

Selected topics in psychometrics

NMST570 (1/1 C+Ex, 3 credits)

Instructor:	Patřicia Martinkova, Ph.D.
TA:	Adela Drabinova, MSc.
Lectures:	Tuesday, 3:40 – 4:30pm, room K11, Sokolovska 83, Praha 2
Lab sessions:	Tuesday, 4:30 – 5:10pm, room K11, Sokolovska 83, Praha 2
Course webpage:	www.cs.cas.cz/martinkova/NMST570.html

Course description:

Psychometrics uses statistical models for analysis of educational and psychological tests. This course covers main topics in psychometrics, such as traditional item analysis, reliability and validity of measurement, use of logistic and nonlinear regression models, item response theory models, differential item functioning, computerized adaptive testing, etc. Methods are demonstrated using data from admission tests and other assessments. Exercises are prepared in freely available statistical software R, other psychometric software is also introduced.

Tentative outline:

- Introduction (2.10.2018)
- Reliability and measurement error (9.10.2018)
- Validity (16.10.2018)
- Traditional item analysis (23.10.2018)
- Regression models for item description (30.10.2018)
- IRT models for binary data (13.11.2018)
- IRT models for binary data (20.11.2018)
- IRT models for ordinal and nominal items (27.11.2018)
- Differential item functioning (1-2 lessons) (4.12.2018, 11.12.2018)
- Computerized adaptive testing (18.12.2018)
- Assessment development and validation. Final project assignment (8.1.2019)

Course goals:

After taking this course you should be able to:

1. Name the main topics studied in psychometrics
2. Describe and apply strategies to find proofs about validity of assessment instrument
3. Describe and apply strategies to find proofs about reliability of the instrument
4. Describe and apply traditional methods to describe item functioning (difficulty, discrimination, distractor analysis)
5. Explain how logistic regression may be used to describe item properties, apply regression models on real data and interpret results
6. Formulate IRT models for binary, polytomous and nominal items (Rasch model, 1-4 parameter IRT model, Graded Response Model, Generalized Partial Credit Model, Rating Scale Model, Nominal Response Model), apply them on real data and interpret results
7. Explain concept of Differential item functioning, describe and apply some DIF detection methods (Mantel-Haenszel Test, Logistic regression, IRT-based Lord's test, Raju's test etc.)
8. Explain process of computerized adaptive testing, prepare your own adaptive test
9. Describe process of assessment development and validation and apply its steps in real situations

Course texts:

- Lecture notes / ShinyItemAnalysis tutorial
- Rao, C. R. & Sinharay S. (2006). Handbook of Statistics. Volume 26: Psychometrics. Amsterdam, NL : Elsevier.
- van der Linden, W. J. (2016). Handbook of item response theory: Models, statistical tools, and applications (Vols.1-3). Boca Raton, FL: Chapman & Hall/CRC.

Grading policy:**Course credit requirements:**

The credit for the exercise class will be awarded to the student who is present at the exercise class sessions (two absences are tolerated) and hands in a satisfactory solution (at least 60% of points) to each homework (10 assignments in total) by the prescribed deadline. In case of more than two absences, student needs to excuse in advance and he/she will receive extra work. Homework will be assigned during lab sessions and deadline to hand in homework will be one week after.

Exam/Grade:

Final project will be assigned during the last lecture. You are welcome and encouraged to use your data for the project in lieu of the project assigned to the class. In such a case, you are expected to prepare written project proposal and submit it to the lecturer at least one week before the last lecture. Final grade will be assigned during oral examination, which will consist of follow up questions on handed homework (50%) and on final project (50%).