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# EXERCISE 3
# -----

rm(list=ls())
d <- read.table('danceability.txt', header=TRUE)
load('mcshapiro.test.RData')
head(d)
names(d)

n <- dim(d)[1]
p <- dim(d)[2]

library(MASS)
library(car)
library(rgl)

# ----- point a

fm <- lm(danceability ~ loudness + energy + tempo, data=d)

summary(fm)

coefficients(fm) # beta_i

summary(fm)$sigma # estimate of sigma

# ----- point b

par(mfrow=c(2,2))
plot(fm)

shapiro.test(residuals(fm))$p

# ----- point c

linearHypothesis(fm, rbind(c(0,1,0,0),
                           c(0,0,1,0)), c(0,0))

# ----- point d

fm2 <- lm(danceability ~ loudness + tempo, data=d)

summary(fm2)

summary(fm2)$sigma

par(mfrow=c(2,2))
plot(fm2)
shapiro.test(residuals(fm2))$p

# ----- point e

library(corrplot)
library(plot.matrix)
library(ggplot2)
library(insight)
library(lattice)
library(lme4)
library(nlme)

lmm1 = lmer(danceability ~ loudness + tempo + (1|genre), data = d)
summary(lmm1)

sigma2_eps <- as.numeric(get_variance_residual(lmm1))

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```
sigma2_eps  
sigma2_b <- as.numeric(get_variance_random(lmm1))  
sigma2_b
```

```
PVRE <- sigma2_b/(sigma2_b+sigma2_eps)  
PVRE # intraclass correlation >20% high
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```
plot(lmm1)
```

```
par(mfrow=c(1,2))  
# 1) Assessing Assumption on the within-group errors  
qqnorm(resid(lmm1))  
qqline(resid(lmm1), col='red', lwd=2)
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# 2) Assessing Assumption on the Random Effects  
qqnorm(unlist(ranef(lmm1)$genre), main='Normal Q-Q Plot - Random Effects for Primary School')  
qqline(unlist(ranef(lmm1)$genre), col='red', lwd=2)
```

```
# ----- point f
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```
ranef(lmm1)  
dotplot(ranef(lmm1))
```


