

STATISTICAL ASPECTS OF SURVEY SAMPLING

QA 723 Wednesday 6:00-9:30 PM

4 Credits

Dr. Martin S. Levy
Room 529 Lindner
Telephone: 556-7145
Martin.levy@uc.edu

Office Hours: Wednesday 4:30:00– 5:30 PM and by appointment. Office hours provide you with an opportunity for personal discussion with me concerning course-related problems such as homework, clarification of classroom discussion, test grading, etc. If the formal hours are unsuitable for you, please make an appointment with me at a mutually agreeable time. I strongly urge you to take advantage of these hours.

Tests: There will be a midterm exam given on Wednesday of the sixth week of class. It will likely be a take-home exam. The comprehensive final will probably be a take-home exam given to you on the last day of class and due the corresponding day of finals week before 6:00PM. The take-home nature of these exams is subject to amendment. No one is exempt from either exam. If you cannot pick up your exam (if it is in paper form) on time you may do so at a later time provided that you inform me first and that you adhere to the specified deadlines. Since it is most likely that I will post the exam on line, i.e., on the Blackboard site, this advice is largely obviated.

Class Communication: Every student will obtain a *Blackboard* account by going to <http://blackboard.uc.edu/> on the INTERNET. We will use Blackboard to communicate.

Class Notes: The class notes will be made available to you in electronic format. I will post the notes on my Blackboard site, in .pdf format. You may read these documents by obtaining the freeware Adobe Reader. You may print out a copy of the notes if you wish. Keep in mind that the college discourages printing multiple copies of such notes in the computer labs.

Homework: Assignments of text problems will be given in class. My version of the "solutions" will be available, either as a lecture topic in class, or distributed along with class notes, on the Internet. These homework assignments are not to be submitted for grading. They are for your educational benefit only, and are not used as an evaluator. You are very strongly urged to attempt the problems and to collaborate in their solutions (see Group-Work section in this syllabus).

Grading: Midterm = 25%
Project = 25%
Final = 40%

The remaining 10% will be based upon any assignments that are collected and other "intangible" sources that may reflect "attitude" such as participation in class discussion.

EXCUSED ABSENCE POLICY: I do not take attendance. While I do appreciate your courtesy in informing me of an absence, or if you must come to class late or leave early, it is not necessary to inform me. The faculty senate has issued a statement of policy regarding make-up work for days missed due to religious observance. It reads in part, "Any UC student who is unable to attend classes or participate in any examination, study or work requirement on some particular day(s) because of his or her religious belief should be given the opportunity either to make up the work that

was missed or to do alternative work that is intrinsically no more difficult than the original exam or assignment — provided that the makeup work does not create an unreasonable burden upon University of Cincinnati and its faculty. Upon request and timely notice, students should be provided reasonable accommodation.” My personal policy is that if you need to miss a class or part of a class for religious reasons or any other reasons for that matter, it is acceptable to me. Take what you want from this experience. Since exams/projects are take-home affairs, the issue of excused absences is nullified anyway, and so I expect that all due dates will be honored. In addition, the information technology people tell me that they will record each class and make them available to you, so that a missed class can be reasonably recouped with some effort on your part. As stated elsewhere in this syllabus, every student is responsible for whatever takes place in the classroom. Missed study opportunity is an issue that you can take up with the members of your work-group; it does not concern me. As stated elsewhere in this syllabus, you will have the opportunity to rate your team members’ participation and performance at the end of the term. I will not offer any student any alternative work or make-up assignments.

Miscellaneous: The grade of “Incomplete” will be given only for fully documented medical conditions or other catastrophes as judged by me. You may drop the course without penalty up to Friday, of the eighth week of the quarter. No special exams or assignments will be given at quarter's end for grade improvement. Students are responsible for all material, assignments and announcements made in class. All exams must be strictly personal efforts. No collaboration on exams is permitted. On the other hand, I strongly urge you to collaborate on the homework assignments in a responsible manner. When required, all exam work must be shown. No work = no credit. Solely I will determine partial credit. Of course you may discuss the basis of your exam grade with me but this must take place in private. Keep all graded tests and assignments returned to you. The final exam will remain in my possession for two quarters. I regard a student's attitude and interest to be a very important component in evaluation and I reserve the right to raise a grade based upon my impression. You are strongly urged to suggest any improvements in the teaching or classroom procedure. In case a notice of class cancellation is posted, you must remain in class for a period of ten minutes to confirm the validity of that notice.

