Latent Structure Analysis
HUDM 6055 001

Fall 2011	Thursday, 3-4:40, HM 234
Instructor:	Lawrence T. DeCarlo
Office:	Grace Dodge 453h
Office hours:	Tues. 3:30-5:00, Thurs. 1:30-3:00, and by appointment
Phone:	212-678-4037
Email:	decarlo@tc.edu
Website:	http://www.columbia.edu/~ld208/

Required text: *Principles and Practice of Structural Equation Modeling* (3rd ed.). Rex B. Kline (2010). New York: The Guilford Press

Required readings:

Boomsma, A. (2000). Reporting analyses of covariance structures. *Structural Equation Modeling*, *7*, 461-483.

Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In R. H. Hoyle (Ed.), *Structural Equation Modeling: Concepts, Issues, and Applications* (pp. 158-176). Thousand Oaks, CA: Sage.

Hox, J. J., & Bechger, T. M. (1998). An introduction to structural equation modeling. *Family Science Review*, *11*, 354-373. This is available for download at Joop Hox's website (link is on my website under links).

Lei, P., & Wu, Q. (2007). An NCME instructional module on introduction to structural equation modeling: Issues and practical considerations. *Educational Measurement: Issues and Practice*, *26*, 33-43.

Recommended:

Structural Equation Modeling: Concepts, Issues, and Applications. (1995). Rick H. Hoyle (Ed.). Thousand Oaks, CA: Sage Publications.

Testing Structural Equation Models. (1993). Kenneth A. Bollen, & J. Scott Long (Eds.). Newbury Park, CA: Sage Publications.

(advanced) *Structural Equations with Latent Variables*. (1989). Kenneth A. Bollen, New York: John Wiley & Sons.

(advanced) *Latent Variable Models and Factor Analysis* (2nd ed.). (1999). David J. Bartholomew & Martin Knott. New York: Oxford University Press.

Topics

Expectations, covariance, regression, maximum likelihood estimation, generalized least squares, path analysis, confirmatory factory analysis, measurement models, and structural equations. You will learn how to diagram the model, write it as a system of equations, write and run an Mplus program, and interpret the results. Possible advanced topics to be covered are analysis of dichotomous or ordinal data, latent class extensions, missing data analysis, multiple group analysis, multilevel analysis, longitudinal data analysis, or growth curve modeling.

Latent structure analysis is a general class of methods that involve manifest and latent variables that are continuous or categorical. Manifest variables are observed and are usually used as measures of the latent variables. Latent variables are not observed and are the constructs of interest in a theory. When the latent variables are continuous, the models are known as structural equation models, which have been widely used in a number of disciplines, such as psychology, education, biology, and medicine. When the latent variables are discrete, the models are known as latent class models, which have been widely used in sociology and to a lesser extent in psychology. In both cases, the manifest variables can be treated as being either continuous or discrete (with ordered or un-ordered categories). Recent developments include models that combine aspects of latent class analysis and structural equation modeling.

This course will introduce the background and computer skills needed to understand and utilize latent variable models. The focus will be on path analysis, confirmatory factor analysis, structural equation models, and latent class extensions of these models. The objectives are to give students and researchers (a) the knowledge as to when these techniques might be useful, (b) an understanding of the theory and statistics involved in these techniques, (c) limitations of these techniques, (d) an ability to read and criticize published research using these techniques, (e) an overview of current issues and developments. The software Mplus will be used to analyze data.

Some additional general references:

Recommended:

Structural equation modeling: Foundations and extensions. (2000). David Kaplan. Thousand Oaks, CA: Sage Publications.

Others:

Latent Variable Models: An Introduction to Factor, Path, and Structural Analysis (2nd Ed.). (1992). John C. Loehlin. Hillsdale, NJ: Lawrence Erlbaum Associates.

A Beginner's Guide to Structural Equation Modeling. (1996). Randall E. Schumacker & Richard G. Lomax, Mahwah, NJ: Lawrence Erlbaum Associates.

