Chap10_2

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```
library(xtable)
library(gmodels)
```

First, set working directory. 'data' is a table with two columns and same number of rows, and should be numeric. Columns have headers indicating the names of the variables. **User will also input desired variable names in double quotes**

```
data <- read.csv("chap10_2.csv", header = FALSE, skip = 1)
colnames(data) <- c("I", "II", "III", "IV", "V")
```

We now combine the observations into one long column (score)

```
colnames(data) <- c("V1", "V2", "V3", "V4", "V5")
score=c(data$V1,data$V2,data$V3,data$V4,data$V5)
```

We now prepare the labels for the 4x5x2 scores according to the factor levels: Admin_1 Admin_2 Admin_3 Admin_4, Admin_1 Admin_2 Admin_3 Admin_4.....etc for Factor A

```
Test_Admin=gl(4,1,5*4*2, labels = c("Admin_1", "Admin_2","Admin_3", "Admin_4"))
```

I I I....., II II .....,III III ....,IV IV ....., V V.....etc for Factor B.

```
Order=gl(5,4*2,5*4*2, labels=c("I","II","III","IV","V"))
```

We now form a data frame with the dependent variable and the factors, then we print the data

```
data = data.frame(score = score, Factor_A = factor(Test_Admin), Factor_B=factor(Order))
knitr::kable(xtable(data))
```

score	Factor_A	Factor_B
127	Admin_1	I
117	Admin_2	I
111	Admin_3	I
108	Admin_4	I
121	Admin_1	I
109	Admin_2	I
111	Admin_3	I
100	Admin_4	I
117	Admin_1	II
113	Admin_2	II
111	Admin_3	II
100	Admin_4	II
109	Admin_1	II
113	Admin_2	II
101	Admin_3	II
92	Admin_4	II
107	Admin_1	III

score	Factor_A	Factor_B
108	Admin_2	III
99	Admin_3	III
92	Admin_4	III
101	Admin_1	III
104	Admin_2	III
91	Admin_3	III
90	Admin_4	III
98	Admin_1	IV
95	Admin_2	IV
95	Admin_3	IV
87	Admin_4	IV
94	Admin_1	IV
93	Admin_2	IV
89	Admin_3	IV
77	Admin_4	IV
97	Admin_1	V
96	Admin_2	V
89	Admin_3	V
89	Admin_4	V
89	Admin_1	V
92	Admin_2	V
93	Admin_3	V
85	Admin_4	V

We now perform the ANOVA on the data

```
aov1=aov(score~Test_Admin*Order, data=data)
```

Model III when both A and B are random

```
aov2 = aov(score~Test_Admin + Order + Error(Test_Admin:Order),
                    data = data)
```

```
## Warning in aov(score ~ Test_Admin + Order + Error(Test_Admin:Order), data =
## data): Error() model is singular
```

We now print the results

```
summary(aov1)
```

```
##                  Df Sum Sq Mean Sq F value   Pr(>F)
## Test_Admin        3   1168   389.2  19.957 3.15e-06 ***
## Order             4   3010   752.5  38.590 3.89e-09 ***
## Test_Admin:Order 12    230    19.2   0.983    0.496
## Residuals        20    390    19.5
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
print(model.tables(aov1,"means"),digits=3)
```

```
## Tables of means
## Grand mean
##
## 100.25
##
```

```
##  Test_Admin
## Test_Admin
## Admin_1 Admin_2 Admin_3 Admin_4
##     106     104      99      92
##
##  Order
## Order
##     I    II   III    IV     V
## 113.0 107.0  99.0  91.0  91.2
##
##  Test_Admin:Order
##           Order
## Test_Admin I   II  III IV  V
##    Admin_1 124 113 104  96  93
##    Admin_2 113 113 106  94  94
##    Admin_3 111 106  95  92  91
##    Admin_4 104  96  91  82  87
```

```
summary(aov2)
```

```
##
## Error: Test_Admin:Order
##            Df Sum Sq Mean Sq F value   Pr(>F)
## Test_Admin  3   1168   389.2   20.30 5.40e-05 ***
## Order       4   3010   752.5   39.26 8.41e-07 ***
## Residuals  12    230    19.2
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Error: Within
##           Df Sum Sq Mean Sq F value Pr(>F)
## Residuals 20    390    19.5
```