Text: Sampling Techniques, 3rd ed. Cochran, Chapters 1-10.
The Survey Research Handbook, 3rd Ed., Alreck and Settle.

Nature of the Course: This is a course in the *statistical aspects of sample survey*. This is an area distinct from but related to the behavioral aspects of sample survey. The former includes issues such as population parameters of interest, statistical sampling designs, such as simple random sampling, stratified sampling, cluster sampling, etc., estimation of parameters under these designs, measuring the precision of these estimators using variance and mean square error formulas, sample size determination under various designs, optimal sampling strategies balancing cost against precision, etc. The latter area includes issues such as questionnaire design, scale development, word-order effects, modes of data collection such as mass mailings, telephone contact via rapid digit dialing, personal interviews, selection and training of canvassers, etc. Be very aware of the fact that the lecture material, and main text involve the *statistical aspects* of sample survey, and not the *behavioral aspects* of sample survey. There are many fine courses on campus, for example in the Political Science Department, that address issues in the behavioral survey sampling area. Your contact with the behavioral issues in sample survey here in this course will be entirely independent and will be addressed through the term project described below. We will not address any of these issues in class. *This is a statistics course.*

Group-Work Structure of the Course: I firmly believe that student cooperation and knowledge exchange can enhance learning in a course such as this. Thus, after the first class, each student **may elect** to join a work group. A work group will consist of at least two students, but no more than 5. This work group should optimally be maintained for the length of the quarter. The work group should cooperate in all work given during the quarter including practice problems, studying, midterm exam, and final exam. **The group structure does not apply to the term project (which will be an individual effort).** All members of a group will share grades on any submitted. One exam is to be submitted in behalf of all members of a work group, and the names of the members of that group should be clearly indicated on the front page. All members are to contribute equitably to the shared workload, carrying a fair weight for the burden. At the end of the quarter, members of each group will be asked to evaluate the contribution of the other work group peers on the basis of a number of criteria taking into consideration such factors as intellectual contribution, attendance at group meetings, mentoring and sharing knowledge, writing up the results, and performing relevant computations. The peer score will reflect, in some sense, an average over all of the work assigned as well as an average of the criterion above. Thus, a student in a work group who may have contributed much on one assignment, may not have contributed the majority of the work on another, yet still such work may be considered by other members to be meritorious “on the average”. A copy of the intragroup evaluation form will be posted in the Final Exam folder on Blackboard.

QA723 Term Project

The purpose of this project is to acquaint the student with the techniques of sample survey as research tools. While the class lectures are designed to provide the mathematical component necessary for a thorough understanding of sample surveys, this project will supply the non-mathematical component.

We should all have gained exposure to sample surveys in our daily lives either through professional endeavors or less formally, via news reports in the popular media. From this exposure, we probably have obtained many preconceived ideas about sample surveys: how they are constructed, conducted, analyzed and reported. In the first part of the following project you will have the opportunity to crystallize your experiences by attempting to formulate a problem whose solution requires data gathered in a sample survey and then to design a sample survey in which you are to give attention to all of the necessary details. During the quarter, especially while reading the text by Alreck and Settle (A and S), you will amend your report taking into account your newly acquired expertise. Thus by the quarter's end, either you will have vindicated yourself as an already established expert on sample survey in which case no change in your first report will be necessary, or you will have learned a few things which will enable you to indicate improvements in your methodology, adding detailed points that you had previously neglected.

The following outline and schedule are to be followed:

On third week of class, hand in a preliminary report treating the items below:

- (1) Declare a research question which is of interest to you and which requires data gathered in a sample survey for resolution (e.g. is there sex discrimination in the reward structure among faculty at this university?).
- (2) Indicate some quantitative measures that you feel would help resolve your question (e.g. mean salary of male and female professors of the same rank, the proportion of male and female

professors tenured after their probations, etc.).

