University of Manitoba - Department of Statistics

Summer Term, 2019

STAT 2400: Introduction to Probability

Course Details

Course Number & Title: Stat 2400, Introduction to Probability

Section & CRN: Section A01, CRN: 1213

Course Schedule: M/W/F, 10:45 am – 12:29 pm in 260 Helen Glass Centre

Lab Schedule: M/W/F: 1:30 pm – 2:30 pm in 260 Helen Glass Centre

Calendar Description: (Lab Required) Basic probability, discrete distributions including binomal, 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

Office Location: 347 Machray Hall

Email: uzelmank@myumanitoba.ca

Office Hours: M/W: 12:45 pm – 2:15 pm, 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 explicity 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 **required**. More on this later.

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 purchase a non-programmable scientific calculator for this course.

Course Structure

Lectures: Lectures will take place Monday, Wednesday, and Friday, from 10:45 am to 12:29 pm. It is in these lectures that I will cover almost all, if not all of the material you are required to know in the course. 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 Monday, Wednesday, and Friday, from 1:30 pm to 2:30 pm. In these 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: 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 Mondays and Wednesdays, from 12:45 pm to 2:15 pm, 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.

Quizzes: Quizzes will take place on Fridays in the Lab timeslot, as per the schedule given below. These quizzes are closed-book and will cover the previous week's material. A writing utensil and a scientific calculator will be required. **The worst quiz will be dropped.**

Midterm: The midterm is tentatively scheduled for July 26 in the Lab timeslot. This Midterm will cover the material from the beginning of the course to July 19th, unless I explicitly state otherwise. A writing utensil and a scientific calculator will be required.

Final Exam: The final exam for this course will be three hours in length, and will take place on August 23rd in 223 Wallace. The final exam will cover the entirety of the course content, with a strong focus on the material taking place after the midterm content coverage.

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).
- By required textbook, I mean **required**. In addition to containing the vast majority of the content I cover in class, the textbook contains numerous exercises. These exercises are by far the best way to become familiar with both the course content, and the types of questions I will be asking you on quizzes and tests (hint 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:

Quizzes	30%
Mid-term Test	30%
Final Exam	40%

If you miss a quiz or midterm, you will be assigned a mark of zero, unless reasons and acceptable evidence are provided. In particular, you must inform me within 48 hours with an acceptable reason (either a medical or family emergency). If you miss for an acceptable reason, and inform me within 48 hours, the weight will be shifted to the final exam. Please note that I will only shift two tests (either the midterm and quiz, or two quizzes). There will be no rewrites.

Class Schedule (Tentative)

Chapter and Title	**Approx. Duration (in lectures)**
Basic Concepts (Weiss, Chap. 1 and 2)	2
– A review of set theory	
– Sample space, events	
– Axioms of probability and basic probability rules	
Combinatorial Probability (Weiss, Chap. 3)	4
– Counting: permutations and combinations	
– The use of counting rules in probability calculations	
Conditional Probability and Independence (Weiss, Chap. 4)	4
– Conditional probability and the general multiplication rule	
– Independence	
– Bayes' rule	
Discrete Random Variables and Probability Distributions (Weiss, Chap. 5)	3
– 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)	4
– 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)	4
– 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 3: First day of class

July 12: Quiz 1

July 19: Quiz 2

July 26: Mid-term

August 2: Quiz 3

August 5: Terry Fox day (university closed)

August 9: Quiz 4 **& VW Date**

August 16: Quiz 5

August 21: Last day of class

August 23: Final Exam

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 9th. By this point in the course, you will have received assessment on three quizzes and the midterm, which will account for at least 45% of your final grade.

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.