

PSYC 943: Fundamentals of Multivariate Modeling

Homework #6 (Total 10 Points)

Due: Friday, October 18, 2013 at 12pm.

Comparing Path Models for Multivariate Regression with Maximum Likelihood in Mplus

This assignment uses data from the iris flower data set (see information here:

http://en.wikipedia.org/wiki/Iris_flower_data_set). The data are of four measurements from 150 observations of three species of irises. The Excel File for this week's homework has removed the character variable of the flower species and in its place put three dummy coded variables:

- dSetosa = 1 if the species was Setosa, = 0 if some other species
- dVersicolor = 1 if the species was Versicolor, = 0 if some other species
- dVirginica = 1 if the species was Virginica, = 0 if some other species.

Additionally, there is a variable named Species that has a 1 if the flower was Setosa, a 2 if the flower was Versicolor, and a 3 if the flower was Virginica.

NOTE: the data online are in two formats: Excel (.xls) and comma-delimited (.csv). The latter should be used with Mplus – it does not have a row of variable headers at the top of the file but those can be found in the Excel file.

Use Mplus (or an equivalent path analysis program) and estimate the following two models with Maximum Likelihood

1. Estimate a multivariate empty model where the four measurements are the DVs. Use an unstructured residual covariance matrix. Note: your log-likelihood should equal that from model 3 of HW #5.
2. Predict the values of all four measurements using the species of the flower. **In your code, for each measurement use an overall intercept that represents the value of the measurement for the Virginica species.** Use an unstructured residual covariance matrix. Note: your log-likelihood should be -98.412.

For each model include the STANDARDIZED option under the OUTPUT section.

Homework Problems:

1. What are the means and standard errors of the means for all four DVs from Model #1?
2. What is the (residual) covariance matrix for all four DVs from Model #1? Provide the standard error for each estimated variance/covariance.
3. What section of the Mplus output gives the (residual) correlation matrix for all four DVs from Model #1? List these estimated values and the standard error for each estimated correlation.
4. Is Model #1 nested within Model #2? If so, what would the null hypothesis be for testing the additional parameters in Model #2? What is the alternative hypothesis?
5. If Model #1 is nested within Model #2 use a likelihood ratio test to test the null hypothesis from Question #4. Provide the test statistic, degrees of freedom, and p-value.
6. What are the means and standard errors of the means all four DVs for *each species* from Model #2?
7. Does Model #2 assume the same or different residual covariance matrices for each species? Provide the standard error for each estimated residual variance/covariance.
8. List the estimated values and the standard error for each estimated residual correlation from Model #2.

9. How much variance is accounted for by species for each dependent variable?
10. Write a brief APA-style results section for the results from these models. Start your section with the two models compared and which was preferred. Following this, describe the results of the preferred model.

Extra Credit Problem #1 (bonus 3 points):

Using the MODEL CONSTRAINT section and the NEW command, for each DV create the mean difference for each pair of species (three pairs total). Provide the mean difference, the standard error, the Wald test statistic, and the p-value.

Extra Credit Problem #2 (bonus 3 points):

Using PROC IML (or some other matrix algebra program) calculate the generalized variance for the estimated residual covariance matrix from Model #1 and Model #2. Calculate the multivariate R^2 from these numbers.

Submission Instructions:

All homework and final answers must be your own and not be copied or paraphrased from anyone else's answers. Homework must be submitted via email (jtemplin@unl.edu) in the form of Microsoft Word document with the name: 943_FirstLast_HW#.docx. Late homework will have a penalty of 10% per calendar day.