

# STAT 3100: Introduction to Statistical Inference (A01)

## FALL 2021

### Tentative Course Outline

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#### Course Details

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<b>Course Title &amp; Number:</b>	Introduction to Statistical Inference (STAT 3100)
<b>Credit Hours:</b>	3
<b>Class Times:</b>	Tu/Th 8:30 a.m. – 9:45 a.m.
<b>Location for Lectures:</b>	Online
<b>Lab Time:</b>	Wednesday 2:30 - 3:45 p.m.
<b>Lab Location:</b>	Online
<b>Pre-Requisites:</b>	STAT 2150 and STAT 2400.
<b>Pre- or Co-Requisites:</b>	One of MATH 2150, MATH 2151, MATH 2720, MATH 2721, or the former MATH 2750.
<b>Calendar Description:</b>	(Lab Required) Introduction to Statistical Inference. Overview of the most common approaches to inference associated with point estimation, confidence intervals and hypothesis testing, including likelihood, least-squares and moment-based methods, as well as large sample approximations. May not be held with the former STAT 3600 or the former STAT 3800.

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#### Instructor Contact Information

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<b>Instructor:</b>	Brad Johnson
<b>Preferred Form of Address:</b>	I'll answer to just about anything
<b>Office:</b>	375 Machray Hall
<b>Office Hours &amp; Availability:</b>	TBA
<b>E-mail:</b>	brad.johnson@umanitoba.ca ( <b>Note:</b> I will only respond to e-mail from UManNet ID's)
<b>Contact:</b>	I prefer contact by e-mail or during class time.

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#### Textbook, Course Delivery, Materials

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<b>Textbook:</b>	<i>Modern Mathematical Statistics with Applications, 2nd Edition.</i> Jay L Devore & Kenneth N. Berk. Springer Texts in Statistics. Springer: New York (2012/2018). [Available free as a SpringerLink e-Book through the library].
<b>Addition resource:</b>	<i>A Modern Introduction to Probability and Statistics: Understanding Why and How.</i> F.M. Dekking, C. Kraaikamp, H.P. Lopuhaa & L.E. Meester. Springer-Verlag: London (2005). [Available free as a SpringerLink e-Book through the library].

**Course Delivery:** This course is delivered remotely. It uses a combination synchronous and asynchronous course design. Students are expected to be online during the scheduled class times and are expected to log in between class times to keep up with discussion and readings. Students will be provided course notes and assigned reading from the textbook as well as exercises. Class time will be used for discussions and questions. Your computer or device, and Internet connection must meet the UM minimum requirements found in the [Student Connectivity Recommendations](#) guide. These are required for all Winter 2021 classes. We will be using either Zoom or Webex for online class delivery. Details and links will be posted on UM Learn.

Students will be given reading assignments from the textbook as well as supplementary lecture notes. It is important to keep up with these readings as online class times will be used for discussion and problem solving based on the assigned material. Students will also be given exercises to complete before class so that they can be discussed during on-line class time. Lab time will also be used for further problem solving and tests/quizzes.

**Professional Conduct:** We recognize that these are unusual circumstances, and that there are some adjustments needed when working virtually. At the same time, we do want to remind students that University policies, such as the Respectful Work and Learning Environment policy, still apply, as do basic expectations around how students will engage with each other, and with the University. This means that when participating in classes, online meetings, etc., students are expected to behave professionally, and follow the same basic norms as they would in person, such as being clothed, not being impaired, and participating respectfully. Essentially, if you wouldn't do it in an in-person class, don't do it in virtual setting.

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### Topics

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Brief list of possible topics to be covered:

- Preliminaries: Continuous Random Variables; Expectation; Variance; Joint Distributions; Conditional Distributions; Independence.
- Statistics and Sampling Distributions; Statistical Models; Estimators; Bias; Mean Square Error; Evaluation of Estimators; Sufficiency.
- Methods of Estimation: Method of Moments; Likelihoods and the Maximum Likelihood Estimator (MLE); Properties of the MLE. Least Squares Estimation.
- Large Sample Properties: CLT; Asymptotic Normality; Delta Method; Linearization;
- Confidence Intervals: General Principles; Pivots; Impact of Bias; Asymptotic Methods.
- Hypothesis Testing: General principles; Likelihood Ratio Tests; Asymptotic Methods; Connections to Confidence Intervals.
- Other topics as time permits.

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### Course Technology

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- Minimum Technology Requirements:** Students enrolled in this course must ensure they satisfy the following minimum technological requirements:
1. A computing device where one can create and edit documents,
  2. An internet connection capable of streaming videos and downloading software, and
  3. Access to a web-cam and microphone.
- See also the University of Manitoba [Student Connectivity Recommendations](#).
- Course web-page:** Course materials will be made available through the University of Manitoba's [UM Learn](#) system ([umanitoba.ca/d21](http://umanitoba.ca/d21)).
- Online Lectures:** Online lectures will make use of Zoom and/or Webex. I will record these and make the recordings available via UMLearn. Students may not record these lectures.
- Crowdmark:** I will be making use of [Crowdmark](#) for midterm tests and examinations. It is important that you upload a scanned copy of your work. For this, you can use a scanner, if you have access to one, or Apps like CamScanner that are free and can be installed on your phone or tablet. Scanning your work is important because pictures tend to be too large (causing problems during uploading and marking) and are often difficult to read (being too blurry and/or having not enough contrast).
- Other Technology:** 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 and/or University of Manitoba Accessibility Services for educational purposes only.

