

# Homework assignment

## L6: IRT models for binary data

**Assignment date:** 19.11.2019  
**Deadline:** 25.11.2019 23:59  
**Slides:** <http://www.cs.cas.cz/martinkova/NMST570>  
**Note:** Send answers and screenshots to [hladka@cs.cas.cz](mailto:hladka@cs.cas.cz)  
**Name:**

### 1 Training in ShinyItemAnalysis

Run `ShinyItemAnalysis` online or locally.

**Ex. 1.1** Finish Exercise 1 in IRT/Training/Dichotomous models tab. Provide proof (screenshot). [4]

**Ex. 1.2** Finish Exercise 2 in IRT/Training/Dichotomous models tab. Provide proof (screenshot). [1.25]

**Ex. 1.3** Finish Exercise 3 in IRT/Training/Dichotomous models tab. Provide proof (screenshot). [1.25]

### 2 Real data analysis

**Ex. 2.1** The EPI is a very frequently administered personality test with 57 items measuring two broad dimensions, Extraversion-Introversion and Stability-Neuroticism, with an additional Lie scale. Download E-score data (24 items) available at

[http://www.cs.cas.cz/hladka/documents/epi\\_escore.csv](http://www.cs.cas.cz/hladka/documents/epi_escore.csv)

Upload data into `ShinyItemAnalysis` and answer following questions:

1. How many observations does data consist of and which items are included in E-score part? [0.25]
2. Fit Rasch model.
  - Which is the easiest item? [0.125]
  - Which is the most difficult one? [0.125]
  - What is the correlation between standardized total scores and factor scores? [0.125]
3. Fit 1PL IRT model.
  - How does the estimate of discrimination in this model differ from Rasch model? Briefly comment. [0.25]
  - Which item is the most informative? [0.125]
4. Fit 2PL IRT model.
  - Which items do have negative discrimination? Read their wording:

<http://febiassessment.com/test/eysencks-personality-inventory-epi-extroversionintroversion/>

and try to explain. [0.75]

- What is the most informative item? [0.125]
- What is the correlation between standardized total scores and factor scores? Compare to Rasch model. [0.125]

NOTE: Data `epi_escore` is binary. Use **Keep item names** option for easier interpretation. You can find wording of the items in `epi.dictionary` data of `psych` package.

**Ex. 2.2** In Ex. 2.1 using 2PL model we noticed that some items have negative discrimination. Upload data into R, use `mirt` library and answer following questions. You can also use sample R script available at:

[http://www.cs.cas.cz/hladka/documents/NMST570\\_HW6.R](http://www.cs.cas.cz/hladka/documents/NMST570_HW6.R)

1. Reverse items with negative discrimination using `reverse.items()` function. [0.125]
2. Fit 2PL IRT model with `mirt()` function. [0.125]
3. Compare estimated item parameters in original data and in data with reversed items. How did the discrimination change? How did the difficulty change? [0.75]
4. Use function `fscores()` to extract factor scores from 2PL IRT model on original data and on data with reversed items. Compare estimates. Briefly comment. [0.5]

### 3 Provide feedback

Here you can provide feedback on lecture, lab session and/or materials (slides, HW assignment, ShinyItemAnalysis manual) [1pt bonus] :)