

Selected topics in psychometrics, NMST570

L3: Item Response Theory Models

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Exercise 1

Consider the following two 2-parameter items:

- Item 1. $a = 1.7$, $b = .7$
- Item 2. $a = 1.4$, $b = .8$

In **IRT models/Training Section**

- Sketch the item characteristic curve for each of the items.
- Calculate probability of correct answer $P_1(\theta)$ and $P_2(\theta)$ for latent abilities $\theta = -2, -1, 0, +1, +2$.
- For what θ are $P_1(\theta)$ and $P_2(\theta)$ equal?
- How do $P_1(\theta)$, $P_2(\theta)$ change if you introduce guessing $c = 0.2$?
- How do $P_1(\theta)$, $P_2(\theta)$ change if you introduce inattention $d = 0.8$?

Exercise 2

Consider the GMAT dataset (default) or HCI dataset

- How many items and how many respondents are in the dataset?
- Fit the Rasch model. How many parameters are estimated?
- Which item has lowest difficulty?
- What is the relationship between standardized total score Z and estimated latent ability?
- Interpret Item-Person Map
- Fit 1PL, 2PL, 3PL and 4PL models. How many parameters are estimated?
- Which item has lowest/highest difficulty and discrimination in 2PL model?
- What is the relationship between Z and estimated latent ability?
- Check item fit.
- Run analysis in R

Exercise 3

Consider neuroticism data `neuroticism500.csv`. Use R.

- How many items and how many respondents are in the data? How are the items rated?
- Fit GRM. How many parameters are estimated? Provide table with discrimination and location parameters for each item.
- Fit 1PL version of GRM (with equal discriminations for all items). Provide table with discrimination and location parameters for each item.
- Use some criteria to decide between these two models.
- Plot Category Response Curves for all items.
- Plot Item Information Curves. Which item is the most informative for average respondent?
- Plot Test information Function. For what type of respondents is the instrument most informative?
- Provide table with response patterns, estimated latent trait scores (factor scores) and their standard errors for first 10 respondents.
- Fit GPCM, PCM, NRM. Interpret as above. Compare the results.
- Download and install student version of IRTPRO from <http://www.ssicentral.com/irt/student.html>
- Run in IRTPRO. Compare results.