

# STAT 4520: Sampling Techniques I, Fall 2018 (A01)

## Tentative Course Outline

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### Course Details

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<b>Course Title &amp; Number:</b>	Sampling Techniques I ( STAT 4520)
<b>Credit Hours:</b>	3
<b>Class Times:</b>	Tuesday & Thursdays 8:30 a.m. – 9:45 a.m.
<b>Location for Lectures:</b>	316 Machray Hall
<b>Pre-Requisites:</b>	STAT 3480 (C) & STAT 3800 (C) or consent of instructor
<b>Course Description:</b>	A development of sampling theory for use in sample survey problems, in regression estimates, in systematic sampling, sources of errors in surveys.

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### Instructor Contact Information

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<b>Instructor:</b>	Brad Johnson
<b>Preferred From of Address:</b>	I'll answer to just about anything.
<b>Office:</b>	375 Machray Hall
<b>Office Hours &amp; Availability:</b>	Open door policy — if my door is open, I am available for questions.
<b>Office Phone Number:</b>	(204) 474-8162
<b>E-mail:</b>	brad.johnson@umanitoba.ca ( <b>Note:</b> I will only respond to e-mail from UMNNet ID's)
<b>Contact:</b>	I prefer contact by e-mail or in person contact.

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### Textbook, Readings, Materials

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<b>Textbook:</b>	There is no textbook for this course. I will make lecture notes available through the UM Learn system (see below).
<b>Other Resources:</b>	Not required. Available from the Science Library <i>Model Assisted Survey Sampling</i> . C. E. Särndal, B. Swensson & J. Wretman. Springer: New York (2003). <i>Sampling Techniques</i> (3rd Ed.). W. G. Cochran. Wiley: New York (1977). <i>Sampling: Design and Analysis</i> . S. L. Lohr. Duxbury Press: Toronto (1999).
<b>Readings:</b>	In order to prepare for class, I will normally ask you to read about the topics to be covered prior the lecture. I am not expecting you to learn the material on your own, only to familiarize yourself with the main ideas and vocabulary so that the lectures are easier to follow. Do not get bogged down in formulae or minute details. If you come across something that is confusing or troubling, don't despair. If your questions are not resolved during the lecture, please ask. As you work on the problem sets, it will be helpful to re-read the material on a more detailed level.

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## Topics

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This is a tentative list of topics to be covered.

- Introduction
- Basic principles for probability samples: definitions; sample statistics; inclusion probabilities; Hansen-Hurwitz and Horvitz-Thompson estimation; improved Hansen-Hurwitz estimator.
- Basic element sampling designs: simple random sampling with and without replacement; Bernoulli sampling; Poisson sampling with and without replacement; multinomial sampling; domain estimation; sampling for proportions.
- Stratified sampling: basic results; choosing strata; optimal allocation; gains in efficiency.
- Single stage cluster sampling: basic results; systematic sampling.
- Functions of several study variables: basic results and definitions; Taylor linearization; estimating ratios; domain estimation.
- Ratio estimator: ratio estimator in element sampling designs; unbiased ratio estimation; gains in efficiency. Ratio estimation in stratified designs and cluster sampling.
- Regression estimation: the difference estimator; generalized regression estimator; regression estimation under the ratio, simple linear regression and common mean models. Regression estimation in stratified designs

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## Course Technology

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**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)).

**Software:** We will also be making use of the software package R. It is freely available for Linux, Macintosh and Windows from *The Comprehensive R Archive Network* at <http://cran.r-project.org/>. Please download and install. A number of datasets will be made available through the UM Learn system ([umanitoba.ca/d21](http://umanitoba.ca/d21)) in the form of an R package.

**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. Electronic messaging, e-mail, social networking, gaming, etc. should be avoided during class time. Cell phones should be 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.

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### Important Dates

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These 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 Section 2.8 of the ROASS Procedure.

Date	Information
Sep 6	Classes Begin - Course Overview
Oct 4	Midterm Test 1
Nov 6	Midterm Test 2
Nov 19	Last day for VW
Dec 4	End of Material
Dec 6	<b>Review Class</b>

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### Course Work, Examinations & Grading

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**Midterm Tests:** There will be 2 in-class mid-term tests worth a total of 50% of your final grade (30% weight for the better test, 20% weight for the other test). The tentative dates are October 4 and November 6, 2018.

**Note:** There will not be any makeup (deferred) mid-term exams for this course. If you miss a mid-term exam, **have a valid excuse**, and **notify me within 48 hours of the scheduled exam**, your final exam will be re-weighted to account for an additional 20% of your final grade. In the event you miss both midterm tests (with valid excuses), your final exam will be worth 100% of your final grade.

**Assignments:** There will be no *formal* assignments for this course. The distributed lecture notes have a number of exercises and questions, which I may add to. 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 UM Learn system ([umanitoba.ca/d21](http://umanitoba.ca/d21)).

**Grading Scheme:**

Item	Percent
2 Mid-term Tests	50% (30% for better test, 20% for other)
Final Exam	50%
Total	100%

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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 at <http://umanitoba.ca/copyright/> 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 participants 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. For full details of the Electronic Communication with Students please visit: [umanitoba.ca/admin/governance/media/Electronic\\_Communication\\_with\\_Students\\_Policy\\_-\\_2014\\_06\\_05.pdf](http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2014_06_05.pdf)

Please note that all communication between myself and you as a student must comply with the electronic communication with student policy ([umanitoba.ca/admin/governance/governing\\_documents/community/electronic\\_communication\\_with\\_students\\_policy.html](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.

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### Academic Integrity

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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 contained in *Academic Calendar > General Academic Regulations > SECTION 8: Academic Integrity*. (see <http://umanitoba.ca/calendar>) The Faculty of Science home page at [www.umanitoba.ca/science](http://www.umanitoba.ca/science) also contains links regarding academic and disciplinary matters.

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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 web page under "Courses" and to the UM Learn system.