Practical Tools (Part I) for Sampling
SURV 747
2 credits/4 ECTS
Spring 2019

Instructor
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Video lecture by Richard Valliant

Short Course Description
This course is a statistical methods class combining hands-on applications and general review of the theory behind different approaches to survey sampling.

Course and Learning Objectives
By the end of the course, students will understand:
- Sample size calculations using estimation targets based on coefficient of variation, margin of error, and power requirements.
- Mathematical programming to determine sample sizes needed to achieve estimation goals for a series of subgroups and analysis variables.
- Resources for designing area probability simples.
- Methods of sample allocation for multistage samples.

Prerequisites
Sampling theory (e.g., SURV440) and Applied sampling (e.g., SURV626).
Some experience with the R statistical computing software is helpful.

Class Structure and Course Concept:
This is an online course using a flipped classroom design. It covers the same material and content as an on-site course but runs differently. In this course, you are responsible for watching video recorded lectures and reading the required literature for each unit and then “attending” mandatory weekly one-hour online meetings where students have the chance to discuss the materials from a unit with the instructor. Just like in an on-site course, homework will be assigned and graded and there will be a final exam at the end of the course.

Although this is an online course where students have more freedom in when they engage with the course materials, students are expected to spend the same amount of time overall on all activities in the course – including preparatory activities.
(readings, studying), in-class-activities (watching videos, participating in online meetings), and follow-up activities (working on assignments and exams) – as in an on-site course. As a rule of thumb, for each credit offered by a course, students can expect to spend one hour per week on in-class activities and three hours per week on out-of-class activities over the span of the term. This is a 2-credit course that runs for 8 weeks. Hence, the total average workload is about 8 hours per week.

**Mandatory Weekly Online Meetings:**
*Monday, 12:00-12:50 PM EDT/5:00-5:50 PM CET, starting March 25*

Meetings will be held online through Zoom. Follow the link to the meeting sessions on the course website on [https://www.elms.umd.edu/](https://www.elms.umd.edu/). If video participation via Internet is not possible, arrangements can be made for students to dial in and join the meetings via telephone.

In preparation for the weekly online meetings, students are expected to watch the lecture videos and read the assigned literature before the start of the meeting. In addition, students are encouraged to post questions about the materials covered in the videos and readings of the week in the forum before the meetings (deadline for posting questions is: one day before the online meeting on Sundays at 12:00 PM EDT/5:00 CET).

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Students have the opportunity to use the Zoom meeting room set up for this course to connect with peers outside the scheduled weekly online meetings (e.g., for study groups). Students are encouraged to post the times that they will be using the room to the course website forum to avoid scheduling conflicts. Students are not required to use Zoom and can of course use other online meeting platforms such as Google Hangout or Skype.

**Grading**
Grading will based on

- 8 Homeworks (60% of grade)
- A take-home final exam (20% of grade)
- 6 Quizzes (10% of grade)
- Class Participation (10% of grade) in discussion during the weekly online meetings and posting questions to the weekly forum (deadline: 24 hours before class) demonstrating understanding of the required readings and video lectures
Dates of when assignment will be due are indicated in the syllabus. There are penalties for turning in homework after the due dates:

1 day late: 10% off
2 days late: 25% off
3 days late: 50% off
4+ days late: no credit

Technical Equipment Needs
The learning experience in this course will mainly rely on the online interaction between students and the instructor during the weekly online meetings. Therefore we encourage all students in this course to use a web camera and a headset. Decent quality headsets and web cams are available for less than $20 each. We ask students to refrain from using built-in web cams and speakers on their desktops or laptops. We know from our experience in previous online courses that this will reduce the quality of video and audio transmission and therefore will decrease the overall learning experience for all students in the course. In addition, we suggest that students use a wire connection (LAN), if available, when connecting to the online meetings. Wireless connections (WLAN) are usually less stable and might be dropped.

Long Course Description
This course and the textbook give students the necessary tools to design and select single- and multi-stage survey samples in the real world. We will cover topics on calculating a sample size for a specified level of precision or within the confines of the survey budget, identifying and creating strata, allocating the sample to the strata given a set of constraints or requirements for detectable differences between group estimates, estimating variance components, and determining what sample sizes to use at different stages in a multi-stage sample.

We will use specialized software for the calculations mentioned. This course will emphasize R but some examples in SAS and Stata are also discussed. Sample size calculations can be done using the R PracTools package written by the instructors or with Microsoft Excel; SAS procedures and Microsoft Excel are used for the mathematical programming (Unit 4). Survey weights can be computed with the R survey package for many designs and estimators—a topic covered in Part II of the Practical Tools series.

R is downloaded for free from http://cran.r-project.org/. Students may also find https://www.rstudio.com/ a helpful interface to execute program code. R packages for this class include, for example, PracTools (developed for the textbook), survey, and sampling. Three videos on the R survey package and five videos on PracTools are posted on http://jointprogram.umd.edu/all/our-faculty#cbp=https://jointprogram.umd.edu/content/richard-valliant. For those
new to R, there are 48 MarinStatsLectures available at https://www.youtube.com/playlist?list=PLqzoL9-eITNBDdKgIGzQcY6OXmsXAHU

There will be small-scale homework problems each week for students to gain practice using all methods covered in the course. The emphasis will be on using the methods to solve practical problems; we review theory as needed for a clear understanding of the underlying assumptions. All are encouraged to discuss their own survey design challenges and solutions during our weekly online meetings.

