Georgia Institute of Technology

School of Civil and Environmental Engineering

# CEE 6650

**Discrete Choice Modeling SYLLABUS**

**Instructor:**

Patricia L. Mokhtarian 322 SEB

phone: 404-385-1443

e-mail: [patmokh@gatech.edu](mailto:patmokh@gatech.edu)

# Course Objectives:

* To understand the behavioral, statistical, and econometric foundations for the formulation and estimation of discrete choice models.
* To explore a variety of discrete choice models and their application to travel demand forecasting and related subjects.
* To gain experience in the formulation, interpretation, and evaluation of discrete choice models using empirical data.

**Formal prerequisite:** Calculus-level introduction to probability & statistics. **Informal prerequisites:** Regression analysis. Having had a course in regional travel demand forecasting is also helpful but not essential.

# Text:

Ben-Akiva, Moshe and Steven R. Lerman (1985) *Discrete Choice Analysis: Theory and Application to Travel Demand.* Cambridge, Mass.: MIT Press.

Plus supplemental readings as assigned.

# Assignments:

Grading will be based on three major assignments, each counting one-third of the grade.

They will involve using the PC-based computer program LIMDEP (or the equivalent) to estimate discrete choice models using real data. Other problems will also be included with these assignments.

Teaming with ***one*** other person is allowed on the HW, at your choice. That is, you may team or not team, you choose your teammate (if any), and you are free to change the arrangement from one assignment to the next. Teamed assignments will receive a single grade for the team, and will be graded to the same standards as un-teamed assignments. Each member of the team is expected to engage thoroughly in, and to make substantive contributions to, ***all*** aspects of the assignment.

My general policy is not to allow three-person teams, because that dilutes the workload, and hence the understanding of the material and therefore the pedagogical value of the assignment, too much. This sometimes has the unfortunate result that someone who wants to team is the “odd person out”, when everyone else is either already paired off or does not wish to team. In such cases, someone must end up unhappy, and for both pedagogical and social-psychological reasons I would rather force someone ***not*** to be on a team who wants to be on one, than to force someone to be ***on*** a team who doesn’t want to be. In my philosophy, teaming is a “bonus”, not an automatic right. So… if you want to team, start forming the team early.

# Honor Code:

* Plagiarism is defined by Webster’s Dictionary (http://www.merriam- webster.com/dictionary/plagiarism) as “the act of using another person’s words or ideas without giving credit to that person.” If caught plagiarizing, you will be dealt with according to the GT Academic Honor Code.
* You may discuss the assignment with other students in the class. However, each student or team must submit her/his/its own homework solutions, written in her/ his/its own words. In other words, the content of any assignment turned in should be *only* that of the person (people) whose name(s) is (are) on the assignment. Copying or borrowing from another person’s solution is a violation of the GT Academic Honor Code, and will be dealt with accordingly.
* Unauthorized use of any previous course materials such as graded homework assignments, other than that explicitly allowed by me or my delegate, is prohibited in this course. Therefore, unauthorized use of such materials is a violation of the GT Academic Honor Code, and will be dealt with accordingly.
* When in doubt, don’t assume or rationalize -- ask! For any questions involving these or any other Academic Honor Code issues, please consult me or [www.honor.gatech.edu.](http://www.honor.gatech.edu/)

# Office of Disability Services:

The Georgia Institute of Technology has policies regarding disability accommodation, which are administered through The Office of Disability Services ([http://disabilityservices.gatech.edu/).](http://disabilityservices.gatech.edu/)) For students with disabilities, please contact this Office to request classroom accommodations.

# COURSE OUTLINE

Introduction (1-2 lectures)

Why probabilistic models

Applications of disaggregate discrete choice models

Review of prob. and statistics fundamentals (3 lectures) (B-A & L Ch. 2; Kmenta Ch. 6; Theil Ch. 8)

Joint, marginal, and conditional distributions for discrete and continuous RVs Maximum likelihood estimation

Desirable properties of estimators

Theories of individual choice behavior (2-3 lectures) (B-A & L Ch. 3, lightly on 3.4-6; Stopher and Meyburg Ch. 16)

Noncompensatory models

Constant and strict utility theory; IIA Random utility theory

Binary choice models (7 lectures) (B-A & L Ch. 4, lightly on 4.4, 4.6; Domencich and McFadden Chs. 4 & 5)

Derivation of linear, logit, and probit models Comparison of binary logit model to logistic regression Prototypical model specification

Maximum likelihood estimation Diagnostic tests (§§2.6 and 4.5, 7.1 - 7.4)

Quasi-t, χ2, LRI (ρ2 or pseudo-R2), adjusted ρ2,

% correctly classified, success table

Multinomial choice models (8-9 lectures) (B-A & L Ch. 5; Train Ch. 2) Background

Properties of the extreme value distribution

Derivation of general and multinomial logit choice probabilities MNL: Testing for IIA

MNL: Elasticities (disaggregate versus aggregate) Maximum likelihood estimation of multinomial logit Taste variations

Market segmentation

Bases for segmentation

Testing for significant differences between segments Multinomial probit

Other discrete choice models (4 lectures)

Nested logit, generalized extreme value Dogit

Ordinal response Mixed logit

Application issues (3 lectures)

Aggregation (B-A & L Ch. 6) [Heterogeneity of choice sets] Sampling (B-A & L Ch. 8)

Choice-based sampling [Sampling of alternatives (B-A & L Ch. 9)]

Ethical issues in modeling and forecasting