



CE 392E: Acquisition & Analysis of Transport Data Spring 2022

Instructor Information

Instructor: Dr. Kara Kockelman
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Course Information

Course Location: ECJ 3.122
Class Times: MW 12:30 – 2:00 pm
Prerequisites: All students should have had at least one college course in probability or statistics and should know how to perform ordinary least-squares regression before enrolling in this course (or be very handy with matrix algebra & such). Permission from the instructor is required for students outside the transportation engineering major.

Grading Policy

Grades will be based on the following*:

Course Component	Share of Score/Grade
Homework	25%-30%
Course Project #1	25%
Course Project #2	25% (20% for report + 5% for presentation)
Examination(s)	20%-25%

* (1) Pluses and minuses will be used in final course grades. (2) The instructor reserves the right to consider class **participation & quizzes** in the evaluation of a student's performance in the course, where participation score is based on participation in class (including attendance). Students should come to class prepared to contribute to each class's lecture and discussion by staying up-to-date with homeworks and reading. These items may contribute **up to 10%** of a student's grade, reducing the other percentages proportionally.

Examinations*

Only one course examination (a significant "midterm") is expected, towards the end of the semester, which may take place partly outside of lecture hours (e.g., as a **take-home** exam). The UT-scheduled final examination slot may be used for student oral presentations of final-project work. *Tentative exam date:* Third Wed of April, 12:30-2:00 pm

*Make-up exams will *not* generally be given to any student. If a student is absent from a scheduled exam due to medical or other problems beyond her/his control and can demonstrate this, the instructor can choose to give the student a completely different exam, additional assignments, and/or change the weighting of the student's various graded contributions.

Homework Assignments

Homework problems will be assigned roughly every **two weeks** and must be handed in at the **beginning** of the period in which they are due. After this time, they will be considered late and given no credit. However, all assigned problems must be completed (within 3 weeks of their due date and at least one week before the final exam) or a student's participation score will be adversely affected.

Course Projects

Two major homework assignments, which we can refer to as “course projects”, will be assigned. **Project 1** is a team endeavor wherein all students administer and design a survey of Americans' evacuation behavior preferences, including their departure time, route choices, travel mode, and their compliance with the evacuation policies. The survey is expected to fully capture people's evacuation behaviors upon upcoming wildfires or a hurricane, with varying scenarios based on people's perspectives of urgency. **Project 2** involves independent investigation, discussion, and application of a distinctive analytical approach to a given dataset, such as a COVID-19 dataset (by Salon et al., 2021) that captures Americans' travel and purchase behaviors during the pandemic. Such work will be followed by an oral presentation to the class (of roughly 10 min+5 min for Q&A).

Course Text and Notes

Required:

- S. Lohr's *Sampling: Design and Analysis* (Duxbury Press 1999)*
- Lecture notes, which will be posted periodically online for students to download

* Copies of assigned chapters are available via a Course Packet for purchase from Canopy Course Notes via Jerome Kubala, 512-497-6662. This Course Packet also contains several chapters from Washington et al.'s *Statistical and Econometric Methods for Transportation Data Analysis* (Chapman & Hall 2003).

Other Reading Suggestions:

- The first edition of Richardson et al.'s *Survey Methods for Transport Planning* (Eucalyptus Press 1995): hard copies can be borrowed from the instructor
- *Collecting, Managing, and Assessing Data Using Sample Surveys* 2011
- Econometrics subject: Mannering et al.'s *Statistical and Econometric Methods for Transportation Data Analysis* (2003, Chapman & Hall)
- Econometrics: W.H. Greene's *Econometric Analysis* (any edition, MacMillan)
- Sampling: W. Cochran's *Sampling Techniques* (Wiley 1963)
- Sampling: C. Särndal et al.'s *Model Assisted Survey Sampling* (Springer 1992)
- Fundamental references: Devore's *Probability & Statistics for Engineering & the Sciences* (an undergrad text) & J. Rice's *Mathematical Statistics and Data Analysis*

Course Objectives, Academic/Learning Goals, Questions, Content, & Schedule

This course covers various aspects of transportation relating to the acquisition and analysis of transportation data. By the end of this course, students should be able to:

- design, develop, implement and evaluate actual surveys of stated & revealed travel behaviors; and
- identify & apply appropriate analytical tools for a variety of transport data types.

They also should be able to:

- reduce response & sampling errors;

- maximize response rates & *data quality*; and
- recognize subtleties in *variable definitions*.

To attain these objectives, we will systematically proceed through a series of topic modules in class, each with specific objectives, and students will undertake two major (and several relatively minor) homework assignments. Primary topics include experimental design and sampling, survey methods and data structure, hypothesis testing, and regression analyses. Tentative scheduling of the course topics is shown here.

