Training Day 1, Asynchronous Activity 1: Exploring the mixture modeling output file from Mplus

In the file Here you will find things needed to complete this actively Namely,

1. The data file is "lca_lsay.dat"
2. Mplus input file titled "c4_lca.inp"
3. Note that you need to unzip files!).

Please answer the following questions.

1) Using the Mplus input file provided, estimate a 4-class LCA model (run the model using Mplus).

See annotated output file linked here: Annotated Mplus Output File

2) Find the output file and open it in Mplus. To help familiarize you with the Mplus output and the information provided when you estimate a mixture model, locate the following things in the output file. We will cover what these all are in Day 2.
- o Total analysis sample size. (i.e., "Number of observations…")
- **Number of observations = 3061**
- o Observed item response counts and proportions.
- **See annotated output file (highlighted)**
- o Number of free parameters.
- **Number of Free Parameters = 23**
- o Log Likelihood Value
- **H0 Value -8664.090**
- o Bayesian Information Criteria (BIC)
- **Bayesian (BIC) 17512.790**
- o Final class counts and proportions based on the estimated model.
- **See annotated output file (highlighted)**
- o Class separation: Entropy & Average Latent Class Probabilities.
- **See annotated output file (highlighted)**
- o Model-estimated item thresholds for each class.
- **See annotated output file (highlighted)**
- o Latent class multinomial logit means (class proportion/size).
- **See annotated output file (highlighted)**
- o Class-specific item response probabilities.
- **See annotated output file (highlighted)**

3) Thinking of this in terms of a latent variable measurement model, which parameters are "measurement parameters" and which parameters are "structural parameters"?

Measurement parameters: The item and class-specific threshold estimates (parameters)

Structural parameters: The class size proportions or intercept logit means.

4) Mplus will sometimes return a message similar to the following:

```
IN THE OPTIMIZATION, ONE OR MORE LOGIT THRESHOLDS APPROACHED EXTREME
VALUES OF -15.000 AND 15.000 AND WERE FIXED TO STABILIZE MODEL
ESTIMATION. THESE VALUES IMPLY PROBABILITIES OF 0 AND 1.  IN THE
MODEL RESULTS SECTION, THESE PARAMETERS HAVE 0 STANDARD ERRORS AND
999 IN THE Z-SCORE AND P-VALUE COLUMNS.
```

Using what you may remember about logits and their values, do you have any guesses as to what this warning message means? (e.g., you can convert these thresholds to probabilities)

 *HINT: Try copying the first sentence of the warning message and search with Google (if stuck you can watch this https://www.youtube.com/watch?v=iQb2x5EEBj4)

Logit thresholds of magnitude 15 translate to probabilities approaching 1 and 0. For example, a threshold of -15 when converted to probability equals 0.9999997 (approximately 1). For estimation purposes, Mplus fixes thresholds greater than 15 (or less than -15) at 15/-15 and consequently, the standard error is not estimated but fixed to zero. In Mplus the value "999" seen in the last two columns of the item threshold table indicates that the parameter was fixed.

6) In the output, find the Latent Class 2 threshold for item "USEFUL$1". Use the equation included in the logistic regression slides to manually convert this to a probability.

Probability = $1/(1+exp(\text{threshold}))$

= $1/(1+\exp(0.599)) = 0.355$