Exam questions

1. Describe some possible designs and statistical methods for obtaining evidence of measurement validity (consider concurrent, predictive, incremental, construct, and content validity).
2. Define tetrachoric and polychoric correlation.
3. Describe the single factor model, models for multiple factors, factor rotation, estimation of model parameters, and factor scores.
4. Define reliability under classical test theory (CTT), derive Spearman-Brown formula.
5. Define Cronbach's alpha and derive its properties.
6. Define some tools of traditional item analysis to describe item difficulty, discrimination, item functioning, item impact on reliability and validity, and missed items. Discuss (derive) how the traditional item difficulty and the item discrimination RIT index are related to parameters of the regression model describing item functioning.
7. Discuss how regression analysis may be used to describe item functioning. Define and describe some models for binary items. In the 4PL model, derive interpretations for parameters a, b, c, and d.
8. Discuss how regression analysis may be used to describe item functioning. Define and describe some models for polytomous items. In the adjacent categories logit model, derive the response category probabilities using the recursive formula. Discuss the relationship between the adjacent-categories logit model and the multinomial regression model.
9. Define IRT models for binary items and model assumptions. Describe some estimation methods.
10. Define IRT models for measurement instruments on Likert scale, including the graded response model (GRM), graded rating scale model (GRSM), partial credit model (PCM), generalized partial credit model (GPCM), rating scale mode (RSM). For each model, provide a model equation and discuss related regression models.
11. Define the nominal response model (NRM) using various parametrizations. Describe the relationship between NRM and the multinomial regression model. Derive the response category probabilities using the recursive formula.
12. Define and discuss some multidimensional IRT models.
13. Describe some methods for analyzing the differential item functioning (DIF): one traditional DIF detection method, one using a group/specific regression model, and one using a group/specific IRT model.
14. Describe the steps in the computerized adaptive testing (CAT).