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 0.6-5 ended normally after 13 iterations
##
##   Estimator                                         DWLS
##   Optimization method                           NLMINB
##   Number of free parameters                          8
##
##   Number of observations                           379
##
## Model Test User Model:
##                                               Standard      Robust
##   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
##     for the simple second-order correction
##
## Model Test Baseline Model:
##
```

```
##   Test statistic                                4919.479    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)                              NA
##   Robust Tucker-Lewis Index (TLI)                                 NA
##
## 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 RMSEA <= 0.05                            0.145       0.025
##
##   Robust RMSEA                                                    NA
##   90 Percent confidence interval - lower                          NA
##   90 Percent confidence interval - upper                          NA
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                             0.029       0.029
##
## Parameter Estimates:
##
##   Information                                 Expected
##   Information saturated (h1) model        Unstructured
##   Standard errors                           Robust.sem
##
## 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
##    .I2                0.000                               0.000    0.000
##    .I3                0.000                               0.000    0.000
##    .I4                0.000                               0.000    0.000
##     lib_ab_views      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
##    .I2                0.117                               0.117    0.117
##    .I3                0.071                               0.071    0.071
##    .I4                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
##     I2                1.000                               1.000    1.000
##     I3                1.000                               1.000    1.000
##     I4                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.