

**ASSIGNMENT 2**  
**ADVANCED METHODS AND ANALYSIS FOR THE LEARNING AND SOCIAL SCIENCES**  
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**KNOWLEDGE STRUCTURE**  
**DUE NOON, MONDAY FEBRUARY 6**

The goal of this assignment is to build improve the knowledge structure for the data set in Asgn1-dataset.csv (the same data set as assignment 1).

You must use an automated method to improve the knowledge structure of this data set. It is acceptable to use Barnes's Q-matrix method, Learning Factors Analysis, Learning Factors Transfer Analysis, Partial Order Knowledge Spaces, or any other automated method. You can use any existing software package, or can implement your own code in any programming language. It is also acceptable to hand-run an automated approach in Excel (show your work). However, it is **not** acceptable to simply change the skill mapping by hand and test.

You should present goodness of fit for both your modified knowledge structure, and the original knowledge structure. You can test your knowledge structure using any variant of PFA or LFA or BKT. If you create a knowledge structure mapping where one item can have multiple skills, you may only be able to test its effectiveness using a knowledge model that handles one-to-many item-skill mappings. You can use either the sum of squared residuals or  $A'$  as your measure of goodness of fit.

Your hand-in must include the new skill for each row in the data table, a list of all model parameters, and the final model's predictions for the probability that each student first attempt on a problem step is correct, for both the original model and your modified model. You must also turn in any code or Excel files (Matlab files, Maple files, etc. etc.) used in your computations. In the case of use of an existing package, it is acceptable to simply state what package you used. You should also turn in a document explaining how you completed the assignment (e.g. the automated method and implementation of it that you used, how you assessed model goodness, and how the resultant model differed from the original model in terms of the knowledge structure mapping. You will be graded on completeness and comprehensibility of your hand-in, whether you correctly and validly apply the method you choose to this data, and whether the methods you chose fit the parameter of this assignment.

**BONUS:** The student who succeeds in producing the largest improvement in the knowledge structure gets the bonus. "Best" is defined as the largest percent difference for the goodness metric, computed without considering the student. Cross-validation does not need to be used for this assignment.