LESSON TOPICS (+ Readings)

Subject	Topics to be Covered	Relevant Reading
Introduction (1.5 lecture)	Overview of Course Study/Data Objectives Discussion of Case Study & Final Projects	Lohr's Ch. 1 RAM Ch. 1 & 2
Data Types (2 lectures)	Human Behavior (& Opinion) – Stated vs. Revealed, & Cognitive Illusions	Course Notes
Survey Types (1 lecture)	Self-completion vs. Interviewer; Telephone vs. Intercept Survey Method (PAPI, CATI, Web-based...) Passive Methods (Cell-phone & GPS devices)	RAM Ch. 3 + Course Notes
Survey Design & Administration (3 lectures)	Questionnaire Design: Instrument Format, Wording Choice, Question Ordering Minimizing Non-Response: Reminders & Incentives Sensitive Questions Need for Pilot Surveys	Lohr 1.5 & RAM Ch. 5 RAM 7.1-7.4 Course Notes RAM Ch. 6
Probability & Statistics Review (2 lectures)	Probability (Mean & Covariance Calculations, Independence & Conditioning) Distributions (Bernoulli, Geometric, Poisson; normal, Student's t, Lognormal...) Combining Variables (Mean & Variance of Functions of Variables) Statistics (Bias & Precision, Confidence Intervals) Hypothesis Tests	Washington et al. pp. 1-44, Lohr's App. B & Ch. 2, RAM 4.6, + Course Notes
Sampling Methods (6 lectures)	SRS – with & w/out Replacement Systematic Stratified Sampling: Single & Multi-Stage Cluster Sampling Complex Surveys Other (Systematic Sampling; Double/two-phase Samples, Choice-based Sampling, Bayesian Sampling...)	RAM Ch. 4 & Lohr Ch. 2, 4-7
Survey Issues (4 lectures)	Sample Size Calculations Non-response & Imputation	RAM 4.6 & 4.6; Lohr 2.5, 4.5, 7.5, Lohr Ch. 8
Data Analysis & Application (5 lectures)	Unit Weights/Expansion Factors: Regression Methods Iterative Proportional Fitting (Estimating Expansion Factors over 2+ Dimensions) Probability: Manipulation of Distributions: The Delta Method, Converting pdfs, Length-based sampling Regression Models (OLS, WLS, Discrete Choice, Systems of Equations)	Lohr Ch. 11, Course Notes & Washington et al. Ch. 3, 7, 10 & 11 Note: Rice's & Greene's textbooks are valuable for further details on this topic.
Review for Course Examination (1 lecture)		
Other Topics (1 lecture)	Potential Topics: Spatial Statistics, Data Processing & Storage, Remotely Sensed Data, Random Number Generation, etc.	
Student Presentations of Project #2 Work (2 lectures)		

Add/Drop Dates

From the 1st through the 12th class day, an *undergraduate student* can drop a course via the web and receive a refund, if eligible. From the 13th through the university's academic drop deadline, a student may Q drop a course with approval from the Dean, and departmental advisor. After the academic drop deadline has passed, a student may drop a course only with Dean's approval, and only for urgent, substantiated, non-academic reasons.

From the 1st through the 4th class day, *graduate students* can drop a course via the web and receive a refund. During the 5th through 12th class day, graduate students must initiate drops in the department that offers the course and receive a refund. After the 12th class day, no refund is given. No class can be added after the 12th class day. From the 13th through the 20th class day, an automatic Q is assigned with approval from the Graduate Advisor and the Graduate Dean. From the 21st class day through the last class day, graduate students can drop a class with permission from the instructor, Graduate Advisor, and the Graduate Dean. Students with 20-hr/week GRA/TA appointments or a fellowship may not drop below 9 hours.

Evaluation Plan

UT's Course/Instructor Survey form will be used as the basic evaluation tool. All students are encouraged to submit written comments during this survey. Other formal assessment opportunities are likely to arise mid-semester; and students are strongly encouraged to provide feedback at any time during the course, in person, via other students or anonymously, to the TA and/or the instructor.

Other Information

1. The University of Texas at Austin provides, upon request, appropriate academic accommodations for qualified students with disabilities. For more information, contact the Division of Diversity and Community Engagement, Services for Students with Disabilities, 471-6259 (voice) or 232-2937 (video phone) or <http://www.utexas.edu/diversity/ddce/ssd>.
2. According to *The General Information Catalog* "a student who is absent from a class or examination for the observance of a religious holy day may complete the work missed within a reasonable time after the absence, if *proper notice* of the planned absence has been given". The deadline for proper notification of such an absence is the 15th day of the semester.
3. Students in CE392E are encouraged and authorized to work on homework assignments together and prepare for exams together. However, all written work handed in by a student is considered to be his/her own work, prepared without *unauthorized* assistance. To ensure your actions never compromise your and our class's integrity, please visit http://deanofstudents.utexas.edu/sjs/acint_student.php. Students who violate University rules on scholastic dishonesty (*e.g.*, anything which gives unfair academic advantage to a student) are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced. An "F" grade will be the recommended penalty in most cases of scholastic dishonesty. One should refer to the Student Judicial Services website at <http://deanofstudents.utexas.edu/sjs> to access the official University policies and procedures on scholastic dishonesty as well as further elaboration on what constitutes scholastic dishonesty. For further elaboration on what constitutes scholastic dishonesty see http://deanofstudents.utexas.edu/sjs/scholdis_whatdis.php
4. Math & statistics tutors and other learning assistance can be obtained via many resources (see <http://www.engr.utexas.edu/undergraduate/97/4668-tutoring-information> including the Academic Community Center at Jester West (see <http://www.engr.utexas.edu/undergraduate/services/tutoring/jester>).