USP 657: Discrete Choice Modeling

- Do you work with data where the outcome is discrete instead of continuous, like choices between brands of goods, healthcare providers, housing, and modes of transportation?
- Are you interested in a family of versatile data analysis approaches to modeling individual behavior?
- Do you want to learn an analytic method which won its creator, Daniel McFadden, the Nobel Prize in 2000, and has been widely used in disciplines ranging from Economics, engineering, marketing, political science, public health, urban studies and many more?

Then this Discrete Choice Modeling course is for you!

This hands-on course covers the basics of analyzing discrete choices, the theory and practice underlying the formulation and estimation of models of individual discrete choice behavior. By the end of the course, students would come away with an understanding of the theory and methods, and the ability to apply and interpret common discrete choice models in their own research.

More information:
https://sites.google.com/a/pdx.edu/usp657/
USP 657: Discrete Choice Modeling
Portland State University, Fall Term

Room and Times: Urban Center 220, Wednesdays 9:00-11:30am
Instructor: Dr. Liming Wang
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Office Hours: Thursdays 12:00-2:00pm or by appointment
Course Website: TBA

Overview:
Discrete choice models are widely used for the analysis of individual choice behavior and can be applied to choice problems in many fields such as economics, environmental management, engineering, urban planning, etc. Recent applications to predict changes in demand and market shares include areas such as choice of travel mode, coffee brand, telephone service, soft drinks and other foods, and choice of durables such as automobiles, air conditioners, and houses.

This course presents the theory and practice underlying the formulation and estimation of models of individual discrete choice behavior with applications to travel, travel related and other choices. The course will provide students with an understanding of the theory, methods, application and interpretation of multinomial logit (MNL), nested logit and other members of the Generalized Extreme Value (GEV) family of models. Depending on the progress on interest of the class, it may also include introductions to advanced topics such as probit model, logit models with latent variables, mixed logit models etc.

Course Objectives:

• Develop an understanding of the theory of choice modeling.
• Familiarization with and understanding of the art, science and methods of discrete choice modeling.
• Develop the ability to use theory, judgment and statistical analysis to obtain enhanced model specifications.
• Become familiar with relevant software and its use.
• Become familiar with current research in choice modeling.

Requirements
Familiarity with intermediate calculus and intermediate statistics including hypothesis testing and linear regression will be helpful in understanding some of the concepts covered in this class.
We will use the R statistical software. The software is installed on most lab computers on campus. R is free and available for download at http://cran.r-project.org. If you’re not familiar with R, you can use a Graphic User Interface (GUI) package RCommander (Rcmdr) as your main interface to R to ease the learning curve. R examples will be used during regular sessions, and instructions of working with R will be offered to assist in using R to complete the assignments.

Classes will be conducted in lecture/discussion format. Readings for each topic will be assigned and expected to be read before class. Digital copies of lecture notes, homework assignments, and links to supplemental reading materials will be made available via the course website.

Grades will be based on 3 homework assignments (60%) and a class project and presentation (30%+10%).

**HOMEWORK ASSIGNMENT (3*20%)**

Homework assignments provide an opportunity to experiment with and learn about model specification and testing. Unless otherwise specified, all homework will be submitted as a single electronic document with figures, tables and attachments included in the main document using the provided report guidelines and sample. Clarity in writing and presentation will be taken into account in grading. Students may collaborate on the approach to and analysis of homework assignments but are expected to prepare and present results and interpretations independently.

**CLASS PROJECT (40%)**

In this class project, you will explore a topic of your choosing in depth, applying discrete choice modeling method for your data analysis. The paper must include original data analysis. This most likely will be analysis of secondary data, such as a travel survey (e.g. 2009 NHTS, OHAS), the American Housing Survey, etc. If you want to collect your own quantitative data or perform a qualitative analysis (e.g. in depth observation, interviews, content analysis, etc.), that’s possible, but will take more planning and work. Check with me first.

Details:

- 15-20 pages, double-spaced, not including figures, tables, and references.
- Initial topic due in class on April 18. This should include a brief description of the topic, a list of key references (including academic literature), specific research question(s) and hypotheses, and the data source(s) you plan to use.
- Paper updates due in class on May 9. This should include a draft of the introduction/background sections, the literature review, and the methodology.
- Final paper due Monday June 9 5 pm.

