University of Manitoba
Department of Statistics

# STAT 2400 – Introduction to Probability I

## Summer Term 2022

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### Course Details

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| **Course Number & Title:** | STAT 2400, Introduction to Probability I |
| **Section & CRN:** | Section A01, CRN: 1727 |
| **Course Schedule:** | Monday/Tuesday/Wednesday/Thursday, 12:30 to 1:45 p.m. (Armes 201), |
| **Lab Schedule:** | Tuesday/Thursday 2:15 - 3:45 pm (Armes 205), |
| **Prerequisites:** | one of STAT 1150 (C) or STAT 2000 (B); <br> one of MATH 1232 (C) or MATH 1700 (B). <br> No special permissions are given with respect to prerequisites. |

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### Instructor Contact Information

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| **Instructor:** | Inesh Munaweera |
| **Office Location:** | 327 Machray Hall |
| **Email:** | ineshpma@myumanitoba.ca |
| **Office Hours:** | Monday, Wednesday and Friday from 10:30 to 11:30 a.m., <br> or by appointment. |

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### General Goals for this Course

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This course is meant to start your basic training in probability theory by providing a semi-formal introduction to its most important basic concepts. As such, some goals for the course are to help you build and develop

- a solid foundation in basic probability that you can rely on for your upper level courses in Statistics, Actuarial Mathematics and Data Science,
- skills related to the understanding and writing of basic mathematical proofs,
- analytical skills related to problem solving.

In this course, you will have an opportunity to develop a solid intuition and understanding of probabilistic ideas, along with solid skills in calculus and applied mathematics. All these skills will be essential to your success. The course is quite demanding and your success will depend heavily on your hard work and ability to solve many practice problems yourself. For instance, getting the solutions from your friends (rather than doing the problems yourself), learning the course notes by heart and cramming for exams are typically not very successful strategies. Remember that, most of the times, the work you do to get to a solution (including all the mistakes made along the way) is more important than the solution itself: you will learn more from the work and research you do to get to the answer than from copying down a solution found online or in some textbook!

## Textbook and Other Materials

**Textbook:** The course will be based on

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

This being said, you should be able to get by without making use of the textbook if you carefully study the provided lecture materials and occasionally read from the other references.

**Other references:** Other useful references that are downloadable in PDF through Springer-Links and the University of Manitoba Libraries are

- Pitman (1993), *Probability*,
- Dekking, Kraaikamp, Lopuhaä & Meester (2005), *A Modern Introduction to Probability and Statistics*,
- Devore & Berk (2012), *Modern Mathematical Statistics with Applications*.

Another very good resource is the following textbook:

- Ross (2010), *A first Course in Probability*, $8^{\text{th}}$ edition,

or, any of the more recent editions.

**Other Materials:** Lecture notes, practice problems, sample tests and exams, solutions, short videos and other materials will be posted on the UM Learn portal regularly.

**Practice Questions:** There are no assignments to be handed in for credit in this course, but opportunities to practice will be provided to you. First, a list of practice problems will be provided to you. You are free (and encouraged) to work in groups on the practice problems, but remember the work you do to get to a solution is more important than the solution itself: it is all about the process needed to get to a solution, rather than the answer itself. So, getting the solutions from a classmate is not going to help you develop the skills you will be examined on.

You will also be provided with practice tests (with complete solutions). It is expected that you use these practice tests as a practice assessment: work on the questions like you would on an regular in-person test, without looking at the solutions. This will allow you to evaluate your level of readiness for writing your test.

## Course Technology & Labs

**In the Classroom:**  Please ensure that any technology used in the class is used in a responsible manner that is mindful of the students around you. You may have cell phones on your person as long as they are kept on silent and are not brought above table height. You may use laptops or tablets in class to help with note taking or follow along with any computer demonstrations but please keep only academic matters up on your screen and refrain from distracting the students around you.

You are also expected to monitor the course UMLearn page between class times to constantly keep up with the latest course-related developments. In particular, the appropriate way to access the lectures (Meeting reference number and password) will be posted in the course calendar on UMLearn.

**Labs:**  There are two labs every week. Attendance is not obligatory, but is very strongly suggested. Note, however, that two tests will take place during the lab. (See Important Dates on p. 4.) During the lab, you can expect the TA to generally solve selected problems taken from the list of supplementary problems and answer other questions that you might have. Labs will initially be delivered remotely and synchronously, and be recorded and made available for later viewing.

## Assessments and Grading Scheme

**Crowdmark:**  The weekly problems, the tests, and the final exam will be marked using the Crowdmark software, an online grading tool. All exams will be written on provided paper and then scanned for grading. Additional instructions will be given prior to the first assessment to ensure the examinations can be scanned correctly. Upon completion of the quizzes and the midterm an electronically marked copy of your exam will be emailed to your UManitoba e-mail address. I will send out an email when the marked copies have been sent. Please check your spam folders if you do not see it in your inbox.

