

**Methods And Theory Of Sample Design**  
*SURVMETH 617 (STATISTICS 580/BIOSTATISTICS 617/SOCIOLOGY 717)*  
*SURV 440*  
Fall, 2008

**INSTRUCTOR**

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**CLASS MEETINGS**

1:00-2:30 PM Monday & Wednesday  
Ann Arbor: G300 ISR-Perry; College Park: 1208 Lefrak; Suitland: US Bureau of the Census

**OFFICE HOURS**

Chat room on CTools, or by appointment

**COURSE CONTENT**

Methods and Theory of Sample Design is concerned with the theory underlying the methods of survey sampling widely used in practice. It covers the basic techniques of simple random sampling, stratification, systematic sampling, cluster and multi-stage sampling, and probability proportional to size sampling; methods of variance estimation for complex sample designs, including the Taylor series expansion method, balanced repeated replications, and jackknife methods; and several specialized topics, including stratification and subclasses, multi-phase or double sampling, ratio estimation, selection with unequal probabilities without replacement, non-response adjustments, imputation, and small area estimation. The course examines both the practical applications of the sampling techniques presented as well as the theory supporting the methods.

**COURSE ORGANIZATION, HOMEWORK, EXAMINATIONS, AND GRADING**

The course meets twice per week, starting at 10 minutes past the hour (1:10 AM) and ending at 2:30 PM. Class time is devoted to lecture and discussion of homework and examination problems. Questions during lectures are welcomed.

Course materials are on the course web site, including lecture notes, homework problems, and readings. The first three lecture notes sections will be distributed in class; students are responsible for printing copies of other sections. Other materials will not be copied and distributed in class.

Homework assignments are assigned in the syllabus below, and are due on the date indicated. The instructor leads a CTools chat room session the evening before each homework assignment is due, usually 7:00-8:00 PM; the instructor will announce any changes in the chat room schedule in class the week before the assignment is due. Homework assignments are graded with a three-point scale, check plus (100), check (90), and check minus (80).

There are two open-book open-notes in-class examinations, a mid-term and a final. Each cover all material discussed previously in the course. Students bring calculator to the examinations. There is a chat room session scheduled the evening before the midterm exam.

The final grade for the course is an average of homework and examination grades: final examination contributes approximately 40%, the midterm examination 30%, the homework 30% grade.

**ACADEMIC CONDUCT**

The faculty of the University of Maryland and University of Michigan expects the conduct of a student registered or taking courses in the university to be consistent with that of a professional person. Courtesy, honesty, and respect should be shown by students toward faculty, guest lecturers, administrative support staff, and fellow students. Similarly, students should expect faculty to treat them

fairly, showing respect for their ideas and opinions and striving to help them achieve maximum benefits from their experience in the school.

Student academic misconduct includes plagiarism, cheating, fabrication, falsification of records or official documents, intentional misuse of equipment or materials, and aiding and abetting the perpetration of such acts. The preparation of reports, papers, and examinations assigned on an individual basis must represent each student’s own effort. Reference sources should be indicated clearly. The use of assistance from other students or aids of any kind during a written examination, except when the use of books or notes has been approved by an instructor, is a violation of the standard of academic conduct.

### COURSE EVALUATION

Until the last several years, students received a paper course evaluation form in class the last day of lecture. Both the University of Maryland and University of Michigan have moved to online course evaluations. All students are strongly urged to use the respective university online course evaluation system at the end of the term. Michigan registered students will use a new online evaluation system that opens December 2. In addition, the Michigan course evaluation will only be available to other students when at least 70% of registered students complete the evaluation.

### TEXTBOOKS

There are two main texts for the course. References to other texts may be made from time to time. *Sampling Techniques, 3rd ed.*, by William G. Cochran (J. Wiley and Sons, Inc., New York, 1977). *Survey Sampling* by Leslie Kish (J.W. Wiley & Sons, New York, 1965).

### ONLINE READINGS

- (1) Kish, L. “Selection With Probabilities Proportional to Size Measures,” Chapter 7 in *Survey Sampling*, pp. 217-247. New York: Wiley and Sons, 1965.
- (2) Kish, L. “Techniques for Computing Variances,” Section 8.6 in *Survey Sampling*, pp. 282-293. New York: Wiley and Sons, 1965.
- (3) Kish, L. “Biases and Nonsampling Errors,” Chapter 13 in *Survey Sampling*, pp. 509-571. New York: Wiley and Sons, 1965.
- (4) Rust, K, and Rao, J.N.K. “Variance Estimation for Complex Surveys Using Replication Techniques,” *Statistical Methods in Medical Research*, Vol. 5, 1996, pp. 283-310.

### COURSE SYLLABUS

Date	Topic	Readings <sup>a</sup>	Homework <sup>b</sup>
Sept 8	Course introduction. Statistical tools.	C 1; K 2.0-2.2	
10	Simple random sampling.	C 2; K 2.3-2.5	
15	Simple random sampling.	C 3; K 2.6-2.9	2.1-2.3,2.5 <sup>Chat</sup>
17	Simple random sampling. Stratification.	C 4; K 3.1-3.3	
22	Stratified sampling.	C5	2.13-2.15, 4.5 <sup>Chat</sup>
24	Stratified Sampling.	C 5A; K 3.4-3.5	
29	Stratified Sampling.	--	3.1-3.3,3.6 <sup>Chat</sup>
Oct 1	Stratified Sampling	--	
6	Cluster Sampling.	C 9; K 5.1-5.2	5.2,5.3,5.7,5.10 <sup>Chat</sup>
8	Systematic sampling.	C 8; K 4.1-4.2	
13	Two stage sampling.	C 10; K 5.3-5.4	5.11,5A.2-3,8.4 <sup>Chat</sup>
15	Two stage sampling.	--	
20	<b>No class: Michigan Fall Break.</b>	--	
22	<b>Midterm exam</b> <sup>Chat</sup>	--	

27	Unequal sized cluster sampling I.	C 9A; K 6.1-6.3	
29	Unequal sized cluster sampling I.		
<i>Nov 3</i>	Ratio estimation.	C 6; K 6.6, 6.12	
5	Unequal sized cluster sampling II.	C 11; K 6.4	8.6,10.1-10.3 <sup>Chat</sup>
10	Variance estimation.	--	
12	Probability proportionate to size sampling.	K7.1-7.5	6.1,6.3,6.5,6.7 <sup>Chat</sup>
17	Probability proportionate to size sampling.	--	
19	Sampling errors for non-linear statistics.	C 11; K 4.3-4.4	Homework 8 <sup>Chat</sup>
24	Sampling errors for non-linear statistics.	K 8.6	
26	Unequal probability w/o replacement.	C 11	Homework 9 <sup>Chat</sup>
<i>Dec 1</i>	Double sampling.	C 12; K 12.1	
3	Unit non-response.	C 13	Homework 10 <sup>Chat</sup>
8	Weighting and other compensation.	K 13.1-13.3	
17	<b><i>Final exam; 1:30-3:30 PM.</i></b>	--	

<sup>a</sup> Refers to sections of Cochran (C) or Kish (K) which should be read before the class session.

<sup>b</sup> Assignment due at the beginning of the indicated class period. All problems are from Cochran or handouts distributed at least one week before the assignment is due.

<sup>Chat</sup> Chat room session evening before homework due, 7:00-8:00 PM, unless specified otherwise.