- (3) Prepare a questionnaire which would get at the important points. Attend to as many details as you can think of (e.g. question order, number of questions, types of questions, number of questions per page, scale for response, etc.).
- (4) Who (what) will be surveyed? How will they (it) be chosen? How many?
- (5) Who will do the field work?
- (6) Other items that you wish to discuss. (This is up to you but probably the most important point.)

KEEP IN MIND: I don't expect that you are using the correct methodology at this stage. Maybe you are and maybe you are not. That is the whole point of the project. You are not expected to be an expert in sample survey after the first three weeks of class. Therefore, it does not matter how crude your sampling strategy, questionnaire, etc. might be. You are only declaring a topic of interest. You are supposed to give a proposal with methodology (for both the questionnaire and the sampling techniques) that you are merely suggesting. As you read the text by A and S, you may discover that you are indeed a very smart person and that you have proposed to do things correctly. Or you may have discovered that you are not exactly correct and that there are better ways to get your information. The final write-up will reflect what you have learned, and you will document your discoveries by **carefully annotating** your questionnaire and description of sampling methodology **with citations** from the A and S book. Thus, after you have **INDEPENDENTLY** read the A and S book will you be regarded as an expert. It is only then that you will be held accountable for the quality of the **FINISHED** product.

Retain a copy of this preliminary report.

Throughout the quarter, read the text by Alreck and Settle independently, keeping your project in mind for critical review. On the day scheduled by the university for our final exam, you should have prepared and be ready to submit a revision and critical review of your report/questionnaire. For each revised item, indicate the reason for the change, citing the appropriate section of A&S which provoked the change. Do the same for any additions you may have made.

ALTERNATIVE PROJECT: If you are more quantitatively oriented, then instead of the above assignment you may turn in a report on one of three areas. The first area topic is variance estimation; the second is messy frame issues (many-to-many frames), and the third is automated sampling methodologies such as random digit dialing (RDD) and their effect on survey statistical quality, such as bias and precision. A good reference for the first is the text *Introduction to Variance Estimation*, Kirk M. Wolter, Springer-Verlag, (1985). For the second area, I have several papers that I will make available to you. For the third area I recommend that you do a literature search via a Web search engine like Google Scholar, and the Current Index to Statistics that can be accessed over the Internet at URL <http://www.statindex.org/CIS/query>. You must still read Alreck and Settle, but you will be graded on your final report instead of a questionnaire.

QA 723

Course Goals, Outline and Policies

The goals of this course are as follows:

1. To introduce the students to the terminology, use and underlying theory of sample surveys.
2. To expose the students to the following designs for sample surveys:
 - (a) Simple random sampling with and without replacement
 - (b) Stratified random sampling
 - (c) Systematic sampling
 - (d) Cluster sampling
 - (e) Probability-Proportional-to-Size sampling
 - (f) Two-stage sampling
3. To make the students aware of other designs not covered in 2.
4. To discuss estimation methods for population means, totals, proportions, ratios and variances under each of the designs covered in 2 including:
 - (a) Means per unit
 - (b) Ratio estimates
 - (c) Regression estimates
 - (d) Probability-Proportional-to-Size estimates
 - (e) Two-stage mean estimates
 - (f) Post-stratificationand to discuss the precision of these estimates under the various sampling designs: hence to discuss the merits and the drawbacks of these designs.
5. To provide enough rigor in the development of these topics so that the student will be able to amend or extend procedures when necessary and to read advanced works on the subject.
6. To expose the student to such non-mathematical issues as; questionnaire design, scale choice and development, interviewer management, modes of data collection, survey interviewing technique, organization and administration of field work, editing, coding, preparation of data for analysis, reporting results, etc.
7. To provide the in-depth mathematical treatment that will enable the students to pursue more advanced study in the statistical area of sample survey.

Achievement of these goals should enable the student to:

1. Communicate effectively with others concerning the use and interpretation of sample surveys.
2. Better understand reports, research, etc., that make use of sample surveys.
3. Identify potential uses of sample surveys.
4. Improve the quality of existing sample surveys and implement effective new surveys.
5. Pursue further study in both the statistical and non-statistical aspects of sample survey.

