond to all urgent emails within 24 hours; less urgent emails may take up to a business day.

Office Hours: As per the schedule above, I will be in my office. During these hours, 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. Unfortunately I have other obligations, and I will not be able to help you if you drop in outside of the office hours / the specific hours we have set up.

Weekly Tests: Associated with each week of lectures, there will be a test (i.e., there will be 5 Tests). The test will be administered through the Crowdmark platform. The test will be made available at 12:01am on Saturday, and will be due at 11:59pm on Sunday. You will write your answers to the questions on paper, and then scan the page or take a picture with your phone. You will then upload the pictures / scans to Crowdmark. The quizzes will either be given the week of the material, or the week following the material. This will be decided by a class vote on the first day of class. The tests are weighted weighted equally (i.e., 20% each).

Final Exam: There is no final exam!

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 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 ask a friend.
- Attend the labs. I will not be able to solve the full breadth of problems in class that I would like to. Thus, in order to see a wide range of problems solved in detail, you must attend the labs. Note that, for many problems, the work is just as important as the final answer; this means that if you do not attend the labs, you will not know what exact steps and explanations I expect to see when you solve problems in a quiz or test. Further, the lab problems have an increased probability of appearing on a quiz or test (hint).
- 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 quiz or test. 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 in person in some way 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:

Test 1	20%
Test 2	20%
Test 3	20%
Test 4	20%
Test 5	20%

In the case of a serious medical or family emergency that prevents you from writing the test, you must contact me by 11:59pm on Monday and inform me of the emergency. You may be asked to provide evidence or documentation attesting to the emergency. If a deferral is appropriate, then that test will be dropped and the remaining tests will take a value of 25% each. Except in extreme circumstances, only one deferral will be permitted.

Class Schedule (Tentative)

Chapter and Title	Approx. Duration (in lectures)
Basic Concepts (Weiss, Chap. 1 and 2)	3
– A review of set theory	
– Sample space, events	
– Axioms of probability and basic probability rules	
Combinatorial Probability (Weiss, Chap. 3)	5
– Counting: permutations and combinations	
– The use of counting rules in probability calculations	
Conditional Probability and Independence (Weiss, Chap. 4)	5
– Conditional probability and the general multiplication rule	
– Independence	
– Bayes' rule	
Discrete Random Variables and Probability Distributions (Weiss, Chap. 5)	4
– Discrete random variables and probability mass functions	
– Important counting random variables	
– Poisson approximation to the binomial	
– Binomial approximation to the hypergeometric	
Jointly Discrete Random Variables (Weiss, Chap. 6)	5
– Marginal and joint probability mass functions	
– Conditional probability mass functions	
– Independent random variables	
– Sums of discrete random variables	
Expected Values of Discrete Random Variables (Weiss, Chap. 7)	5
– Basic properties of expected values	
– Mean and variance of discrete random variables	
– Covariance and correlation of discrete random variables	
– Conditional expectation and variance	

Important dates:

July 5: First day of class

August 3: VW Deadline

July 8: End of Revision Period

August 5: Terry Fox day (university closed)

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.

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](#)

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](#)

Voluntary Withdrawal

The Voluntary Withdrawal (VW) date for this course is August 3rd.

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:

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

In other words, I do not like having cameras pointed at me. If you would like to take a picture of something I have written, please do so at the end of class.