## set seed and path, load libraries

set.seed(1234567)

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

setwd(path)

library(MASS)

library(lme4)

## number of replications

nrep= 1000

## conditions

# number of persons: 30, 50, 100

# number of items per level: 10, 20, 50

# fixed effect (b0): 0, 1, 2

# fixed effect (b1): 0, 0.2, 0.8

# person random effect:

# tau0(sd): 0.5

# tau1(sd): 0.2

# corr(tau0,tau1): 0.6

# item random effect(sd):

#omega=0.2

## set parameters

nperson=30;

nitem=10;

b0 = 0;

b1 = 0;

tau0=0.5; tau1=0.2; r=0.6;

omega=0.2;

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

r\*tau0\*tau1, tau1^2),

nrow=2)

**---> sigma가 없음 (e, 잔차의 모수가 없음), 7개의 parameter**

## 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)

**# person random**

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

**# item random**

w= rep(w1, 2\*nperson)

**# logit (y 대신 logit)**

**logit = (b0\*x0 + b1\*x1)+ ss+ w --->**

## probability -- p값 생성

**p <-** 1/(1 + exp(-logit)) ----> exp(-logit)

## from unif(0,1) -- 난수생성

**probunif<-** runif(nperson\*nitem\*2) ---> runif command: 난수만들기 함수/ 600개의 난수 생성

# y -- y값 생성 **(0 or 1)**

y<- ifelse(**probunif**<**p**,1,0) ---> **y값은 0 아니면 1** (위에서 만든 **난수**가 p보다 작은 것이 참이면 1

거짓이면 0 출력)

## data frame

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

###### estimation

m1=glmer(y ~ 1+x1+(1+x1|j)+(1|i), family=binomial ,data=dat) **# maximal model(i.e., random slope)**

m2=glmer(y ~ 1+x1+(1|j)+(1|i), family=binomial, data=dat) **# random intercept-only**

m1.null = glmer(y ~ 1+(1+x1|j)+(1|i), family=binomial, data=dat) **# x1이 없음 --> null model**

m2.null = glmer(y ~ 1+(1|j)+(1|i), family=binomial, data=dat)

## several things to save

# b1

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

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)

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)