Advanced Structural Equation Modeling: Issues and Techniques. (1996). George A. Marcoulides & Randall E. Schumacker. Mahwah, NJ: Lawrence Erlbaum Associates.

Structural Equation Modelling with LISREL: Essentials and Advances. (1987). Leslie A. Hayduk, Baltimore, MD: John Hopkins University Press.

Basics of Structural Equation Modeling. (1997). G. M. Maruyama, Thousand Oaks, CA: Sage.

A First Course in Structural Equation Modeling. (2000). Tenko Raykov & George A. Marcoulides. Mahway, NJ: Lawrence Erlbaum Associates.

Software

There are a number of software packages available for structural equation modeling (SEM). LISREL is one of the leading packages, from one of the major contributors to SEM; a student demo version and other information is available from the scientific software international website: www.ssicentral.com.

The software we will be using is Mplus, which offers a simple intuitive command language and some advanced features. A student version is available at the website: www.statmodel.com.

Mplus offers advanced capabilities, such as the incorporation of latent classes into structural equation models. A user's manual can be downloaded from the website:

Muthén, L.K. and Muthén, B.O. (1998-2010). Mplus User's Guide. Sixth Edition. Los Angeles, CA: Muthén & Muthén.

The website at statmodel.com also provides examples of a number of applications, references to articles discussing technical details, and a discussion list covering various topics of interest.

Another useful reference for Mplus is:

Structural equation modeling with Mplus: Basic concepts, applications and programming. (2011). Barbara M. Byrne. Routledge academic.

Semnet

Semnet is a discussion group concerned with structural equation modeling. Students should join the listserv and read ongoing discussions. There are also archives that can be searched (e.g., by topic, author, etc.). The easiest way to join the listserv or search the archives is by simply going to:

http://bama.ua.edu/archives/semnet.html

where steps for joining and searching the archives are given. *Important note*: students should *read* the list. You should not post a question to the list without first thoroughly researching the literature, researching the archives of semnet for similar questions, and asking me about it.

Journals

Many journals publish articles involving structural equation models. If you look through journals in your research area, you will most likely find examples where SEM is used. Some journals that particularly focus on SEM and methodological issues are:

Structural Equation Modeling
Psychological Methods
Multivariate Behavioral Research
Sociological Methods and Research

Requirements and Grading

You should be familiar with regression analysis, working with data in a spreadsheet, and have some experience running statistical analysis on a computer. Class attendance and participation are important in order to successfully complete the course. Grades will be determined by at least two in-class quizzes (80%) and homework grades (20%).

Services for Students with Disabilities

The College will make reasonable accommodations for persons with documented disabilities. Students are encouraged to contact the Office of Access and Services for Individuals with Disabilities for information about registration (166 Thorndike Hall). Services are available only to students who are registered and submit appropriate documentation." As your instructor, I am happy to discuss specific needs with you as well.

IN Incomplete

The grade of Incomplete is to be assigned only when the course attendance requirement has been met but, for reasons satisfactory to the instructor, the granting of a final grade has been postponed because certain course assignments are outstanding. If the outstanding assignments are completed within one calendar year from the date of the close of term in which the grade of Incomplete was received and a final grade submitted, the final grade will be recorded on the permanent transcript, replacing the grade of Incomplete, with a transcript notation indicating the date that the grade of Incomplete was replaced by a final grade.

If the outstanding work is not completed within one calendar year from the date of the close of term in which the grade of Incomplete was received, the grade will remain as a permanent Incomplete on the transcript. In such instances, if the course is a required course or part of an approved program of study, students will be required to re-enroll in the course including repayment of all tuition and fee charges for the new registration and satisfactorily complete all course requirements. If the required course is not offered in subsequent terms, the student should speak with the faculty advisor or Program Coordinator about their options for fulfilling the degree requirement. Doctoral students with six or more credits with grades of Incomplete included on their program of study will not be allowed to sit for the certification exam.