

Answers to exercises ordered categorical indicator variables

Exercise 6.1

Item wordings:

1. The woman decides on her own that she does not wish to have a child.
2. The couple agree that they do not wish to have a child.
3. The woman is not married and does not wish to marry the man.
4. The couple cannot afford any more children.

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

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

```
colMeans(Abortion)
```

```
##          I1          I2          I3          I4
## 0.4379947 0.5936675 0.6358839 0.6174142
```

Item I3 is the most-endorsed (easiest) item, item I1 is the least endorsed (most difficult) item.

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

```
library("lavaan")
model <- '
  lib_ab_views =~ I1 + I2 + I3 + I4
'
fit.abo <- cfa(model, data = Abortion, ordered = paste0("I", 1:4))
summary(fit.abo, standardized = TRUE, fit.measures = TRUE)
```

```
## lavaan 0.6.15 ended normally after 13 iterations
##
##      Estimator                      DWLS
##      Optimization method           NLMINB
##      Number of model parameters              8
##
##      Number of observations              379
##
## Model Test User Model:
##
##      Standard      Scaled
##      Test Statistic    7.291    12.647
```

```

## Degrees of freedom                2          2
## P-value (Chi-square)              0.026       0.002
## Scaling correction factor          0.587
## Shift parameter                   0.234
## simple second-order correction
##
## Model Test Baseline Model:
##
## Test statistic                    4919.480    3905.848
## Degrees of freedom                6          6
## P-value                          0.000       0.000
## Scaling correction factor          1.260
##
## User Model versus Baseline Model:
##
## Comparative Fit Index (CFI)        0.999       0.997
## Tucker-Lewis Index (TLI)          0.997       0.992
##
## Robust Comparative Fit Index (CFI)          0.944
## Robust Tucker-Lewis Index (TLI)          0.831
##
## Root Mean Square Error of Approximation:
##
## RMSEA                            0.084       0.119
## 90 Percent confidence interval - lower    0.025       0.062
## 90 Percent confidence interval - upper    0.153       0.185
## P-value H_0: RMSEA <= 0.050            0.145       0.025
## P-value H_0: RMSEA >= 0.080            0.614       0.880
##
## Robust RMSEA                      0.377
## 90 Percent confidence interval - lower    0.179
## 90 Percent confidence interval - upper    0.611
## P-value H_0: Robust RMSEA <= 0.050      0.007
## P-value H_0: Robust RMSEA >= 0.080      0.990
##
## Standardized Root Mean Square Residual:
##
## SRMR                            0.029       0.029
##
## Parameter Estimates:
##
## Standard errors                    Robust.sem
## Information                        Expected
## Information saturated (h1) model    Unstructured
##
## Latent Variables:
## Estimate Std.Err z-value P(>|z|) Std.lv Std.all
## lib_ab_views =~
## I1          1.000          0.921    0.921
## I2          1.020    0.035   29.205    0.000    0.940    0.940
## I3          1.046    0.032   32.997    0.000    0.964    0.964
## I4          0.982    0.034   28.553    0.000    0.905    0.905
##
## Intercepts:

```

```

##               Estimate Std.Err z-value P(>|z|) Std.lv Std.all
##      .I1           0.000           0.000           0.000           0.000
##      .I2           0.000           0.000           0.000           0.000
##      .I3           0.000           0.000           0.000           0.000
##      .I4           0.000           0.000           0.000           0.000
##      lib_ab_views  0.000           0.000           0.000           0.000
##
## Thresholds:
##               Estimate Std.Err z-value P(>|z|) Std.lv Std.all
##      I1|t1         0.156      0.065      2.410      0.016      0.156      0.156
##      I2|t1        -0.237      0.065     -3.639      0.000     -0.237     -0.237
##      I3|t1        -0.347      0.066     -5.273      0.000     -0.347     -0.347
##      I4|t1        -0.299      0.066     -4.559      0.000     -0.299     -0.299
##
## Variances:
##               Estimate Std.Err z-value P(>|z|) Std.lv Std.all
##      .I1           0.151           0.151           0.151           0.151
##      .I2           0.117           0.117           0.117           0.117
##      .I3           0.071           0.071           0.071           0.071
##      .I4           0.182           0.182           0.182           0.182
##      lib_ab_views  0.849      0.040     21.276      0.000      1.000      1.000
##
## Scales y*:
##               Estimate Std.Err z-value P(>|z|) Std.lv Std.all
##      I1            1.000           1.000           1.000           1.000
##      I2            1.000           1.000           1.000           1.000
##      I3            1.000           1.000           1.000           1.000
##      I4            1.000           1.000           1.000           1.000

```

- c) The robust χ^2 value are significant, which is to be expected with a sample size of 379. The robust CFI indicates good model fit, as does the SRMR. The robust RMSEA indicates that the model does not fit well, and the p -value of the close fit test indicates that close fit should be rejected.

Looking at the standardized loadings, all are significant and substantial. All loadings have similar values. The variance of the latent trait is significant.

All in all, I would conclude that model fit seems acceptable.

- d) If you would have to create a 1-item abortion attitude test, I would use Item 3, because it has the highest discrimination parameter.
- e) If the 1-item test has to be used to find persons with extremely liberal views on abortion, I would select the item with the highest threshold (difficulty): Item 1. Persons agreeing with this statement have relatively the most liberal views on abortion.