Readings
Primary readings will be from the following volume:


Additional required and recommended readings will be made available on the course website: https://www.elms.umd.edu/

Academic Conduct
Clear definitions of the forms of academic misconduct, including cheating and plagiarism, as well as information about disciplinary sanctions for academic misconduct may be found at

https://www.president.umd.edu/sites/president.umd.edu/files/documents/policies/III-100A.pdf (University of Maryland) and


Knowledge of these rules is the responsibility of the student and ignorance of them does not excuse misconduct. The student is expected to be familiar with these guidelines before submitting any written work or taking any exams in this course. Lack of familiarity with these rules in no way constitutes an excuse for acts of misconduct. Charges of plagiarism and other forms of academic misconduct will be dealt with very seriously and may result in oral or written reprimands, a lower or failing grade on the assignment, a lower or failing grade for the course, suspension, and/or, in some cases, expulsion from the university.
Accommodations for Students with Disabilities
In order to receive services, students at the University of Maryland must contact the Disability Support Services (DSS) office to register in person for services. Please call the office to set up an appointment to register with a DSS counselor. Contact the DSS office at 301.314.7682; http://www.counseling.umd.edu/DSS/.

Students at the University of Mannheim should contact the Commissioner and Counsellor for Disabled Students and Students with Chronic Illnesses at http://www.uni-mannheim.de/studienbueros/english/counselling/disabled_persons_and_persons_with_chronic_illnesses/.

Course Evaluation
In an effort to improve the learning experience for students in our online courses, students will be invited to participate in an online course evaluation at the end of the course (in addition to the standard university evaluation survey). Participation is entirely voluntary and highly appreciated.

Class Schedule
Please note that assignments and dates are subject to change. Information (e.g., articles and assignments) posted to the course website supersedes the information noted here.

Unit 1: Overview / The R Statistical Package / Sample Design and Sample Size in Single-stage Surveys

Video lecture (Richard Valliant): available online Monday, March 18, 2019

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Online meeting (Jill A. Dever): Monday, March 25, 12:00 PM EDT/5:00 PM CET

Online quiz 1: due Tuesday, March 26, 12:00 PM EDT/5:00 PM CET

Homework 1: due Thursday, March 28, 8:00 AM EDT/1:00 PM CET

Readings:
Textbook Chapter 1 - Section 3.1;
R Primer (if needed)
Unit 2: Sample Design and Sample Size in Single-stage Surveys (continued)

Video lecture (Richard Valliant): available online Monday, March 25, 2019

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Online meeting (Jill A. Dever): Monday, April 1, 12:00 PM EDT/6:00 PM CEST

Online quiz 2: due Tuesday, April 2, 12:00 PM EDT/5:00 PM CET

Homework 2: due Thursday, April 4, 8:00 AM EDT/1:00 PM CET

Readings:
   Textbook Sections 3.2 - 3.7

Unit 3: Power Computations and Sample Size Determination

Video lecture (Richard Valliant): available online Monday, April 1, 2019

Online meeting (Jill A. Dever): Monday, April 8, 12:00 PM EDT/6:00 PM CEST

Online quiz 3: due Tuesday, April 9, 12:00 PM EDT/5:00 PM CET

Homework 3: due Thursday, April 11, 8:00 AM EDT/1:00 PM CET

Readings:
   Textbook Chapter 4

Unit 4: Mathematical Programming/Study Performance rates and Effect on Sample Size

Video lecture (Richard Valliant): available online Monday, April 8, 2019

Online meeting (Jill A. Dever): Monday, April 15, 12:00 PM EDT/6:00 PM CEST

Homework 4: due Thursday, April 18, 8:00 AM EDT/1:00 PM CET

Readings:
   Textbook Chapters 5-7
Unit 5: Designing Multistage Samples
Video lecture (Richard Valliant): available online Monday, April 15, 2019
Online meeting (Jill A. Dever): Monday, April 22, 12:00 PM EDT/6:00 PM CEST
Homework 5: due Thursday, April 25, 8:00 AM EDT/1:00 PM CET
Readings:
   Textbook Chapters 8 – Section 9.2.3

Unit 6: Designing Multistage Samples (continued)
Video lecture (Richard Valliant): available online Monday, April 22, 2019
Online meeting (Jill A. Dever): Monday, April 29, 12:00 PM EDT/6:00 PM CEST
Online quiz 4: due Tuesday, April 30, 12:00 PM EDT/5:00 PM CET
Homework 6: due Thursday, May 2, 8:00 AM EDT/1:00 PM CET
Readings:
   Textbook Sections 9.2.4 - 9.6

Unit 7: Area Probability Sampling
Video lecture (Richard Valliant): available online Monday, April 29, 2019
Online meeting (Jill A. Dever): Monday, May 6, 12:00 PM EDT/6:00 PM CEST
Online quiz 5: due Tuesday, May 7, 12:00 PM EDT/5:00 PM CET
Homework 7: due Thursday, May 9, 8:00 AM EDT/1:00 PM CET
Readings:
   Textbook Sections 10.1 - 10.5

Unit 8: Area Probability Sampling (continued) / Wrap-up
Video lecture (Richard Valliant): available online Monday, May 6, 2019
Online meeting (Jill A. Dever): Monday, May 13, 12:00 PM EDT/6:00 PM CEST
Online quiz 6: due Tuesday, May 14, 12:00 PM EDT/5:00 PM CET
Homework 8: due Thursday, May 16, 8:00 AM EDT/1:00 PM CET
Readings:
Textbook Sections 10.6 - Chapter 11

Final Exam
Due: Monday, May 20, 1:00 PM EDT/6:00 PM CET

Note: Student access to the course website will be revoked two weeks after the final exam.