Homework assignment
L6: IRT models for binary data

Assignment date:	**24.11.2020**
Deadline:	**30.11.2020 23:59**
Slides:	http://www.cs.cas.cz/martinkova/NMST570
Note:	Send answers and R script to hladka@cs.cas.cz and martinkova@cs.cas.cz (in CC)
	Include NMST570 in subject of your e-mails
Name:	

Lecture presentation

Watch lecture presentation (online Zoom, or video shared on course webpage) and provide answer(s) to question(s) posed in the presentation.

Reading with Perusall (alternative)

It is possible to skip up to 4 HW assignments and to provide satisfactory feedback (10 relevant annotations, each may gain up to 1 point) to readings instead (Chapter 7 and relevant R code this week).

1   Reading with Perusall

Provide 1 annotation in Czech or in English to assigned reading (Chapter 7 and relevant R code this week) [1].

2   Training in ShinyItemAnalysis

Run ShinyItemAnalysis online or locally.

Ex. 2.1   Finish Exercise 1 in IRT/Training/Dichotomous models tab. Provide proof (screenshot). [3]

Ex. 2.2   Finish Exercise 2 in IRT/Training/Dichotomous models tab. Provide proof (screenshot). [1.25]

Ex. 2.3   Finish Exercise 3 in IRT/Training/Dichotomous models tab. Provide proof (screenshot). [1.25]

3   Real data analysis

Ex. 3.1   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

> https://github.com/patriciamar/psychometrics_intro/blob/master/datasets/EPI/epi_escore.csv

Upload data into the ShinyItemAnalysis application and answer following questions:
NOTE: Data epi_escore is binary. Use **Keep item names** option for easier interpretation.

1. How many observations does the data consist of and which items are included in the E-score part? [0.25]

2. Fit the Rasch model.
   - Which item is the easiest? [0.125]

- Which item is the most difficult one? [0.125]

- What is the correlation between the standardized total scores and the factor scores? [0.125]

3. Fit the 1PL IRT model.
   - How do the estimates of the discrimination parameters in this model differ from those in the Rasch model? Briefly comment. [0.25]

   - Which item is the most informative one? [0.125]

4. Fit the 2PL IRT model.
   - Which items do have a negative discrimination? Read item wording at

   > https://stylemanagementexperience.com/test/eysencks-personality-inventory-epi-extroversionintroversion/

   and try to explain. [0.75]

   - Which item is the most informative one? [0.125]

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

Ex. 3.2 In Ex. 3.1 using the 2PL model we noticed that some items have negative discrimination. Upload data into R, use the `mirt` package and answer the following questions. You can also use sample R script available at:

> http://www.cs.cas.cz/hladka/documents/NMST570_HW6.R

1. Reverse items with negative discrimination using the `reverse.items()` function. [0.125]

2. Fit the 2PL IRT model with the `mirt()` function. [0.125]

3. Compare estimated item parameters in original data and in data with the reversed items. How did the discrimination change? How did the difficulty change? Briefly comment [0.75]

4. Use function `fscores()` to extract factor scores from the 2PL IRT model on original data and on data with the reversed items. Compare estimates. Briefly comment. [0.5]

4   Provide feedback

Here you can provide feedback on lecture, lab session and/or materials (slides, video presentation, HW assignment, `ShinyItemAnalysis` application, etc.) [1pt bonus] :)