**Chapter 3: Structural Equation Modeling**

This document provides the answer for Exercise 1 in Chapter 3 on structural equation modeling. The exercise is based on Fox, Nie, and Byrnes SEM package for R version 3.1-3. Other examples in Fox *et al.* are included in the R package.

Begin by providing the moments:

R.DHP <- readMoments(diag=FALSE, names=c("ROccAsp", "REdAsp", "FOccAsp",

"FEdAsp", "RParAsp", "RIQ", "RSES", "FSES", "FIQ", "FParAsp"))

.6247

.3269 .3669

.4216 .3275 .6404

.2137 .2742 .1124 .0839

.4105 .4043 .2903 .2598 .1839

.3240 .4047 .3054 .2786 .0489 .2220

.2930 .2407 .4105 .3607 .0186 .1861 .2707

.2995 .2863 .5191 .5007 .0782 .3355 .2302 .2950

.0760 .0702 .2784 .1988 .1147 .1021 .0931 -.0438 .2087

Specify the model using the RAM notation:

model.dhp <- specifyModel()

RParAsp -> RGenAsp, gam11, NA

RIQ -> RGenAsp, gam12, NA

RSES -> RGenAsp, gam13, NA

FSES -> RGenAsp, gam14, NA

RSES -> FGenAsp, gam23, NA

FSES -> FGenAsp, gam24, NA

FIQ -> FGenAsp, gam25, NA

FParAsp -> FGenAsp, gam26, NA

FGenAsp -> RGenAsp, beta12, NA

RGenAsp -> FGenAsp, beta21, NA

RGenAsp -> ROccAsp, NA, 1

RGenAsp -> REdAsp, lam21, NA

FGenAsp -> FOccAsp, NA, 1

FGenAsp -> FEdAsp, lam42, NA

RGenAsp <-> RGenAsp, ps11, NA

FGenAsp <-> FGenAsp, ps22, NA

RGenAsp <-> FGenAsp, ps12, NA

ROccAsp <-> ROccAsp, theta1, NA

REdAsp <-> REdAsp, theta2, NA

FOccAsp <-> FOccAsp, theta3, NA

FEdAsp <-> FEdAsp, theta4, NA

Fit the model and provide a summary:

sem.dhp.1 <- sem(model.dhp, R.DHP, 329,

fixed.x=c('RParAsp', 'RIQ', 'RSES', 'FSES', 'FIQ', 'FParAsp'))

summary(sem.dhp.1)

Model Chisquare = 26.69722 Df = 15 Pr(>Chisq) = 0.03130238

AIC = 64.69722

BIC = -60.24365

Normalized Residuals

Min. 1st Qu. Median Mean 3rd Qu. Max.

-0.79950 -0.11780 0.00000 -0.01201 0.03974 1.56500

R-square for Endogenous Variables

RGenAsp FGenAsp ROccAsp REdAsp FOccAsp FEdAsp

0.5220 0.6170 0.5879 0.6639 0.6888 0.5954

Parameter Estimates

Estimate Std Error z value Pr(>|z|)

gam11 0.16122243 0.03879229 4.1560429 3.238070e-05 RGenAsp <--- RParAsp

gam12 0.24964929 0.04398092 5.6763087 1.376323e-08 RGenAsp <--- RIQ

gam13 0.21840307 0.04419737 4.9415399 7.750795e-07 RGenAsp <--- RSES

gam14 0.07183948 0.04970692 1.4452610 1.483846e-01 RGenAsp <--- FSES

gam23 0.06188722 0.05171967 1.1965895 2.314666e-01 FGenAsp <--- RSES

gam24 0.22886655 0.04416219 5.1824090 2.190383e-07 FGenAsp <--- FSES

gam25 0.34903584 0.04528981 7.7067195 1.290931e-14 FGenAsp <--- FIQ

gam26 0.15953378 0.03882594 4.1089486 3.974645e-05 FGenAsp <--- FParAsp

beta12 0.18423260 0.09488782 1.9415832 5.218758e-02 RGenAsp <--- FGenAsp

beta21 0.23547774 0.11938936 1.9723511 4.856954e-02 FGenAsp <--- RGenAsp

lam21 1.06267796 0.09013868 11.7893663 4.428606e-32 REdAsp <--- RGenAsp

lam42 0.92972549 0.07028107 13.2286762 5.993366e-40 FEdAsp <--- FGenAsp

ps11 0.28098701 0.04623153 6.0778220 1.218259e-09 RGenAsp <--> RGenAsp

ps22 0.26383553 0.04466689 5.9067359 3.489525e-09 FGenAsp <--> FGenAsp

ps12 -0.02260953 0.05119394 -0.4416447 6.587463e-01 FGenAsp <--> RGenAsp

theta1 0.41214545 0.05122465 8.0458422 8.565431e-16 ROccAsp <--> ROccAsp

theta2 0.33614511 0.05209992 6.4519310 1.104339e-10 REdAsp <--> REdAsp

theta3 0.31119482 0.04592713 6.7758385 1.236867e-11 FOccAsp <--> FOccAsp

theta4 0.40460363 0.04618437 8.7606177 1.941833e-18 FEdAsp <--> FEdAsp

Iterations = 32