

A New Model for Cognitive Diagnostic Computer-Adaptive Testing: An IRT-Based Continuous Conjunctive Latent Trait Diagnostic Modeling Approach

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Abstract: This study proposes a new modeling approach for implementing cognitive diagnosis in large scale testing, namely, the IRT-based continuous conjunctive latent trait diagnostic model, which combines the features of a multidimensional IRT (MIRT) model and a diagnostic classification model (DCM) into a single model. The new model can be viewed as an extension of Embretson's (1987) multicomponent latent trait model (MLTM; Embretson, 1985; 1997; Whitely, 1980), with item level a/g parameters and a Q-matrix. We will explore in detail the model identifiability, monotonicity, and estimation. In addition, we will compare the new model with the existing MIRT and DCM models in terms of

 model fit and
the amount of useful information about examinees' abilities that can be extracted from the response data.

Lastly, we will formulate item selection methods for computer adaptive testing that are tailored to this new model and evaluate their performance compared to a non-adaptive version.