SURVMETH 625
Methods of Survey Sampling
Summer 2020

CLASS MEETINGS:
Lecture: 2:00-5:00 PM, Monday, Tuesday & Thursday
Laboratory: 2:00-4:00 PM, Wednesday & Friday
June 3 - July 3, 2019

INSTRUCTORS
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OFFICE HOURS
By BlueJeans per appointment.

COURSE CONTENT
Methods of Survey Sampling is an applied statistics methods course, but differs from most statistics courses because it is concerned almost exclusively with the *design* of data collection. Methods for the analysis of collected data will not be discussed much in the course. The course will concentrate on problems of applying sampling methods to human populations, since sampling human populations poses a number of particular problems not found in sampling of other types of units. The principles of sample selection, though, can be applied to many other types of populations.

The course is presented at a moderately advanced statistical level. While we will not develop mathematical aspects of sampling theory, statistical notation and outlines of some algebraic proofs will be given. Therefore, a sound background in applied statistics is necessary. A thorough understanding of the notation and results will be required.

The aims of the course are to teach basic ideas of sampling from an applied perspective and to provide experience with realistic problems. The course will cover the main techniques used in sampling practice: simple random sampling, stratification, systematic selection, cluster sampling, multistage sampling, and probability proportionate to size sampling. These methods will be examined further in the context of area probability sampling. The course will also cover sampling frames, cost models, sampling error estimation techniques, non-sampling errors, and compensating for missing data.

LECTURE AND LABORATORY SESSIONS
Lecture sessions are three times per week (Monday, Tuesday and Thursday), starting at 2:00 PM and ending at 5:00 PM, with one 10 minute break. Laboratory sessions are twice per week (Wednesday and Friday), starting at 2:00 PM and ending at 4:00 PM. In the Laboratory sessions there will be discussions of homework problems and solutions, review for examinations, examination solutions, and discussions on the course project.

Lectures and laboratories will be on live video through compressed video technology. A two-way interactive audio-video system allows those at the transmitting site to see and hear those attending remotely, and those at the remote site to see and hear those at the transmitting site. All lecture and

laboratory sessions will be recorded, and may be viewed later with standard 'browser' software. Instructions will be provided via email on how to log on and view recorded sessions.

Lecture notes and other materials will be presented on projection systems in the classroom. Students have access to a copy of all materials presented on the projectors through the course web site (via Canvas), although handwritten notes will be inserted in lecture frequently.

All registered students have access to the site through registration at the University of Michigan. The web site contains lecture notes, homework problems and related materials, homework solutions, readings, the course project and related materials, discussion items, an email log, the chat room, and a Q&A web platform (Piazza). Materials posted on the web site will not be distributed in class (except the first lecture session when paper copies of the syllabus, lecture notes, and first homework problem will be distributed for those attending in Ann Arbor).

HOMEWORK

The homework assignments are to be turned in by the beginning of the class session when due. The regular problems will be graded on a five level system: check-plus (100), check (90), check-minus (80), late (60), not submitted (0). The 'late' score will be assigned for any assignment turned in after the assigned time and day, without prior permission of the instructors.

Homework will be submitted electronically via the course web site as an attachment to the Assignment tool. Students must submit solutions, handwritten or typed, in a single .pdf format file, with name and homework set number at the top of the first page, and page numbers at the bottom of each page. Files must be submitted in a standard name convention: 'Surname First Initial HW #.pdf'. For example, 'Nishimura R HW 1.pdf'. The submitted homework will be marked electronically and returned via the Assignment tool as an attachment, along with a copy of a homework solution.

Study groups are useful, and encouraged. Group answers are not acceptable. Each student must submit individual homework exercise solutions.

The project is a multi-stage sampling exercise distributed early in the term, and discussed throughout the course during class sessions. The instructors will assign 4-5 students each to project teams. Each team will submit one copy of the project in .pdf format with name 'Team # project.pdf' (for example, 'Team A project.pdf') via the Assignment tool.

All students in a team receive the same base score (maximum 80 points). Each student also completes an evaluation for the other students in the team. The remainder of each student's project grade (maximum 20 points) will be based on the evaluations by fellow students in the team. Students who do not turn in evaluations of other team members will receive zero for the individual component, regardless of team ratings.

EXAMINATIONS AND FINAL GRADE

There will be an in-class cumulative open book, open notes midterm examination on Friday, June 19, 2:00-5:00 PM. The cumulative, open book, open notes final examination will be held Friday, July 2, 2:00-5:00 PM.

