L3: Item Response Theory Models

Selected topics in psychometrics, NMST570

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April 3, 2018

Exercise 1: Dichotomous IRT models

Consider the following two 2-parameter items:

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

Use ShinyItemAnalysis `https://cemp.shinyapps.io/ShinyItemAnalysis/`, section **IRT models/Training - Dichotomous models**

- 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 innatention $d = 0.8$?

Exercise 2: Data analysis with dichotomous IRT models

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`