Exercise section 18

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5/17/2021

# Answer

ابتدا داده ها را وارد نرم‌افزار می‌کنیم:

At the first we want to input our data to R:

s<-factor(rep(1:4 ,each = 15))  
v<-factor(rep(c(1:3) ,4 ,each = 5))  
y1<-c(59.3,60.3,60.9,60.6,60.4,59.3,59.4,60.0,58.9,59.5,59.4,60.2,60.7,60.5,60.1,  
 63.7,64.1,63.4,63.2,63.2,60.6,61.0,60.7,60.6,60.3,63.8,63.2,63.3,63.2,63.1,  
 68.1,68.0,68.5,68.6,68.6,64.0,63.4,63.5,63.4,63.5,68.0,68.7,68.7,68.4,68.6,  
 69.8,69.5,69.5,69.9,70.3,66.6,66.5,67.1,65.8,65.6,70.1,72.3,69.7,69.9,69.8)  
y2<-c(4.5,4.5,5.3,5.8,6.0,6.7,4.8,5.1,5.8,4.8,5.1,5.3,6.4,7.1,7.8,5.4,5.4,5.4,5.3,  
 5.0,6.8,6.5,6.8,7.1,6.0,5.7,6.1,6.0,5.9,5.4,3.4,2.9,3.3,3.1,3.3,3.6,3.9,3.7,  
 3.7,4.1,3.7,3.5,3.8,3.5,3.4,1.4,1.3,1.3,1.3,1.1,1.8,1.7,1.7,1.8,1.9,1.7,0.7,  
 1.5,1.3,1.4)  
y3<-c(38.4,38.6,37.2,38.1,38.8,37.9,36.6,38.7,37.5,37.0,38.7,37,37.4,37,36.9,39.5,  
 39.2,39.0,39,39,38.1,38.6,38.8,38.6,38.5,40.5,40.2,40,40,39.7,42.2,42.4,41.5,  
 41.9,42.1,10.9,41.4,41.6,41.4,41.1,42.3,41.6,40.7,42.0,41.4,48.4,47.8,46.9,  
 47.5,47.1,45.7,46.8,46.3,46.3,46.1,48.1,47.8,46.7,47.1,46.7)  
y4<-c(295,302,318,345,325,275,290,295,296,330,299,315,304,302,308,271,284,281,291,  
 270,248,264,257,260,261,282,284,291,299,295,280,284,286,284,268,233,248,244,  
 266,244,293,284,277,299,285,265,247,231,268,247,205,239,230,235,220,253,249,  
 226,248,236)

حال با همه داده ها را بصورت یک فهرست نمایش می‌دهیم:

Now we make a data frame to see our data:

Data<-data.frame(s,v,y1,y2,y3,y4)  
head(Data)

## s v y1 y2 y3 y4  
## 1 1 1 59.3 4.5 38.4 295  
## 2 1 1 60.3 4.5 38.6 302  
## 3 1 1 60.9 5.3 37.2 318  
## 4 1 1 60.6 5.8 38.1 345  
## 5 1 1 60.4 6.0 38.8 325  
## 6 1 2 59.3 6.7 37.9 275

tail(Data)

## s v y1 y2 y3 y4  
## 55 4 2 65.6 1.9 46.1 220  
## 56 4 3 70.1 1.7 48.1 253  
## 57 4 3 72.3 0.7 47.8 249  
## 58 4 3 69.7 1.5 46.7 226  
## 59 4 3 69.9 1.3 47.1 248  
## 60 4 3 69.8 1.4 46.7 236

حال مدل خود را با فرضیات زیر تشکیل می‌دهیم ، در اینجا ما 3 تا فرضیه را بصورت هم‌زمان آزمون میکنیم:

No we make our model with this hypothesis,we have 3 hypothesis here:

response<-cbind(y1,y2,y3,y4)  
result0<-manova(response~s\*v)  
summary(result0 , test = "Wilks")

## Df Wilks approx F num Df den Df Pr(>F)   
## s 3 0.001952 95.196 12 119.35 < 2.2e-16 \*\*\*  
## v 2 0.065642 32.660 8 90.00 < 2.2e-16 \*\*\*  
## s:v 6 0.161611 4.523 24 158.20 2.999e-09 \*\*\*  
## Residuals 48   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

According to the p-values<alpha=0.05, we can say that all of our treatments and s , v are signifact with our response and all of the first hypothesis reject.

باتوجه به مقادیر p-مقدار داریم که همه آنها از آلفا که همان 0.05 هست کمترند ولذا تمامی فرض‌های 0 ما یعنی برابری ها نیز رد می‌شود.