Final grades will be a weighted composite of homework (approximately 30%), class project (approximately 30%), and examination scores (approximately 40%). The instructors may alter the relative weights, depending on overall class performance on each component of the final grade.

ACADEMIC INTEGRITY

Students are responsible for upholding the policy on academic integrity in the University of Michigan Standard Practice Guide; please see https://spg.umich.edu/policy/303.03.

TEXTBOOKS AND ASSIGNED READING

The principal text for the course will be *Survey Sampling* by Leslie Kish (John Wiley and Sons, Inc., New York, 1965). It is available at university bookstores or through online sales. Students may find

that the following texts serve as useful supplemental reading to several lecture topics: *Introduction to Survey Sampling* by Graham Kalton (Sage Publications, Beverly Hills, 1983), *Sample Survey Methods and Theory*, Volume 1, by Morris Hansen, *et al*. (New York: John Wiley and Sons, Inc., 1953), and *Sampling Techniques*, 3rd edition, by William G. Cochran (New York: John Wiley and Sons, Inc., 1977).

There are also assigned readings of several papers (see list below), available on Canvas.

[1] Rust, K. "Variance estimation for complex estimators in sample surveys," *Journal of Official Statistics*, 1(4) (1985): 381-397.

[2] Kish, L. and Frankel, M. "Inference from complex samples," *Journal of the Royal Statistical Society*, Series B, **36** (1974): 1 - 37.

[3] Kalton, G. and Kasprzyk, D. "The treatment of missing survey data," *Survey Methodology*, **12** (1986): 1 - 16.

[4] "Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys Revised 2016," downloaded from aapor.org, May, 2016.

SYLLABUS

Date		Time	Topic	Readings[a]	HW
June	8	2:00-5:00	**Lecture:** Course introduction. Principles in sample selection. Simple random sampling.	Kish 1.0-1.7	
	9	2:00-5:00	**Lecture:** Frame problems. Weights and weighted estimators. Cluster sampling.	Kish 2.1-2.7, 5.1-5.2	
	10	2:00-4:00	**Laboratory**: HW1		
	11	2:00-5:00	**Lecture:** Two stage sampling. Intra-cluster homogeneity. Stratified sampling.	Kish 5.3-5.4, 3.1-3.3	1
	12	2:00-4:00	**Laboratory:** HW2. HW1 solution. Project introduction.		
	15	2:00-5:00	**Lecture:** Sample allocation. Stratification topics. Systematic sampling.	Kish 3.4, 3.6, 4.1-4.2	2
	16	2:00-5:00	**Lecture:** Unequal sized cluster sampling. Stratified cluster sampling.	Kish 6.1-6.5	
	17	2:00-4:00	**Laboratory:** HW3. HW2 solution. Project discussion.		
	18	2:00-5:00	**Lecture:** Complex sampling (weighting, stratification, cluster selection).	Kish 6.6, 11.7	3
	19	2:00-5:00	**Midterm Exam**: In-class open-book open-notes.		
	22	2:00-4:00 4:00-5:00	**Lecture:** Controlling sample size. Probability proportionate to size selection, PPS. **Laboratory**: HW4. HW3 solution.	Kish 7.1-7.3	
	23	2:00-5:00	**Lecture**: Probability proportionate to estimated size selection, PPeS. PPS problems.	Kish 7.4-7.5	4
	24	2:00-4:00	**Laboratory:** HW5. HW4 solution. Project discussion.		
	25	2:00-5:00	**Lecture**: Area sampling (two & three stage). Variance estimation (collapsing & combining strata). Balanced repeated replication.	Kish 9.1-9.7, Kish 4.3-4-4, **[1]**	5
	26	2:00-4:00	**Laboratory:** HW6. HW5 solution. Project discussion.		
	29	2:00-5:00	**Lecture:** Jackknife repeated replication. Generalized variances & software.	Kish 14.1-14.3, **[2]**	
	30	2:00-5:00	**Lecture:** Total survey error. Response error. Non-observation error & nonresponse adjustment. Missing data compensation.	Kish 13.1-13.6, **[3] [4]**	6
July	1	2:00-4:00	**Laboratory:** HW6 solution. Review for final exam.		
	2	2:00-5:00	**Final Exam:** Open book, open notes in-class cumulative final.		Project

[a] Readings are from the textbooks by Kish, or from specified papers.