Exercises session 5: Multigroup analyses

```
library("lavaan")
```

```
## Warning: package 'lavaan' was built under R version 3.4.4
```

```
## This is lavaan 0.6-1
```

```
## lavaan is BETA software! Please report any bugs.
```

Exercise 4.1: Measurement invariance between the WISC and WISC-IV

In this exercise, we will compare the measurement models underlying two different versions of the Wechsler Intelligence Scale (WISC): the original WISC and the WISC-IV. In fact, the data come from the same sample of participants, who completed both the WISC and the WISC-IV, but we are ignoring this repeated measures structure here, which may not be completely appropriate.

First, we read in the data:

```
WISC.cor <- lav_matrix_lower2full(c(
  1.00,
  0.31, 1.00,
  0.36, 0.40, 1.00,
  0.51, 0.46, 0.45, 1.00,
  0.29, 0.40, 0.33, 0.43, 1.00,
  0.39, 0.29, 0.27, 0.36, 0.33, 1.00,
  0.32, 0.27, 0.29, 0.33, 0.24, 0.28, 1.00,
  0.22, 0.32, 0.15, 0.22, 0.27, 0.12, 0.26, 1.00
))
WISC.means <- c(7.83, 5.50, 5.67, 21.50, 7.67, 8.00, 6.50, 34.83)
WISC.sds <- c(2.69, 1.50, 2.36, 6.06, 1.85, 2.18, 5.97, 9.94)
WISC.cov <- cor2cov(WISC.cor, sds=WISC.sds)

WISCIV.cor <- lav_matrix_lower2full(c(
  1.00,
  0.46, 1.00,
  0.58, 0.55, 1.00,
  0.63, 0.43, 0.73, 1.00,
  0.27, 0.51, 0.37, 0.33, 1.00,
  0.45, 0.38, 0.37, 0.43, 0.13, 1.00,
  0.33, 0.52, 0.49, 0.41, 0.29, 0.43, 1.00,
  0.15, 0.27, 0.16, 0.09, 0.12, 0.25, 0.23, 1.00
))
WISCIV.means <- c(15.17, 15.00, 11.83, 21.67, 12.17, 17.83, 18.67, 45.83)
WISCIV.sds <- c(4.93, 4.10, 5.20, 6.54, 2.72, 5.35, 9.36, 10.44)
WISCIV.cov <- cor2cov(WISCIV.cor, sds=WISCIV.sds)

WISC.names <- c("Compr", "Arith", "Simil", "Vocab", "DigSpan", "PictCompl",
                "BlockDes", "Cod")

names(WISC.means) <- names(WISC.sds) <- colnames(WISC.cov) <-
  rownames(WISC.cov) <- names(WISCIV.means) <- names(WISCIV.sds) <-
  rownames(WISCIV.cov) <- colnames(WISCIV.cov) <- WISC.names
```

```
WISC.cov.list <- list(WISC.cov, WISCIV.cov)
WISC.mean.list <- list(WISC.means, WISCIV.means)
WISC.n.list <- list(WISC.n = 200, WISCIV.n = 200)
```

a) Fit a two-domensional model, with Verbal Comprehension (Similarities, Vocabulary and Comprehension), Working Memory (Artihmetic, Digit Span and Coding) and Perceptual Reasoning (Picture Completion and Block Design) to both covariance matrices. Perform a multigroup analyses, using edition as the grouping variable.

b) Assess whether configural invariance between the WISC and WISC-IV is tenable.

c) Assess whether loadings, intercepts and residual variances are equal between the two WISC versions.

Exercise 4.2: Genetically informative design

a) Using the data from the example on Genetically Informative Design, fit the ACE, CE, and AE models to the BMI covariance matrix.

You can copy-paste the covariances from below:

```
MZ <- lav_matrix_lower2full(c(
  .725,
  .589, .792
))
DZ <- lav_matrix_lower2full(c(
  .779,
  .246, .837
))
rownames(MZ) <- colnames(MZ) <- rownames(DZ)  <- colnames(DZ) <- c("P1", "P2")
bmi.cov <- list(MZ=MZ, DZ=DZ)
bmi.n <- list(MZ=534, DZ=328)
```

b) For each model, determine how much variance in BMI is accounted for by additive genetic effects, by non-shared family effects and/or measurement error.

Additional exercise: Gender and age differences in anxiety as measured by the HADS

Download the file 'HADS.sav' from BB and read it into R:

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

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

The file contains scores on seven items of the Anxiety subscale of the Hospital Anxiety and Depression Scale. Barth and Martin (2005) a two-dimensional model, consisting of Psychomotor Agitation (PAG; items 1, 4 and 6) and a Psychic Anxiety (ANX; items 2, 3, 5 and 7) factor:

1. I feel tense or wound up.
2. I get a sort of frightened feeling as if something bad is about to happen.
3. Worrying thoughts go through my mind.

4. I can sit at ease and feel relaxed.

5. I get a sort of frightened feeling like butterflies in the stomach.

6. I feel restless and have to be on the move.

7. I get sudden feelings of panic.

a) Assess measurement invariance of the HADS Anxiety items with respect to gender ('geslacht'). Describe and interpret any differences you found.

b) Assess structural invariance of the HADS Anxiety factor with respect to gender ('geslacht'). Describe and interpret any differences you found.

c) Fit one single model, in which you assess the main and interaction effects of gender ('geslacht') and age ('leeftijd') on Psychomotor Agitation and Psychic Anxiety levels.