**Final Mark:**  The final mark for the course will be obtained from the following rule.

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|---|---|---|
| Tests (2) | 50% | (best 30%, other 20%) |
| Final Exam | 50% | (covering all course content) |

**Letter Grade:**  I normally use the following cutoffs when assigning letter grades:

| Letter Grade | Mark out of 100 | Letter Grade | Mark out of 100 |
|:---:|:---:|:---:|:---:|
| A+ | 90-100 | C+ | 65-70 |
| A | 80-90 | C | 60-65 |
| B+ | 75-80 | D | 50-60 |
| B | 70-75 | F | below 50 |

However, I might elect to use slightly lower or higher thresholds for some letter grades if I think they are more appropriate.

**Caveat:** To receive a passing grade in the course, you need to have received a passing mark in at least two assessments.

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### Tests and Exam
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**Tests:**  There will be three 75-minute tests, currently scheduled for **July 20**, and **August 3**, all during the lab time slots between **2:15 − 3:30 pm**.

Make-up tests will not be scheduled. Should you miss a test, you will be assigned a mark of zero unless you notify me by email within 48 hours of the scheduled test. If you miss one test, the final exam will count for 70% of your final mark for the course, and the other test will be respectively worth 30% of your final mark. Do note the potential impact of the above caveat in this case.

**Final Exam:**  The Final Exam will be scheduled by the Registrar's office during the University-wide examination period taking place between August 15 and August 20, inclusive. If you miss the final exam, you should contact a student advisor from your home Faculty within 48 hours of the scheduled exam time.

**Grading timeline:**  Under normal circumstances, test results should be available (and marked papers returned) within two weeks of a test being written.

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### Important Dates
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The following dates are important as to how the course will progress throughout the term.

| Date | Information |
|:---|:---|
| July 4 | First Lecture |
| July 7 | First Lab |
| July 20 | Test 1 (Modules 1 and 2) |
| Aug 1 | Terry Fox Day - no class (Class is moved to 2:30 - 1:45 pm on Friday, Aug 5) |
| Aug 2 | Voluntary Withdrawal Date |
| Aug 3 | Test 2 (Modules 3 and 4) |
| Aug 11 | Last lecture - Last day to VW the course |
| Aug 15 - 20 | Final Examination Period |

The dates and content for the tests are tentative (and subject to change at my discretion). Changes are subject to Section 2.8 of the ROASS Procedure.

## Outline of Covered Topics and Approximate Timeline

| Module and Title | Approx. Duration (classes) |
|---|:---:|
| 1. Basic Concepts (Weiss, Chap. 1 and 2)<br>– Axioms of probability and basic probability rules | 3 |
| 2. Combinatorial Probability (Weiss, Chap. 3)<br>– Counting rules and probability calculations | 3 |
| 3. Conditional Probability and Independence (Weiss, Chap. 4)<br>– Conditional probability, Independence & the Bayes rule | 4 |
| 4. Discrete Random Variables (Weiss, Chap. 5)<br>– Discrete random variables and probability mass functions | 5 |
| 5. Continuous Random Variables (Weiss, Chap. 8)<br>– Continuous random variables, cdf, pdf | 5 |
| 6. Expected Values (Weiss, Chap. 7, 10, 11)<br>– Basic properties of expected values, mean and variance<br>– Moment generating functions | 4 |
| 7. Additional Optional Topics<br>– Joint Distributions - many independent random variables<br>– Central limit theorem | Time permitting |

## Class Communications

The University requires all students to activate an official U of M email account. You should be using this for all communications between your and me (and, in fact anything related to 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

`www.umanitoba.ca/admin/governance/governing_documents/community/electronic_`
`communication_with_students_policy.html`

When emailing me, please make sure to follow proper email etiquette: emails should start with an opening salutation, be written in complete English sentences and be signed with your name and student number. I will generally reply to emails within 24 hours, depending on the urgency of the situation and my availability, except during weekends. Note that I will not divulge grades over email.

## Academic Integrity

The value of a degree from the University of Manitoba is dependent on students and faculty strictly upholding values of honesty and academic integrity in all their work. Academic dishonesty devalues the hard work and effort of students who are working honestly to achieve their degrees. For these reasons, it is important that you understand the basics of academic integrity, what constitutes academic dishonesty and what are its very serious consequences. Useful resources can be found at

`www.umanitoba.ca/student/resource/student_advocacy/academicintegrity/students/`
`a-to-i-what-is-academic-integrity.html`

and

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

## 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 at: `www.sci.umanitoba.ca/statistics/courses-and-programs/outlines`.