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### Course Work, Examinations & Grading

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**Midterm Tests:** There will be 3 midterm tests scheduled during lab times (Wednesdays @ 2:30 - 3:45 p.m.). These tests will account for 60% of your final grade (25% for the best test out of 3, 20% for the second best and 15% for the remaining test). The tentative dates are: Sep 29, Oct 20 and Nov 17 (2021).

**Note:** There will not be any makeup (deferred) midterm tests for this course. If you miss one or more midterm tests, **with a valid excuse**, and **notify me within 48 hours of the scheduled test(s)**, your final exam will be re-weighted as follows: **If you miss 1 test, your final exam weight is 55% (with remaining tests worth 20% and 25%); if you miss 2 tests, your final exam weight is 75% (with remaining test worth 25%); if you miss all 3 tests, your final exam is worth 100%.**

**Assignments:** There will be no *formal* assignments for this course. I will provide lists of problems for you to work on on your own to practice. The midterm tests and final examination will be based, in part, on these or similar problems. You are free (and encouraged) to work in groups on these but you must be able to complete the work individually on tests/examinations. Additional problems may be posted to the course web page

**Lab:** Once a week, starting September 15, there will be a compulsory lab held online (Wednesdays @ 2:30 – 3:45 p.m.). Generally, a teaching assistant will be solving selected problems (taken from the list of supplementary problems) and answering other questions that you might have. **The 3 midterm tests are during lab times as well.**

Grading Scheme:	Item	Percent
	3 Midterm Tests	60% (25%/20%/15% — see above)
	Final Exam	40%
	Total	100%

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### Important Dates

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Midterm test dates are tentative and subject to change at the discretion of the instructor and/or based on the learning needs of the students, but such changes are subject to the current [ROASS Procedures](#) as well as any addendums/modifications passed by the Senate.

Date	Information
Sep 8	First Class
Sep 29	Midterm Test #1
Sep 30	No Class
Oct 20	Midterm Test #2
Nov 17	Midterm Test #3
<b>Nov 23</b>	<b>Last day for voluntary withdrawal</b>
Dec 9	Last Class

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### Using Copyrighted Material

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Please respect copyright. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed. For more information, see the [University's Copyright Office website](#) or contact [um\\_copyright@umanitoba.ca](mailto:um_copyright@umanitoba.ca).

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### Recording Class Lectures

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Brad Johnson 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 of Brad Johnson. Course materials (both paper and digital) are for the participant's private study and research.

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### Class Communication

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The University requires all students to activate an official University email account.

Please note that all communication between myself (and teaching assistant(s)) and you as a student must comply with the [University of Manitoba Electronic Communication with Student Policy](#). You are required to obtain and use your U of M email account for all communication between yourself and the University, including for this class.

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### Academic Integrity

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The University has a number of resources centred around academic integrity, some of which can be found on the [University Academic Integrity](#) page. It is important that you understand what constitutes academic dishonesty and that you are familiar with the very serious consequences. Please familiarize yourself with the information in the above link as well as the information contained in the [Academic Calendar \(2020-2021\)](#) relating to academic integrity and the student discipline bylaws. The [Faculty of Science](#) home page also contains links regarding academic and disciplinary matters as does the [University of Manitoba Governing Documents for Students](#).

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### ROASS Schedule A

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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 will be posted to the [Department of Statistics Courses and Programs](#) page.

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### Index to Web Links

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For those you you who cannot see or make use of the hyperlinks in this document, here is a list of websites referenced herein along with their url's:

Student Connectivity Recommendations:	<a href="https://centre.cc.umanitoba.ca/wp-content/uploads/2020/04/Student-Connectivity-Recommendations.pdf">https://centre.cc.umanitoba.ca/wp-content/uploads/2020/04/Student-Connectivity-Recommendations.pdf</a>
UM Learn:	<a href="https://www.umanitoba.ca/d21">https://www.umanitoba.ca/d21</a>
Crowdmark:	<a href="https://crowdmark.com/">https://crowdmark.com/</a>
ROASS Procedures:	<a href="https://centre.cc.umanitoba.ca/wp-content/uploads/2019/10/Responsibilities_of_Academic_Staff_re_Students_ROASS_Procedures_-_2016_09_01.pdf">https://centre.cc.umanitoba.ca/wp-content/uploads/2019/10/Responsibilities_of_Academic_Staff_re_Students_ROASS_Procedures_-_2016_09_01.pdf</a>
University's Copyright Office website:	<a href="https://umanitoba.ca/copyright/">https://umanitoba.ca/copyright/</a>
University of Manitoba Electronic Communication with Student Policy.:	<a href="https://umanitoba.ca/admin/governance/governing_documents/students/index.html">https://umanitoba.ca/admin/governance/governing_documents/students/index.html</a>
University Academic Integrity:	<a href="https://umanitoba.ca/student-supports/academic-supports/academic-integrity">https://umanitoba.ca/student-supports/academic-supports/academic-integrity</a>
Academic Calendar (2020-2021):	<a href="http://crscalprod.ad.umanitoba.ca/catalog/viewcatalog.aspx?pageid=viewcatalog">http://crscalprod.ad.umanitoba.ca/catalog/viewcatalog.aspx?pageid=viewcatalog</a>
Faculty of Science:	<a href="https://www.sci.umanitoba.ca/">https://www.sci.umanitoba.ca/</a>
University of Manitoba Governing Documents for Students:	<a href="https://umanitoba.ca/admin/governance/governing_documents/students/index.html">https://umanitoba.ca/admin/governance/governing_documents/students/index.html</a>
Department of Statistics Courses and Programs:	<a href="https://www.sci.umanitoba.ca/statistics/courses-and-programs/outlines/">https://www.sci.umanitoba.ca/statistics/courses-and-programs/outlines/</a>