

R-Code Two-way analysis of variance

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R Code

```
?heart.rate #####in package ISwR
View(heart.rate)
library(psych)
str(heart.rate)
headTail(heart.rate)
summary(heart.rate)
attach(heart.rate)
subj=factor(subj)
timef=factor(time, labels=c(0,30,60,120))
##### creating data set differently
heart.rate <- data.frame(hr = c(96,110,89,95,128,100,72,79,100,
92,106,86,78,124,98,68,75,106,
86,108,85,78,118,100,67,74,104,
92,114,83,83,118,94,71,74,102),
subj=gl(9,1,36),
time=gl(4,9,36,labels=c(0,30,60,120)))
#####
#####
library(FSA)
Summarize(hr~subj+time) #####To check if cell sizes are balanced

#####
?lm
model1=lm(hr~subj+time)
model2=lm(hr~subj*time)
anova(lm(hr~subj+time)) ##### 2-ways ANOVA
anova(lm(hr~subj * timef))
##### Type II sum of squares
library(car)
Anova(model1,type="II")
Anova(model2)
#####
res=residuals(model1)
hist(res)
hist(res, prob=TRUE)
curve(dnorm(x, mean=mean(res), sd=sd(res)), add=TRUE)
```

```
shapiro.test(x)
y=fitted(model1)
plot(x,y)
plot(model1)
interaction.plot(time, subj, hr)          #####Interaction plot
interaction.plot(subj, time, hr)
##### Mean separation t
library(multcompView)
library(lsmeans)
leastsquare= lsmeans(model1, pairwise~subj, adjust="tukey")
leastsquare$contrasts
CLD=cld(leastsquare,alpha=0.05,adjust="tukey")
#####plot of means and conf.
##### order the level for printing
factor(CLD$subj, levels=c("good","bad"))
library(ggplot2)
ggplot(CLD, aes(x=subj,y=leastsquare,lable=.group))
#####Friedman test
friedman.test(hr~time|subj,data=heart.rate)
friedman.test(hr~subj|time,data=heart.rate)

#####Exercise
attach(two.way)
anova(lm(StressReduction~Treatment * Age))
```