Homework assignment

L8: IRT models for ordinal and nominal items

Assignment date:	**27.11.2018**
Deadline:	**3.12.2018 23:59**
Slides:	http://www.cs.cas.cz/martinkova/NMST570
Note:	Send answers and `R` script to drabinova@cs.cas.cz
Name:	

1 ShinyItemAnalysis

Open IRT models/Training/Polytomous models in `ShinyItemAnalysis`

https://shiny.cs.cas.cz/ShinyItemAnalysisNMST570/

and answer following questions:

Ex. 1.1 Consider item following graded response model rated 0-1-2-3, with discrimination $a = 1$ and difficulties $b_1 = -0.5, b_2 = 1$ and $b_3 = 1.5$.

1. Fill in table with probabilities of obtaining k and more points for specific level of ability θ [1.5]

		θ				
		-2	-1	0	1	2
$k \geq$	0					
	1					
	2					
	3					

2. Fill in table with probabilities of obtaining exactly k points for specific level of ability θ [1.5]

		θ				
		-2	-1	0	1	2
$k =$	0					
	1					
	2					
	3					

   HINT: What should be the sum in the columns?

3. What is the expected item score for latent abilities $\theta = -2, -1, 0, 1, 2$? [0.5]

Ex. 1.2 Consider item following generalized partial credit model rated 0-1-2, with discrimination $a = 1$ and threshold parameters $d_1 = -1$ and $d_2 = 1$.

1. For what ability levels do the category probability curves cross? [0.3]
2. What is the expected item score for these ability levels? [0.3]
3. Change discrimination to $a = 2$. Do the category probability curves cross for the same ability levels? How did the expected item score change for these ability levels? [0.4]

2 Real data analysis

Consider neuroticism data `neuroticism500.csv` available at

http://www.cs.cas.cz/drabinova/documents/neuroticism500.csv

Use pseudo `R` code

http://www.cs.cas.cz/drabinova/documents/NMST570_HW8.R

modify it and answer following questions

Ex. 2.1 Describe basic properties of the dataset:

1. How many items and how many respondents are in the data? [0.125]
2. How are the items rated? [0.125]

Ex. 2.2 Consider graded response model and use `mirt` library.

1. Fit graded response model with the same discrimination for all items. Provide table with discrimination and location parameters for each item. [0.5]
2. Fit graded response model with no constrain. Provide table with discrimination and location parameters for each item. [0.5]
3. Use some criteria to decide between these two models. [0.5]
4. For better model, plot category response curves for all items. [0.25]
5. For better model, plot item information curves for all items in one plot. [0.25]
6. For better model, plot test information function. For what type of respondents is the instrument the most informative? [0.5]

3 Reading

Read "Empirical Example" in chapter 7 "Partial Credit Model" of Handbook of Item Response Theory, volume 1 and answer following questions.

Ex. 3.1 Describe data used in empirical example

1. How many markers judged the quality of essays? [0.125]
2. What was the grade scale used by markers? [0.125]
3. How many essays did each marker mark? [0.125]

Ex. 3.2 Read "Measuring Essay Quality" and answer following questions:

1. Briefly describe how was the quality of essays estimated. [0.25]
2. What was the best quality essay? [0.125]
3. What was the least quality essay? [0.125]
4. Briefly describe marking patterns in Essay 22 (Figure 7.2). [0.5]

Ex. 3.3 Read "Calibrating Markers".

1. Briefly describe how was the behavior of markers assessed. [0.25]
2. Markers 57, 25, 43, and 24 are describes as "typical", "harsh", "lenient", and "noncommittal". Briefly describe why. [0.75]

3. Explain why different uses of grades does not have to be source of misfit. [0.125]
4. Provide an example of how it could be avoided of different use of grades. [0.25]

4 Provide feedback

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