Exercises session 4: Ordered Categorical Indicators

Exercise 6.1

Bartholomew, Steele, Galbraith, and Moustaki (2008) analyzed four items from the British Social Attitudes Survey concerning abortion. The item responses from 379 respondents are available in the Abortion data from the ltm package. The items are given in Table 6.6. For each items, respondents were to indicate yes (1) or no (0) on whether abortion should be allowed. We will rename the items I1-I4.

```
library(ltm)
summary(Abortion)
```

```
##      Item 1          Item 2           Item 3           Item 4
##  Min.   :0.000   Min.   :0.0000   Min.   :0.0000   Min.   :0.0000
##  1st Qu.:0.000   1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.:0.0000
##  Median :0.000   Median :1.0000   Median :1.0000   Median :1.0000
##  Mean   :0.438   Mean   :0.5937   Mean   :0.6359   Mean   :0.6174
##  3rd Qu.:1.000   3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:1.0000
##  Max.   :1.000   Max.   :1.0000   Max.   :1.0000   Max.   :1.0000
```

```
names(Abortion) <- c(paste0("I", 1:4))
```

Hint: use 'ordered = paste0("I", 1:4)' to declare the items as ordered categorical in using the cfa() function.

a) Find the proportion who endorsed each item (i.e., the mean score).

b) Fit a CFA for binary responses using the CFA function, assuming a single latent variable underlies the item responses.

c) Evaluate overall model fit.

Inspect the estimated thresholds and loadings to answer the following questions:

d) If you would have to create a 1-item abortion attitude test, which item would you select?

e) If the 1-item test has to be used to find persons with extremely liberal views on abortion, which item would you select?

f) Looking at the discrimination parameters (loadins) and their standard errors, would you expect the Rasch or 2pl model to fit better?

g) Statistically test whether the Rasch or 2pl model fits better.

Exercise 6.2

Beaujean and Sheng (2010) conducted an IRT analysis of the ten-item vocabulary test from the General Social Survey. Data from the respondents with responses to all 10 items (n = 2943) from the 2000 decade group are available as a space delimited file (gss2000.dat), and the items are named word.a-word.j. Get the file gss2000.dat from the github repository. To load it in R, type:

```
gssdat <- read.table("gss2000.dat", header = TRUE)
```

Hint: use following code in cfa() function: ordered = paste0("word.", letters[1:3])

a) Conduct an item-level confirmatory factor analysis with one latent variable. Analyze only the first three items, as analyzing all 10 will involve a lot of typing.

b) What are the easiest and most difficult items?

c) What are the best and worst indicators of the latent trait? directly using ltm().

d) Does the Rasch, or the 2pl model fit the 3 vocabulary items better?

Additional exercise: HADS

Get the HADS.sav file from github and open it in R using:

```
library(foreign)
HADSdata <- read.spss("HADS.sav", to.data.frame = TRUE)
```

```
## re-encoding from UTF-8
```

The file contains item responses of 502 respondents to the 7 anxiety items on the Hospital Anxeity and Depression Scale.

a) Fit the graded response model to the responses.
b) Which category from which item is the 'easiest'?
c) What do we mean by 'easiest' in this case?
d) Are all category thresholds ordered similarly across items?
e) Fit a partial credit model to the item responses.
f) Test whether the GRM or PCM fits the responses best.