**Link for the ZOOM sessions**

Topic: IRT

Join Zoom Meeting

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**Final Essay IRT SoSe 2022**

Deadline: 30.09.2022

About 20 to 25 pages (analyses included), but I will not stop you if you want to do more (feel free to create a markdown if you want). Please do not make up pages by plotting graphs/pictures and outputs of analyses in a very large format, or by writing down very long mathematical derivations when not necessary, or by adding not needed references. Please do not plagiarize material (e.g., copy pasting entire paragraphs from other sources or use the content of entire sections of other works to make up your essay by simply rephrasing their content). It does not count in favour of a good score. Please keep in mind that it is not only a matter of “repeating” what someone else says but more of discussing it with your own words, with a particular focus on the implications and meaning of the concepts. Feel free to use not only the class and tutorium material but also any material or reference you find on your own. The important point is to have “a critical eye” on the problem.

To structure your essay, make use of Sections and Subsections.

Please use font size 11 and border margins of 2.5cm on the left and right.

Please reference all used source materials according to some standard (ideally APA, but any format common in your field is acceptable). Correct referencing is an important part of the writing process. Again, use and cite material appropriately, do not plagiarize.

Choose one of the three “Essays” below and elaborate. Essay 1 is a free essay, Essay 2 is a structured essay with a given dataset and a theoretical part. Essay 3 is the same of Essay 2 but with a dataset of your choice. The BONUS exercises are those granting the best scores (provided that all the rest is also well done of course). You do not have to follow exactly the order given by the suggested points, but the more you cover the better the grade. Essay 1 is more complex to properly write than Essays 2 and 3. This will be positively taken into account in the grading.

**Essay 1**

Choose a topic in IRT and elaborate on it. The topic is of your choice but it should be covered from both a theoretical and an applied perspective and quite in detail. E.g., if you decide to explore the interface between IRT and machine learning imagine to write down a mini-review and to include applied parts to show the implementation of the methods and the complexity of the problems.

**Essay 2**

**Main practical exercise (about 15-20 pages analyses included)**

The dataset in the file “SCS\_data.xlsx” contains more the responses of more than 3000 individuals to the items of the Sexual Compulsivity Scale (SCS). This scale, made up of 10 four-points Likert items, is a self-report widely used in research studies about high libido, [hypersexuality](https://en.wikipedia.org/wiki/Hypersexuality) and [sexual addiction](https://en.wikipedia.org/wiki/Sexual_addiction), and one of the most widely used measure of SC among gay and bisexual men. Both items and rating categories can be found online (e.g., <https://en.wikipedia.org/wiki/Sexual_Compulsivity_Scale>).

Analyse the dataset. You do not have to follow exactly the order of the points given below but the more topics you cover, and the more extensively you cover them, the better the grade. Please keep in mind that is not just a matter of showing code and numeric outputs but of also discussing with your own words the implications and meaning of results.

1. Prepare the dataset for further analysis: A 0 in the data stands for missing value. The responses to the items are coded from 1 to 4. Treat the third gender option (gender=3) as missing value. Brief descriptive statistics and decide how to treat missing data.
2. Decide how to dichotomize the items and provide a CTT and an IRT analysis.
   1. Calculate proportion of correct responses and biserial correlations and discuss them.
   2. Estimate a Rasch model with at least three different packages/method of your choice (BONUS I: one package is *lavaan*). Compare, interpret, and discuss the meaning and results for the estimated parameters. Plot and discuss the ICCs. Analyse the fit of the items and discuss the implications.
   3. Discuss if and which alternative IRT models (e.g., 2PL) you think are feasible. If feasible, choose one and discuss and compare it to the Rasch model in terms of estimated parameters, and Infit/Outfit indexes.
   4. Investigate DIF of the dichotomized data
3. It has been suggested that items form two subfactors: one given by Q1-Q4 and Q10 since they concern consequences for lifestyle, and one given by items Q5-Q9 since they mainly address compulsivity of sexual thoughts. If possible, fit and compare unidimensional, correlated-traits, bifactor, and hierarchical models to the original categorical data. Establish the best fit model and discuss the possible implications. (BONUS II: discuss to which subscale item Q10 should belong and why).
4. Calculate all indexes needed to discuss the reliability and the unidimensionality of the scale and whether sum scores can be used to measure the general factor and the subscales. Comment on the results. Compare and discuss the results of different estimates of omega.
5. Investigate measurement invariance (of the original categorical data) w.r.t. the demographics (Age, Gender: M/F) and discuss the results (compare it to the DIF analysis in point 4).
6. BONUS III: Analyse the original data with a polytomous IRT model.

**Theoretical Exercise**

Choose one topic among those listed below. Please elaborate on the topic using your own words (About 3-4 pages, font size 11, border margins of 2.5cm on the left and right), do not merely copy-paste and provide correct referencing according to some style (e.g., APA). Feel free to use not only the class and tutorium material but also any material or reference you find on your own. The important point is to have “a critical eye” on the problem and make the pieces fit together.

1. Discuss the relation between Item Response Theory and Factor Analysis.
2. Describe the main differences between Classical Test Theory and Item Response Theory.
3. Discuss the assumptions and limits of IRT models in testing and assessment.

**Essay 3**

Same as Essay 2 but use a dataset of your choice for the practical part (please provide me the data together with the final essay and script).