Marginal maximum likelihood estimation in polytomous Rasch models using SAS

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Item response theory (IRT) models are statistical models used in situations where a questionnaire form the basis of an ordering of a group of subjects with respect to a unidimensional latent variable. The models are applicable in any situation where there is a need for describing the location of persons and items on an underlying latent scale. Important examples are found within the fields of educational research, physical functioning and psychological well-being.

Before an ordering of subjects can be done in a meaningful way a number of requirements must be met. These comprise unidimensionality, local independence, no DIF and monotonicity. These requirements are tested by fitting data to an IRT model. Traditionally, specialized software has been needed and this have limited the use of IRT models: Because they were not implemented in standard software the models were mainly been used in research environments where specialized software was available.

Fitting dichotomous (Tjur, 1982; TenVergert, Gillespie & Kingma, 1993) and polytomous (Agresti, 1993) Rasch models in standard software using conditional estimation is also possible. Conditional tests for unidimensionality of latent variables as well as parameter estimation and goodness-of-fit tests for regression models where either outcome variables or covariates are latent have been implemented in SAS macros (Christensen & Bjorner, 2003).

Recently procedures like PROC NLMIXED in SAS, the NLME library in Splus, and GLLAMM (Rabe-Hesketh, Skrondal & Pickles, 2004) in Stata has made ordinal random effects models a standard tool.

This talk describes a SAS macro that can be used to fit the polytomous Rasch models (Rasch 1960, Fischer & Molenaar, 1995), where the number of item categories are allowed to differ across items. The macro estimates item and person parameters and makes a plot of the item characteristic curves. It also plots a so-called Wright map that shows the locations of persons and items.
along the latent scale. Furthermore the macro plots item information functions and produces a graphical test of fit. The macro is flexible with regards to analyzing subsets of items as illustrated by a data example. Some useful extensions are discussed; inclusion of an item discrimination parameter, extensions to multidimensional models, and reduced rank parametrization useful in situations where the number of response categories is large.

References


