## set seed and path, load libraries

set.seed(123)

path <- ("c:/users/USER/jeewon")

setwd(path)

library(MASS)

library(lme4)

## number of replications

nrep= 1000

## conditions (adapted from Matuschek et al.(2017))

**#** number of persons: 30, **50**

**#** number of items per level: 10, **20**

# fixed effect (b0): 2000

# **fixed effect** (b1): 0, **25**

# person random effect:

**# tau0(sd): 100**

**# tau1(sd): 20**

**# corr(tau0,tau1): 0.6**

# item random effect(sd):

**#omega=20, 60, 100**

**# sigma(=sd(e)): 300**

## set parameters

**nperson=30;**

**nitem=10;**

b0=2000;

**b1=0;**

**tau0**=100; **tau1**=20; **r**=0.6;

**omega=20;**

sigma=300

S= matrix(c(**tau0**^2, r\*tau0\*tau1, r\*tau0\*tau1, tau1^2),nrow=2)

**\*Random slope model(참가자효과) --> MVN**

## design matrix

**#id**

j=rep(c(1:nperson), each=2\*nitem)

i=rep(c(1:nitem), 2\*nperson)

**# fixed**

x0=1

x1= rep(c(rep(0, nitem),rep(1,nitem)),nperson)

###### spaces to save

ll<- numeric(0)

fixed<- numeric(0)

#### FOR LOOP

for (n in 1:nrep) {

# generate random effects

s = **mvrnorm(**nperson, mu=c(0,0), Sigma=S)

w1 = rnorm(nitem, mean=0, sd=**omega**)

e = rnorm(nperson\*nitem\*2, mean=0, sd=sigma)

# person random

ss = rep(s[,1],each=2\*nitem)\*x0 + rep(s[,2],each=2\*nitem)\*x1

# item random

w= rep(**w1**, 2\*nperson)

**# y**

y= (b0\*x0+b1\*x1) +ss +w +e

## data frame

dat<- data.frame(j, i,x0,x1, ss,w,e,y)

###### estimation

m1 = lmer(y ~ 1+x1 + (1+x1|j) + (1|i), data=dat, REML=F) # **maximal model (i.e., random slope)**

m2 = lmer(y ~ 1+x1 + (1|j) + (1|i), data=dat, REML=F) # **random intercept-only**

**m1.null** = lmer(y ~ 1 + (1+x1|j) + (1|i), data=dat, REML=F) # **x1이 없음**

m2.null = lmer(y ~ 1 + (1|j) + (1|i), data=dat, REML=F)

## several things to save

# b1 **(Fixed effect)**

fixed1<- summary(m1)$coefficients[c(2,4)] **<--- coefficients and SE**

fixed2<- summary(m2)$coefficients[c(2,4)]

fixed<- rbind(fixed, c(fixed1,fixed2))

# log-likelihood

ll1<- summary(m1)$logLik

ll2<- summary(m2)$logLik

ll1.null<- summary(m1.null)$logLik

ll2.null<- summary(m2.null)$logLik

ll\_n<- c**(ll1, ll2, ll1.null, ll2.null) <--- 4 rows**

ll<- rbind(ll, ll\_n)

} ## END of FOR LOOP

## save files

**# fixed effect**

colnames(fixed) <- c("m1est", "m1se", "m2est", "m2se")

write.table(fixed, file="fixed.txt", sep="\t", row.names = F, col.names = T)

**# log-likelihood**

colnames(ll) <- c("ll.m1","ll.m2","ll.m1.null", "ll.m2.null")

write.table(ll, file="ll.txt", sep="\t", row.names = F, col.names = T)