my\_data <- read.csv(file.choose())

str(my\_data)

head(my\_data)

attach(my\_data)

# One way Anova Model without interaction

model1 <- lm(Time~ Drink, data=my\_data)

summary(model1)

anova(model1)

# two way Anova ModelModel with interaction

model2 <- lm(Time~Drink\*Method)

summary(model2)

anova(model2)

# Model with aditve effect

model3 <- lm(Time~Drink + Method)

summary(model2)

anova(model3)

## Interaction Plot

with(my\_data,interaction.plot(Drink, Method, Time,col = c("#00AFBB", "#E7B800"),

main="Interaction Plot",xlab="Drinks", ylab="Time"))

# Color box plot by a second group: "supp"

library("ggpubr")

ggboxplot(my\_data, x = "Drink", y = "Time", color = "Method")

# Stacked bar plots as x = Drink, y = Time by method

ggplot(my\_data, aes(x = Drink, y = Time)) +

geom\_bar(aes(color = Method, fill = Method),

stat = "identity", position = position\_stack())

########dot chart

ggdotchart(my\_data, x = "Drink", y ="Time",

color = "Method", palette = "jco", size = 3,

add = "segment",

add.params = list(color = "lightgray", size = 1.5),

position = position\_dodge(0.3),

ggtheme = theme\_pubclean())

# Perorm pairwise comparisons

compare\_means(len ~ dose, data = ToothGrowth)

# Visualize: Specify the comparisons you want

compare\_means(Time ~ Drink, data = my\_data)

my\_comparisons <- list( c("Coffee", "Milk"), c("Milk", "Tea"), c("Coffee", "Tea") )

ggboxplot(my\_data, x = "Drink", y = "Time",

color = "Drink", palette = "jco")+

stat\_compare\_means(comparisons = my\_comparisons)+

stat\_compare\_means(label.y = 50)

# Use only p.format as label. Remove method name.

ggplot(my\_data, aes(Method, Time)) +

geom\_boxplot(aes(color = Method))+

facet\_wrap(~Drink) +

scale\_color\_manual(values = c("#00AFBB", "#E7B800")) +

stat\_compare\_means(label = "p.format")

# Box plot facetted by "dose"

p <- ggpaired(my\_data, x = "Method", y = "Time",

color = "Method", palette = "jco",

line.color = "gray", line.size = 0.4,

facet.by = "Drink", short.panel.labs = FALSE)

p

# Use only p.format as label. Remove method name.

p + stat\_compare\_means(label = "p.format", paired = TRUE)

R code output :

> str(my\_data)

'data.frame': 24 obs. of 3 variables:

$ Drink : chr "Coffee" "Coffee" "Coffee" "Coffee" ...

$ Method: chr "Stir" "Fan" "Ice" "Passive" ...

$ Time : int 139 76 95 181 134 82 94 201 271 95 ...

> head(my\_data)

Drink Method Time

1 Coffee Stir 139

2 Coffee Fan 76

3 Coffee Ice 95

4 Coffee Passive 181

5 Milk Stir 134

6 Milk Fan 82

> attach(my\_data)

The following objects are masked from my\_data (pos = 3):

Drink, Method, Time

The following objects are masked from my\_data (pos = 4):

Drink, Method, Time

The following objects are masked from my\_data (pos = 5):

Drink, Method, Time

The following objects are masked from my\_data (pos = 8):

Drink, Method, Time

> model1 <- lm(Time~ Drink, data=my\_data)

> summary(model1)

Call:

lm(formula = Time ~ Drink, data = my\_data)

Residuals:

Min 1Q Median 3Q Max

-110.75 -41.88 -16.38 60.75 149.25

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 130.38 27.51 4.740 0.000111 \*\*\*

DrinkMilk -2.75 38.90 -0.071 0.944311

DrinkTea 75.38 38.90 1.938 0.066235 .

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 77.8 on 21 degrees of freedom

Multiple R-squared: 0.1983, Adjusted R-squared: 0.122

F-statistic: 2.598 on 2 and 21 DF, p-value: 0.09817

> anova(model1)

Analysis of Variance Table

Response: Time

Df Sum Sq Mean Sq F value Pr(>F)

Drink 2 31447 15723.3 2.5976 0.09817 .

