

# MAX 526: Quantitative Models for Marketing

## Assignment 3

Total: 50 points

In this assignment, you will use a Nested Logit model to study store choice decisions of consumers. The data consists of a panel of consumers choosing between two stores to buy one of six different types of (Dannon) yogurt over a 52 week period. The data consists of the following SAS datasets - Products, Prodchars, Panel.

The SAS Documentation for Proc MDC will be found under SAS/ETS in the help files. The following sections of the documentation will be helpful to complete this assignment.

1. Details: MDC Procedure
2. Syntax: Proc MDC
3. Syntax: Model Utility and Nest statements
4. Examples: Decision Tree and Nested Logit

Submit your work as a report in a single PDF file. Make sure to properly refer to the question numbers in your report and include all relevant utility function equations and results. Properly organize and format your report to improve readability. Include all your code as an Appendix to the report and refer to it in the main report. Upload both your report and a file containing all your documented SAS code by the submission deadline.

*The values in parenthesis at the end of the questions indicate the maximum marks for the question. A (5) indicates that you will get 5 pts if you do the work correctly. A (3/5) value indicates that will get 3 pts if you do the analysis correctly and 2 points for the quality of your comments/inference.*

**Note: Do not include raw data or copy-paste all the SAS output in your report! Determine what is important and include only relevant information in your report. Remember to make a copy of the original data before you make changes!**

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In this exercise you will setup and estimate a nested logit model without an outside good. The exercise will walk you through the typical steps in setting up, estimating and interpreting a nested logit model. Most of the initial steps involves assembling the choice sets and forming the data for input to Proc MDC. Note that the *iri\_key* variable is an identifier for the store.

1. Begin by looking at the contents of each dataset using Proc Contents. Report what you observe. Compute the summary statistics for the characteristics of each product by store. Do you find any patterns? Use the *panel* dataset to compute the share of each included product. (3/5)
2. Define the total number of product  $J$  and stores  $S$  in the choice set. Write a data step to create and assign a unique id called JID to each product and a unique SID to each store. *Hint: JID=1,2,3...J; SID=1,2,...S.* Based on your understanding of the data, define the number of levels and the choices made in each nest. (3/5)
3. Assemble the choice set for each week. Use the *product* and *prodchar* dataset to create a choice set for each week. The choice set for a week should contain all stores, products in each store and their attributes in that week. Create alternative specific intercepts for each alternative in the choice set. Write out a matrix where the rows correspond to the alternatives and columns correspond to the intercepts. Write a data step to include the intercepts in the choice set dataset. Merge the weekly choicest data to the *panel* dataset and introduce a binary dummy variable *bought* to indicate the chosen product in the choice set. (3/5)
4. Write out the utility functions for a nested logit model with only the alternative specific intercepts for the lower level nests and only the inclusive values for the upper level nests. Specify the nested logit model in Proc MDC. Estimate the model and interpret the results. What can you conclude from the coefficients for the inclusive value terms? (3/5)
5. Add price as a covariate in the utility functions at the lower level. Write out the utility functions and estimate the model. Comment on your results. (3/5)
6. Add the display variable to the model. Write out the utility functions and estimate the model. Comment on your results. (3/5)
7. Add the feature variable to the model. Write out the utility functions and estimate the model. Comment on your results. (3/5)
8. Estimate a conditional logit model with 12 alternatives, price and display. Comment on the estimated parameters (5)
9. (Optional) Invert the model in Questions 6. Build a nested logit model where consumers choose the product first and then store for each product. Comment on your results. (0)
10. Tabulate the loglikelihood, AIC and BIC values for the estimated models. Which model would you select for subsequent analysis and why? (5)
11. Assume the the product manager of Dannon had given you this data with the hope that you would help him understand the market. Based on your analysis what would you report to the manager? (5)