

SYLLABUS
EAR 728 - Factor Analysis and Multidimensional Scaling
Instructor: Bond

Recommended Texts: Gorsuch, Factor Analysis (2nd Ed.), Factor Analysis I & II and MD Scaling (Sage)

General: This course combines introductions to Factor Analysis (FA) and Multidimensional Scaling (MDS). Both procedures attempt to uncover the "underlying structure" in a set of data, and the mathematical foundations underlying the two procedures are very similar. Over the course of the semester, we will explore in some detail the similarities and differences between the two, and the kinds of questions that each is best suited to answer. When you have completed this course, you should be able to (1) understand the basic mathematical foundations underlying FA and MDS, (2) determine what kinds of theoretical and practical questions can be answered using FA or MDS, and (3) set-up and run computer programs to perform each procedure and interpret the results.

Grading: Grades will be based upon two take-home examinations (a Mid-term and a Final) and one class presentation. The examinations will each account for 40% of the final grade, and the presentation will account for 20% of the final grade.

Examinations: Three or five questions requiring judgment and argument for which there are generally no "right" answers. By no "right" answers, I do **not** mean to imply that there are also no wrong answers, or more precisely, I do not mean to imply that there are no wrong-headed answers. There are many. If you happen to come up with a wrong-headed approach to a problem situation presented on one of the examinations, your rhetorical skills will have to be extraordinary to rescue the situation.

Presentations: The class presentation on factor analysis may be either (1) a discussion of your own data or other data available to you or (2) a discussion and critique of a published paper that employs factor analysis. (If the latter option is chosen, the paper must first be approved by me.) The presentation on multidimensional scaling **MUST** involve the analysis of data you have collected. (Note: Data collection for MDS is very straightforward and typically does not require a lot of subjects (for most purposes, 10 to 15 will do just fine).

Week 1	Some necessary preliminary statistics: <u>Basic Correlation and Regression Analysis</u>
Week 2	<u>Overview of Factor Analysis & MD Scaling Procedures</u>
Week 3	<u>Matrix Algebra</u>
Week 4	<u>The Basic Factor Analysis Model</u> The basic equations Common vs. Unique Variance Singular Value Decomposition of a matrix Factor loadings Correlation between variables & factors Correlation among variables in terms of factor loadings
Week 5	<u>The Basic Factor Analysis Model (Cont'd)</u>
Week 6	<u>Varieties of Factor analysis</u> Principal Axes Factor analysis The Centroid Solution The <u>Minimum Residual</u> (Minres) Solution The Maximum Likelihood Solution Alpha Factor Analysis Guttman's Image Factor Analysis
Week 7	<u>Factor Rotation</u> Factor score indeterminacy Purpose of factor rotation Graphical rotations Analytic rotations Criteria for rotation The varimax solution The Quartimax solution The Promax solution The Oblimin solution (Mid-term handed out)
Week 8	<u>Factor Analysis using SPSS-PC</u>

(Mid-term due)

Weeks 9 Introduction to Multidimensional Scaling (MDS)

What MDS can do
How MDS works
Similarity as the inverse of spatial distances
Various distance models
How MDS differs from factor analysis
How many dimensions and what they mean
Measures of Fit (The STRESS indices)

Week 10 Intro to MDS (Cont'd)

The similarity matrix and how it is obtained
Transforming similarities into scalar products
The Young-Householder Theorems
Unweighted MDS
Weighted MDS
Individual Differences

Week 11 MD Scaling on SPSS-PC

Setting up an ALSCAL Job
Understanding ALSCAL output
Some examples

Week 12 Class Presentations

Weeks 13 Class presentations

Week 14 Class presentations

(Final Exam handed out in class meeting before finals week. Due following week.)