**10.9 R 语言应用**

**# 陈文贤 着 《大话统计学》 清华大学出版社 2022年**

# R例10.3

if(!require(ggpubr)){install.packages("ggpubr")} ; library(ggpubr)

if(!require(car)){install.packages("car")} ; library(car)

if(!require(lawstat)){install.packages("lawstat")} ; library(lawstat)

if(!require(profvis)){install.packages("profvis")} ; library(profvis)

par(mfrow=c(1,1))

X <- list(T1=c(105,98,110), T2=c(115,109,121,130), T3=c(103,96,105,107,112),

T4=c(124,127,118), T5=c(115,112) , T6=c(85,106,98,111) , T7=c(79,87)) ; X

times <- stack(X)$values ; treat <- stack(X)$ind ; tapply(times, treat, summary)

plot(times~ treat , col=c("red","green","blue","orange","purple","grey","yellow"))

pause(10) # 等候 10 秒钟

Aov <- aov(times~ treat) ; summary(Aov)

model <- lm(times~ treat) ; anova(model) ; summary(model)

par(mfrow=c(2,2))

plot(model,col.smooth="red")

pause(10) # 等候 10 秒钟

bartlett.test(times~ treat) # 检验方差相等 (假定正态分布)

levene.test(times, treat) # 检验方差相等 (非正态分布)

pairwise.t.test(times, treat, p.adjust="bonf") # Bonferroni多重比较检验

leveneTest(times, treat) # 检验方差相等 (非正态分布)

# R例10.1

data <- read.csv("C:/大话统计学 网络资源/StatData/Chap10\_1A.csv",header=TRUE)

# 读入 Chap10\_1.csv

ggboxplot(data, x = "Treat", y = "Time", color = "Treat", palette = c("red", "blue", "orange",

"purple"), ylab = "Time", xlab = "Treat")

ggline(data, x = "Treat", y = "Time", add = c("mean\_se", "jitter"), ylab = "Time", xlab =

"Treat", color = "Treat", palette = c("red", "blue", "orange", "purple"))

model.aov <- aov(Time ~ Treat, data = data) # 方差分析

summary(model.aov)

plot(model.aov, 2) # 残差的正态 QQ plot

pause(10) # 等候 10 秒钟

data <- read.csv("C:/大话统计学 网络资源/StatData/Chap10\_1B.csv",header=TRUE)

# 读入 Chap10\_1B.csv

ggboxplot(data, x = "Treat", y = "Time", color = "Treat", palette = c("red", "blue", "orange",

"purple"), ylab = "Time", xlab = "Treat")

ggline(data, x = "Treat", y = "Time", add = c("mean\_se", "jitter"), ylab = "Time", xlab =

"Treat", color = "Treat", palette = c("red", "blue", "orange", "purple"))

model.aov <- aov(Time ~ Treat, data = data) # 方差分析

summary(model.aov)

plot(model.aov, 2) # QQ test

pause(10) # 等候 10 秒钟

Aov <- aov(Time~Treat, data = data)

THSD <- TukeyHSD(Aov) ; THSD # Tukey 多重检验

par(mfrow=c(1,1)) ; par(las=1)

plot(THSD)

pause(10) # 等候 10 秒钟

residual <- residuals(object = model.aov)

shapiro.test(x = residual) # Shapiro-Wilk test 残差正态检验

if(!require(ISwR)){install.packages("ISwR")} ; library(ISwR)

# 患者麻醉期间接受三种不同通气方法(ventilation)的叶酸(folate)数据。

attach(red.cell.folate) ; str(red.cell.folate)

summary(red.cell.folate)

anova(lm(folate~ventilation))

summary(lm(folate~ventilation))

pairwise.t.test(folate, ventilation, p.adj="bonferroni")

pairwise.t.test(folate,ventilation)

bartlett.test(folate~ventilation) # Bartlett 检验结果 : 方差不相等

# oneway.test (适用于非齐性方差之假定 , 假定几个组的方差有不相等)

oneway.test(folate~ventilation)

pairwise.t.test(folate,ventilation,pool.sd=F)

xbar <- tapply(folate, ventilation, mean)

s <- tapply(folate, ventilation, sd)

n <- tapply(folate, ventilation, length)

sem <- s/sqrt(n)

stripchart(folate~ventilation, method="jitter", jitter=0.05, pch=16, vert=T)

arrows(1:3,xbar+sem,1:3,xbar-sem,angle=90,code=3,length=.1, col=c("red","green","blue"))

lines(1:3,xbar,pch=4,type="b",cex=2, col=c("red","green","blue"))

pause(10) # 等候 10 秒钟

kruskal.test(folate~ventilation) # 非参数统计 方差分析

shapiro.test(folate) # 正态分布检验

## 心率数据 Heart rate data

attach(heart.rate) ; str(heart.rate)

head(heart.rate) ; heart.rate[sample(1:nrow(heart.rate), 5),]

# 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)))

anova(lm(hr~subj+time)) # 二因素(子) 方差分析

interaction.plot(time, subj, hr)

pause(10) # 等候 10 秒钟

interaction.plot(ordered(time),subj,hr)

pause(10) # 等候 10 秒钟

interaction.plot(time,subj,hr,col=c("red","orange","yellow","green","blue","pink","purple"))

friedman.test(hr~time|subj,data=heart.rate) # 非参数统计 二因素(子) 方差分析