The best papers (high A grades) will be worthy of submission to an academic journal. Use empirical journal articles as a model to follow in terms of format, style, etc.

**Citations** You must cite all of your sources in your work. Please review this web site about citations: [http://library.pdx.edu/citing_sources.html](http://library.pdx.edu/citing_sources.html)
In-class presentation. You will present your class project in-class in the 10th week. Plan for a 15-minute presentation.

Late assignments will be marked down – one-third of a grade per day late. “One-third of a grade” is, for example, from A to A-, B+ to B, etc. (or 3.3% using the scale below). As with incomplete grades, I generally do not allow students to turn things in late without assessing this penalty, except in unusual circumstances, e.g. medical emergencies. Having too much work in other classes or at work/internship does not count. All students have those challenges.

Readings and Schedule
There are three texts for this course. Course notes and supplemental readings will be distributed via the course web site. You may be able to get away with just the first two texts, as I intend to cover the essential points in the third text in my lecture notes; however, it is highly recommended if you plan to do work/research in this area.

1. The primary text is A Self Instructing Course in Mode Choice Modeling (SIC), Prepared For U.S. Department of Transportation, F.S. Koppelman et al., January 31, 2006. This text is available for download from the following website: http://www.ce.utexas.edu/prof/bhat/COURSES/LM_Draft_060131Final-060630.pdf
   2. Discrete Choice Methods with Simulation (TRAIN) by Kenneth Train (2003 edition) published by Cambridge University Press. I highly recommend you buy a paperback copy of this book, which may be purchased through many online retailers. A free version for academic use is also available via Kenneth Train’s website: http://elsa.berkeley.edu/books/choice2.html.
   3. Discrete Choice Analysis: Theory and Application to Travel Demand (DCA) by Ben-Akiva and Lerman (1985 edition), available from The MIT Press, 55 Hayward Street, Cambridge, MA 02142, (1-800-356-0343 or mitpress-orders@mit.edu). You may also find it available from various online retailers.

Schedule
Topics covered may be adjusted based on progress and class interests.

Week 1: Introduction and Choice Theory
Readings
   • SIC2, Chapters 1-3
   • DCA, Chapter 3

Week 2 Binary and Multinomial Logit Model
Readings
   • TRAIN, Chapters 2, 3;
   • SIC2, Chapters 4, 5
   • DCA, Chapters 4 (skim) & 5
Assignment: Homework 1 assigned

Week 3: Model Specification Development and Testing
Readings
- SIC2, Chapter 6

Assignment: Initial class project proposal due.

Week 4: Application of Discrete Choice Models for Analysis
Developing the model is only half the battle. In this section we'll discuss how to employ the model for analysis, including the use of elasticities, forecasting, and welfare analysis.

Readings
- DCA, Chapter 6
- TRAIN, Chapter 3
- SIC2, Chapter 11

Assignment: Homework 1 due; Homework 2 assigned

Week 5: Order Choice Models
Readings
- Greene, W. 2008

Week 6: Data Collection, Sampling, and Sample Design
Choice Experiments and Stated Preference Models
The methods in this course often require in-depth surveys. In this section we’ll study types of data (revealed preferences, stated preferences, conjoint, psychometric data), survey and experimental design, and issues of sampling.

Readings
- DCA, Chapter 8
- Adamowicz, 1994
- Camero, 1994
- Haab, 1998 (comment to Camero 1994)
- Camero, 1998 (correction to Camero, 1994)

Assignment: Class project updates due

Week 7 Nested Logit and Generalized Extreme Value Models
Readings
- TRAIN, Chapter 4
- SIC2, Chapter 7
- DCA, Chapter 10 (Except Section 10.7)

Assignment: Homework 2 due; Homework 3 assigned
Week 8: Models of Spatial Choice; Choice Set Formation

Readings
- McFadden, 1978
- Frejinger and Ben-Akiva, 2009
- Nerella and Bhat, 2004

Week 9: Advanced Topics in Discrete Modeling

Readings
- TRAIN, Chapter 6
- Walker and Ben-Akiva, 2011
- Greene and Hensher, 2003

Assignment: Homework 3 due.

Week 10: Class project presentation