

## **PSYC 943: Fundamentals of Multivariate Modeling**

### **Homework #7 (Total 10 Points)**

**Due: Friday, November 1, 2013 at 12pm.**

#### **Multivariate Models with Predictors**

The data for this assignment was collected as part of a collaborative effort between food sciences and marketing at Midwestern Red State University. The goal of the study was to ascertain to what extent restaurant preferences were conditional on specific menu offerings. In particular, 100 participants were asked to choose between mild or hot wings, and were asked to try either of these offerings at Applebees (APP), Buffalo Wild Wings (BW3), and Wing Zone (WZ). Each subject completed a survey about their opinions as to the quality of their wings at each restaurant in which higher scores are better; the mean across items on a 1 to 10 scale served as the primary outcome. The order of restaurant was randomized across participants.

Use the ratings data file and SAS PROC MIXED on stacked (long format) data to answer the following questions. Estimate each model referenced below using maximum likelihood within SAS PROC MIXED (and Kenward-Roger denominator degrees of freedom). The model for the means for each should include the main and interactive effects of wing type (mild or hot, a between-subjects factor) and restaurant (APP, BW3, and WZ, a within-subjects factor). The CLASS statement may be easier to use for this assignment, in which LSMeans can be used to request means and any F-tests, and ESTIMATE can be used for any specific comparisons between groups or DVs. The covariance structure will vary as instructed in questions 1-3. For questions 7 on, use the model with the covariance structure that most closely approximates the actual data without estimating unnecessary parameters (i.e., is more parsimonious if fit is equivalent).

#### **Homework Questions (1-35 worth .25 points each):**

1. What is the -2LL for a compound symmetry (CS) model for the covariance
2. What is the -2LL for a compound symmetry heterogeneous (CSH) model for the covariance
3. What is the -2LL for an unstructured model for the covariance
4. What is the test statistic, degrees of freedom, and p-value for the comparison of fit for CS vs. UN
5. What is the test statistic, degrees of freedom, and p-value for the comparison of fit for CS vs. CSH
6. What is the test statistic, degrees of freedom, and p-value for the comparison of fit for CSH vs. UN
7. What is the residual variance for Applebees (APP)
8. What is the residual variance for Buffalo Wild Wings (BW3)
9. What is the residual variance for Wing Zone (WZ)
10. What is the residual covariance between APP and BW3
11. What is the residual covariance between APP and WZ
12. What is the residual covariance between BW3 and WZ
13. What is the mean rating for mild wings at APP
14. What is the mean rating for mild wings at BW3
15. What is the mean rating for mild wings at WZ
16. What is the mean rating for hot wings at APP
17. What is the mean rating for hot wings at BW3
18. What is the mean rating for hot wings at WZ
19. What is the marginal mean rating for mild wings
20. What is the marginal mean rating for hot wings

21. What is the marginal mean rating for APP
22. What is the marginal mean rating for BW3
23. What is the marginal mean rating for WZ
24. What is the F-value for the  $df=1$  marginal main effect of wing type
25. What is the F-value for the  $df=2$  marginal main effect of restaurant
26. What is the F-value for the  $df=2$  interaction of wing type by restaurant
27. What is the F-value for the  $df=2$  main effect of restaurant for mild wings
28. What is the F-value for the  $df=2$  main effect of restaurant for hot wings
29. What is the F-value for the  $df=1$  main effect of wing type at APP
30. What is the F-value for the  $df=1$  main effect of wing type at BW3
31. What is the F-value for the  $df=1$  main effect of wing type at WZ
32. What is the t-value for the test of the preference for APP vs. BW3 and WZ for mild wings
33. What is the t-value for the test of the preference for BW3 vs. WZ for mild wings
34. What is the t-value for the test of the preference for WZ vs. APP and BW3 for hot wings
35. What is the t-value for the test of the preference for APP vs. BW3 for hot wings
36. Write up the analyses conducted and the results in an APA-formatted results section (1.25 points)

### **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](mailto: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.