Residuals 21 127115 6053.1

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> # two way Anova ModelModel with interaction

> model2 <- lm(Time~Drink\*Method)

> summary(model2)

Call:

lm(formula = Time ~ Drink \* Method)

Residuals:

Min 1Q Median 3Q Max

-26.500 -3.125 0.000 3.125 26.500

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 8.300e+01 8.498e+00 9.768 4.61e-07 \*\*\*

DrinkMilk 1.500e+00 1.202e+01 0.125 0.902733

DrinkTea 1.550e+01 1.202e+01 1.290 0.221423

MethodIce 1.300e+01 1.202e+01 1.082 0.300615

MethodPassive 1.245e+02 1.202e+01 10.360 2.44e-07 \*\*\*

MethodStir 5.200e+01 1.202e+01 4.327 0.000984 \*\*\*

DrinkMilk:MethodIce -5.000e+00 1.700e+01 -0.294 0.773630

DrinkTea:MethodIce -3.500e+00 1.700e+01 -0.206 0.840289

DrinkMilk:MethodPassive -1.200e+01 1.700e+01 -0.706 0.493616

DrinkTea:MethodPassive 1.255e+02 1.700e+01 7.384 8.45e-06 \*\*\*

DrinkMilk:MethodStir -6.962e-14 1.700e+01 0.000 1.000000

DrinkTea:MethodStir 1.175e+02 1.700e+01 6.914 1.62e-05 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 12.02 on 12 degrees of freedom

Multiple R-squared: 0.9891, Adjusted R-squared: 0.9791

F-statistic: 98.72 on 11 and 12 DF, p-value: 5.159e-10

> anova(model2)

Analysis of Variance Table

Response: Time

Df Sum Sq Mean Sq F value Pr(>F)

Drink 2 31447 15723 108.874 2.030e-08 \*\*\*

Method 3 104321 34774 240.787 5.544e-11 \*\*\*

Drink:Method 6 21061 3510 24.306 4.726e-06 \*\*\*

Residuals 12 1733 144

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> # Model with aditve effect

> model3 <- lm(Time~Drink + Method)

> summary(model2)

Call:

lm(formula = Time ~ Drink \* Method)

Residuals:

Min 1Q Median 3Q Max

-26.500 -3.125 0.000 3.125 26.500

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 8.300e+01 8.498e+00 9.768 4.61e-07 \*\*\*

DrinkMilk 1.500e+00 1.202e+01 0.125 0.902733

DrinkTea 1.550e+01 1.202e+01 1.290 0.221423

MethodIce 1.300e+01 1.202e+01 1.082 0.300615

MethodPassive 1.245e+02 1.202e+01 10.360 2.44e-07 \*\*\*

MethodStir 5.200e+01 1.202e+01 4.327 0.000984 \*\*\*

DrinkMilk:MethodIce -5.000e+00 1.700e+01 -0.294 0.773630

DrinkTea:MethodIce -3.500e+00 1.700e+01 -0.206 0.840289

DrinkMilk:MethodPassive -1.200e+01 1.700e+01 -0.706 0.493616

DrinkTea:MethodPassive 1.255e+02 1.700e+01 7.384 8.45e-06 \*\*\*

DrinkMilk:MethodStir -6.962e-14 1.700e+01 0.000 1.000000

DrinkTea:MethodStir 1.175e+02 1.700e+01 6.914 1.62e-05 \*\*\*

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 12.02 on 12 degrees of freedom

Multiple R-squared: 0.9891, Adjusted R-squared: 0.9791

F-statistic: 98.72 on 11 and 12 DF, p-value: 5.159e-10

> anova(model3)

Analysis of Variance Table

Response: Time

Df Sum Sq Mean Sq F value Pr(>F)

Drink 2 31447 15723 12.416 0.0004088 \*\*\*

Method 3 104321 34774 27.460 6.187e-07 \*\*\*

Residuals 18 22794 1266

---

Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

## Interaction Plot

with(my\_data,interaction.plot(Drink, Method, Time,col = c("#00AFBB", "#E7B800"),

main="Interaction Plot",xlab="Drinks", ylab="Time"))