Exercise section 16

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# section 16:

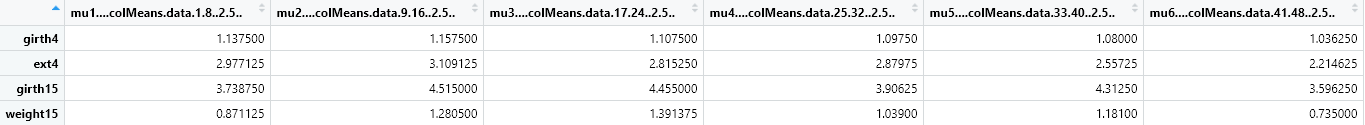
## 1)

library(heplots)

data(RootStock)  
data<-as.data.frame(RootStock)  
group<-as.factor(data$rootstock)  
response<-cbind(RootStock$girth4,RootStock$ext4,RootStock$girth15,RootStock$weight15)  
summary(manova(response~group))

## Df Pillai approx F num Df den Df Pr(>F)   
## group 5 1.3055 4.0697 20 168 1.983e-07 \*\*\*  
## Residuals 42   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

means<-data.frame(  
mu1<-colMeans(data[1:8,2:5]),  
mu2<-colMeans(data[9:16,2:5]),  
mu3<-colMeans(data[17:24,2:5]),  
mu4<-colMeans(data[25:32,2:5]),  
mu5<-colMeans(data[33:40,2:5]),  
mu6<-colMeans(data[41:48,2:5])  
)  
means



حال در بالا میتوانیم بردارهای میانگین را مشاهده بکنیم.

colSums(means)

## mu1....colMeans.data.1.8..2.5.. mu2....colMeans.data.9.16..2.5..   
## 8.724500 10.062125   
## mu3....colMeans.data.17.24..2.5.. mu4....colMeans.data.25.32..2.5..   
## 9.769125 8.922500   
## mu5....colMeans.data.33.40..2.5.. mu6....colMeans.data.41.48..2.5..   
## 9.130750 7.582125

با توجه به آخرین خروجی نیز می‌توان مشاهده کرد که جمع میانگین های جامعه دوم از همه با اهمیت تر هستش.

## 2)

### a)

H0 : mu1 = mu2 = mu3 H1 : At least one of the means is not equal

### b)

M1y1<-c(5.4,5.2,6.1,4.8,5.0,5.7,6.0,4.0,5.7,5.6,5.8,5.3)  
M1y2<-c(6,6.2,5.9,5,5.7,6.1,6,5,5.4,5.2,6.1,5.9)  
M1y3<-c(6.3,6,6,4.9,5,6,5.8,4,4.9,5.4,5.2,5.8)  
M1y4<-c(6.7,5.8,7,5,6.5,6.6,6,5,5,5.8,6.4,6)  
M2y1<-c(5,4.8,3.9,4,5.6,6,5.2,5.3,5.9,6.1,6.2,5.1)  
M2y2<-c(5.3,4.9,4,5.1,5.4,5.5,4.8,5.1,6.1,6,5.7,4.9)  
M2y3<-c(5.3,4.2,4.4,4.8,5.1,5.7,5.4,5.8,5.7,6.1,5.9,5.3)  
M2y4<-c(6.5,5.6,5.0,5.8,6.2,6.0,6,6.4,6,6.2,6,4.8)  
M3y1<-c(4.8,5.4,4.9,5.7,4.2,6,5.1,4.8,5.3,4.6,4.5,4.4)  
M3y2<-c(5,5,5.1,5.2,4.6,5.3,5.2,4.6,5.4,4.4,4.0,4.2)  
M3y3<-c(6.5,6,5.9,6.4,5.3,5.8,6.2,5.7,6.8,5.7,5,5.6)  
M3y4<-c(7,6.4,6.5,6.4,6.3,6.4,6.5,5.7,6.6,5.6,5.9,5.5)  
  
Method<-factor(rep(c(1:3), each = 48))  
variable<-factor(rep(c(1:12),12))  
response<-c(M1y1,M1y2,M1y3,M1y4,M2y1,M2y2,M2y3,M2y4,M3y1,M3y2,M3y3,M3y4)  
result<-aov(response~Method+variable)  
summary(result)

## Df Sum Sq Mean Sq F value Pr(>F)   
## Method 2 1.11 0.5526 1.222 0.2981   
## variable 11 8.07 0.7336 1.622 0.0997 .  
## Residuals 130 58.80 0.4523   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 

### c)

for y1: method1:

response<-c(M1y1,M2y1,M3y1)  
group<-factor(rep(1:3,each = 12))  
result<-aov(response~group)  
summary(result)

## Df Sum Sq Mean Sq F value Pr(>F)  
## group 2 1.051 0.5253 1.293 0.288  
## Residuals 33 13.408 0.4063

method2:

data<-cbind(response,group)  
r<-oneway.test(response~group , data = data ,var.equal = TRUE)  
r

##   
## One-way analysis of means  
##   
## data: response and group  
## F = 1.2928, num df = 2, denom df = 33, p-value = 0.288

for y2: method1:

response<-c(M1y2,M2y2,M3y2)  
group<-factor(rep(1:3,each = 12))  
result<-aov(response~group)  
summary(result)

## Df Sum Sq Mean Sq F value Pr(>F)   
## group 2 4.605 2.3025 9.378 0.000596 \*\*\*  
## Residuals 33 8.103 0.2455   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

method2:

data<-cbind(response,group)  
r<-oneway.test(response~group , data = data ,var.equal = TRUE)  
r

##   
## One-way analysis of means  
##   
## data: response and group  
## F = 9.3777, num df = 2, denom df = 33, p-value = 0.000596

for y3: method1:

response<-c(M1y3,M2y3,M3y3)  
group<-factor(rep(1:3,each = 12))  
result<-aov(response~group)  
summary(result)

## Df Sum Sq Mean Sq F value Pr(>F)   
## group 2 2.382 1.1911 3.386 0.046 \*  
## Residuals 33 11.607 0.3517   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

method2:

data<-cbind(response,group)  
r<-oneway.test(response~group , data = data ,var.equal = TRUE)  
r   
## One-way analysis of means  
##   
## data: response and group  
## F = 3.3863, num df = 2, denom df = 33, p-value = 0.04596

for y4: method1:

response<-c(M1y4,M2y4,M3y4)  
group<-factor(rep(1:3,each = 12))  
result<-aov(response~group)  
summary(result)

## Df Sum Sq Mean Sq F value Pr(>F)  
## group 2 0.811 0.4053 1.266 0.295  
## Residuals 33 10.566 0.3202

method2:

data<-cbind(response,group)  
r<-oneway.test(response~group , data = data ,var.equal = TRUE)  
r   
## One-way analysis of means  
##   
## data: response and group  
## F = 1.2658, num df = 2, denom df = 33, p-value = 0.2954

### d)

for each test we have alpha = 0.05 and when we use 4 test total error will be 4\*0.05 = 0.2 so its better that we use 1 manova our multiple anova test just with 0.05 error.

خطای ما به 0.2 افزایش خواهد یافت.زیرا 4 تا 0.05 ازمون شده است.