

STAT 4520: Sampling Techniques I, Winter 2020 (A01)

Tentative Course Outline

Course Details

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| Course Title & Number: | Sampling Techniques I (STAT 4520) |
| Credit Hours: | 3 |
| Class Times: | Tuesday & Thursdays 8:30 a.m. – 9:45 a.m. |
| Location for Lectures: | Online |
| Pre-Requisites: | [STAT 2300 and (one of STAT 3450, the former STAT 3120, or the former STAT 3470)] or the former STAT 3480 |
| Course Description: | Development of sampling theory for use in sample survey problems. Covered topics include: probability sampling and inclusion probabilities, standard sampling designs, ratio and regression estimators, linearization of estimators. |

Instructor Contact Information

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| Instructor: | Brad Johnson |
| Preferred From of Address: | I'll answer to just about anything. |
| Office: | 375 Machray Hall (I will not be there) |
| Office Hours & Availability: | TBA |
| E-mail: | brad.johnson@umanitoba.ca (Note: I will only respond to e-mail from UMNNet ID's) |
| Contact: | I prefer contact by e-mail or in person contact. |

Textbook, Readings, Materials

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| Textbook: | There is no textbook for this course. I will make lecture notes available through the UM Learn system (see below). |
| Other Resources: | 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). |
| Readings: | 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. |

Topics

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.
- 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.
- Regression estimation: the difference estimator; generalized regression estimator; regression estimation under the ratio, simple linear regression and common mean models.
- Stratified sampling: basic results; choosing strata; optimal allocation; ratio and regression estimation in stratified designs; gains in efficiency.
- Single stage cluster sampling: basic results; ratio estimators; systematic sampling.

Course Technology

- 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](http://umanitoba.ca/d21) system (umanitoba.ca/d21).
- Online Lectures:** Online lectures will make use of Zoom and/or Webex.
- Crowdmark:** I will be making use of [Crowdmark](http://www.crowdmark.com) for quizzes 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.
- Additional 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](http://umanitoba.ca/d21) system (umanitoba.ca/d21) in the form of an R package.

Important Dates

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 |
|-----------|------------------------|
| Jan 19 | First Class |
| Feb 11 | Midterm Test I |
| Feb 15-19 | Winter Break |
| Mar 18 | Midterm Test II |
| Mar 31 | Last Day for VW |
| Apr 15 | Review Class |

Course Work, Examinations & Grading

Midterm Exams: There will be 2 in-class mid-term exam, for a total of 60% of your final grade (35% for the better test, 25% for the remaining test). The tentative dates are February 11 and March 18, 2021.

Note: There will not be a 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 accordingly to account for 65% of your final grade for the first missed midterm and 100% of your final grade if you miss both midterm exams.

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).

Grading Scheme:

| Item | Percent |
|----------------|---|
| Mid-term Tests | 60% (35% for better test, 25% for remaining test) |
| Final Exam | 40% |
| Total | 100% |

Using Copyrighted Material

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.

Recording Class Lectures

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.

Class Communication

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.

Academic Integrity

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.

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 will be posted to the Department of Statistics Courses and Programs page.

Index to Web Links

For those of 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:

UM Learn: <https://www.umanitoba.ca/d21>

Crowdmark: <https://crowdmark.com/>

UM Learn: <https://www.umanitoba.ca/d21>

UM Learn: <https://www.umanitoba.ca/d21>

University's Copyright Office website: <https://umanitoba.ca/copyright/>

University of Manitoba Electronic Communication with Student Policy.: https://umanitoba.ca/admin/governance/governing_documents/students/index.html

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| University Academic Integrity: | In- | https://umanitoba.ca/student-supports/academic-supports/academic-integrity |
| Academic Calendar (2020-2021): | | http://crscalprod.ad.umanitoba.ca/catalog/viewcatalog.aspx?pageid=viewcatalog |
| Faculty of Science: | | https://www.sci.umanitoba.ca/ |
| University of Manitoba Governing Documents for Students: | Gov- | https://umanitoba.ca/admin/governance/governing_documents/students/index.html |
| Department of Statistics Courses and Programs: | Stat- | https://www.sci.umanitoba.ca/statistics/courses-and-programs/outlines/ |