Exercises Week 2 Latent Variable Modeling

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

Exercise 3.1

Note that you can use the same covariance matrix for exercise 3.1 and 3.2:

```
Health.cov2 <- lav_matrix_lower2full(c(
   0.77,
   0.38, 0.65,
   0.39, 0.39, 0.62,
  -0.25,-0.32,-0.27, 6.09,
   0.31, 0.29, 0.26,-0.36, 7.67,
   0.24, 0.25, 0.19,-0.18, 0.51, 1.69,
  -3.16,-3.56,-2.63, 6.09,-3.12,-4.58,204.79,
  -0.92,-0.88,-0.72, 0.88,-1.49,-1.41, 16.53, 7.24
))
rownames(Health.cov2) <- colnames(Health.cov2) <- c("Dep1","Dep2","Dep3", "SocAct",
                                                    "Falls", "ChronCond", "PhysAct",
                                                    "PersMob")
```

Additional question:

Do you think it is a good idea to combine the three depression indicators and Social Activity as a measure of poor psychosocial health?

Exercise 3.2

Additional question:

Does the model fit well?

Additional exercise 1:

Load the Holzinger and Swineford (1939) dataset, included in the lavaan package:

```
data(HolzingerSwineford1939)
```

This is a classic dataset with several scores on mental ability subtests, of 7th- and 8th-grade children. We use first six subtests (x1 - x6).

a) Fit a single factor model using robust ML estimation. Does it fit well, according to the Hu & Bentler (1999) criteria?
b) Is there a large difference between the standard and robust chi-square values?
c) Inspect parameter estimates, modification indices and residuals to create a better fitting model.
d) Does your new model fit well, according to the Hu & Bentler (1999) criteria?

Additional exercise 2:

Below, code to generate a covariance matrix (sample size was $N = 500$) is provided. The models to be fitted to these data consist of three latent variables:

- Variables $X1$, $X2$ and $X3$ are indicators of latent variable Stress.
- Variables $Y1$, $Y2$ and $Y3$ are indicators of a reflective latent variable Satisfaction.
- Variables $Y4$, $Y5$ and $Y6$ are indicators of a reflective latent variable Optimism.
- Both Satisfaction and Optimism should be regressed on Stress.

a) Fit a model to the data where Stress is a formative latent variable.

b) Fit a model to the data where Stress is a reflective latent variable.

c) Compare the values of the fit indices and the standardized loadings between the reflective and formative model. Based on these values, would you prefer the formative or reflective model?

```
## Input covariances:
cormat <- lav_matrix_lower2full(c(
  1.000,
  0.700,  1.000,
  0.713,  0.636,  1.000,
  0.079,  0.066,  0.076,  1.000,
  0.088,  0.058,  0.070,  0.681,  1.000,
  0.084,  0.056,  0.074,  0.712,  0.633,  1.000,
  0.279,  0.248,  0.240,  0.177,  0.155,  0.170,  1.000,
  0.250,  0.214,  0.222,  0.157,  0.143,  0.152,  0.373,  1.000,
  0.280,  0.236,  0.251,  0.173,  0.178,  0.171,  0.448,  0.344,  1.000
))

## Input standard deviations:
sds = c(2.5, 2.1, 3.0, 4.1, 3.9, 4.4, 1.2, 1.0, 1.2)

## Reconstruct covariance matrix from correlations and sds:
covmat <- diag(sds) %*% cormat %*% diag(sds)

## Assign row and column names:
rownames(covmat) <- colnames(covmat) <- c("Y1", "Y2", "Y3", "Y4", "Y5", "Y6",
                                          "X1", "X2", "X3")
```