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#Coded in Rstudio by Tyler G. James

########## DATA FILES ##########
test <- read_excel("~/OneDrive - University of Florida/School/Grad School/
EDF 7439 Item Response Theory/Final Project/kfftest.xlsx")

#N = 2250, k(items)=10
test1 <- as.matrix(test[1:2250,1:10])

########## CTT ANALYSES #########
library(CTT)

CTTanalysis <- itemAnalysis(test1, itemReport=TRUE)
CTTanalysis$itemReport
mean(CTTanalysis$itemReport$itemMean)
mean(CTTanalysis$itemReport$pBis)

mean(test$KFF_Total)
sd(test$KFF_Total)
median(test$KFF_Total)
hist(test$KFF_Total, main = "Histogram of KFF Raw Summated Score", xlab =
"Summated Score", sub="Med. = 6, M = 5.4249 (SD = 2.5035)")

########## IRT MODELS, LTM FOR ITEM FIT Q1 #########
library(ltm)

#1PL
model1PLtm <- rasch(test1)
fit1PLtm <- item.fit(model1PLtm,simulate.p.value=TRUE)

#2PL
model2PLtm <- ltm(test1 ~ z1)
fit2PLtm <- item.fit(model2PLtm,simulate.p.value=TRUE)

#3PL
model3PLtm <- tpm(test1)
fit3PLtm <- item.fit(model3PLtm,simulate.p.value=TRUE)

########## IRT MODELS, OVERALL FIT ##########
anova(model1PLtm, model2PLtm)
anova(model2PLtm, model3PLtm)

########## IRT MODELS, ITEM PARAMETER ESTIMATION ##########
##2PL in LTM
item.pars.model2PLtm <- as.data.frame(coef(model2PLtm));
item.pars.model2PLtm

##2PL run in mirt
library(mirt)
#defining a unidimensional model
# (note that you have to run the three lines, including the last hashtag)
uni_model <- mirt.model()
theta = 1-10
#
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#Running 1-PL model/Rasch binary
model1PLmirt <- mirt(test1, uni_model, itemtype='Rasch',SE=TRUE)
coef(model1PLmirt,printSE=TRUE,IRTpars=TRUE,as.data.frame=TRUE)
#Running 2-PL model
model2PLmirt <- mirt(test1, uni_model, itemtype='2PL',SE=TRUE)
coef(model2PLmirt,printSE=TRUE,IRTpars=TRUE,as.data.frame=TRUE)
#Running 3-PL model
model3PLmirt <- mirt(test1, uni_model, itemtype='3PL',SE=TRUE)
coef(model3PLmirt,printSE=TRUE,IRTpars=TRUE,as.data.frame=TRUE)

#residuals
theta2PL <- fscores(model2PLmirt)
LD <- residuals(model2PLmirt) #standardized values w/ Chi-Square, over .10
Q3 <- residuals(model2PLmirt, type = "Q3") #Yen's Q3

#ICC curves
plot(model2PLtm)
attach(mtcars)
par(mfrow=c(3,4))
plot(model2PLtm, main="Item 1 2PL ICC", items = 1)
plot(model2PLtm, main="Item 2 2PL ICC", items = 2)
plot(model2PLtm, main="Item 3 2PL ICC", items = 3)
plot(model2PLtm, main="Item 4 2PL ICC", items = 4)
plot(model2PLtm, main="Item 5 2PL ICC", items = 5)
plot(model2PLtm, main="Item 6 2PL ICC", items = 6)
plot(model2PLtm, main="Item 7 2PL ICC", items = 7)
plot(model2PLtm, main="Item 8 2PL ICC", items = 8)
plot(model2PLtm, main="Item 9 2PL ICC", items = 9)
plot(model2PLtm, main="Item 10 2PL ICC", items = 10)

#item information curves
plot(model2PLtm, type = "IIC")
attach(mtcars)
par(mfrow=c(3,4))
plot(model2PLtm, type = "IIC", main="Item 1 2PL IIC", items = 1)
plot(model2PLtm, type = "IIC", main="Item 2 2PL IIC", items = 2)
plot(model2PLtm, type = "IIC", main="Item 3 2PL IIC", items = 3)
plot(model2PLtm, type = "IIC", main="Item 4 2PL IIC", items = 4)
plot(model2PLtm, type = "IIC", main="Item 5 2PL IIC", items = 5)
plot(model2PLtm, type = "IIC", main="Item 6 2PL IIC", items = 6)
plot(model2PLtm, type = "IIC", main="Item 7 2PL IIC", items = 7)
plot(model2PLtm, type = "IIC", main="Item 8 2PL IIC", items = 8)
plot(model2PLtm, type = "IIC", main="Item 9 2PL IIC", items = 9)
plot(model2PLtm, type = "IIC", main="Item 10 2PL IIC", items = 10)

#graphic of item fit (observed vs expected)
attach(mtcars)
par(mfrow=c(3,4))
itemfit(model2PLmirt,group.bins=15,empirical.plot=1) #graphic of item fit
(observed vs. expected)
itemfit(model2PLmirt,group.bins=15,empirical.plot=2) #graphic of item fit
(observed vs. expected)
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itemfit(model2PLmirt,group.bins=15,empirical.plot=3) #graphic of item fit
(observed vs. expected)
itemfit(model2PLmirt,group.bins=15,empirical.plot=4) #graphic of item fit
(observed vs. expected)
itemfit(model2PLmirt,group.bins=15,empirical.plot=5) #graphic of item fit
(observed vs. expected)
itemfit(model2PLmirt,group.bins=15,empirical.plot=6) #graphic of item fit
(observed vs. expected)
itemfit(model2PLmirt,group.bins=15,empirical.plot=7) #graphic of item fit
(observed vs. expected)
itemfit(model2PLmirt,group.bins=15,empirical.plot=8) #graphic of item fit
(observed vs. expected)
itemfit(model2PLmirt,group.bins=15,empirical.plot=9) #graphic of item fit
(observed vs. expected)
itemfit(model2PLmirt,group.bins=15,empirical.plot=10) #graphic of item fit
(observed vs. expected)

#theta and se estimation
fscores2 <- factor.scores(model2PLtm, model = "EAP")
theta2 <- fscores2$score.dat$z1; theta2
hist(theta2, main = "", xlab = "Theta Estimate under 2PL")

mean(theta2)
min(theta2)
max(theta2)

se2 <- fscores2$score.dat$se.z1

plot(model2PLmirt,type="infoSE") #plot of test information and se's of
theta
abline(h=0.5,v=0,col="red")

cor(theta2PL, test$KFF_Total)
plot(test$KFF_Total, theta2PL, xlab = "Raw Scores", ylab = "Latent Scores",
sub = "r = 0.986")
abline(h=-0.780,v=0,col="red")
abline(h=-1.739,v=0,col="green")
abline(h=0.2662,v=0,col="green")

Zh2PL <- personfit(model2PLmirt)
Zh2 <- as.numeric(unlist(Zh2PL))
hist(Zh2,main="",xlab="Zh")
sum(Zh2 <= -1.96) #54
sum(Zh2 >= 1.96) #0
#54 cases have "unacceptable" person fit based on Zh2 values, 2.4% of
cases;
hist(Zh2,main="",xlab="Zh",xlim=c(-4.5,2))
abline(h=0,v=1.96,col="red")
abline(h=0,v=-1.96,col="red")
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