ANOVA 2

Lucky

2-Factor ANOVA. Use a 5% Level of Significance

a. Can we conclude differences exist between the 4 forms?

b. Can we conclude taxpayers in different tax brackets require different amount of time?

c. Is there an evidence of interaction between the two factors? Explain what it means.

d. Graph to show the interaction between the two factors.

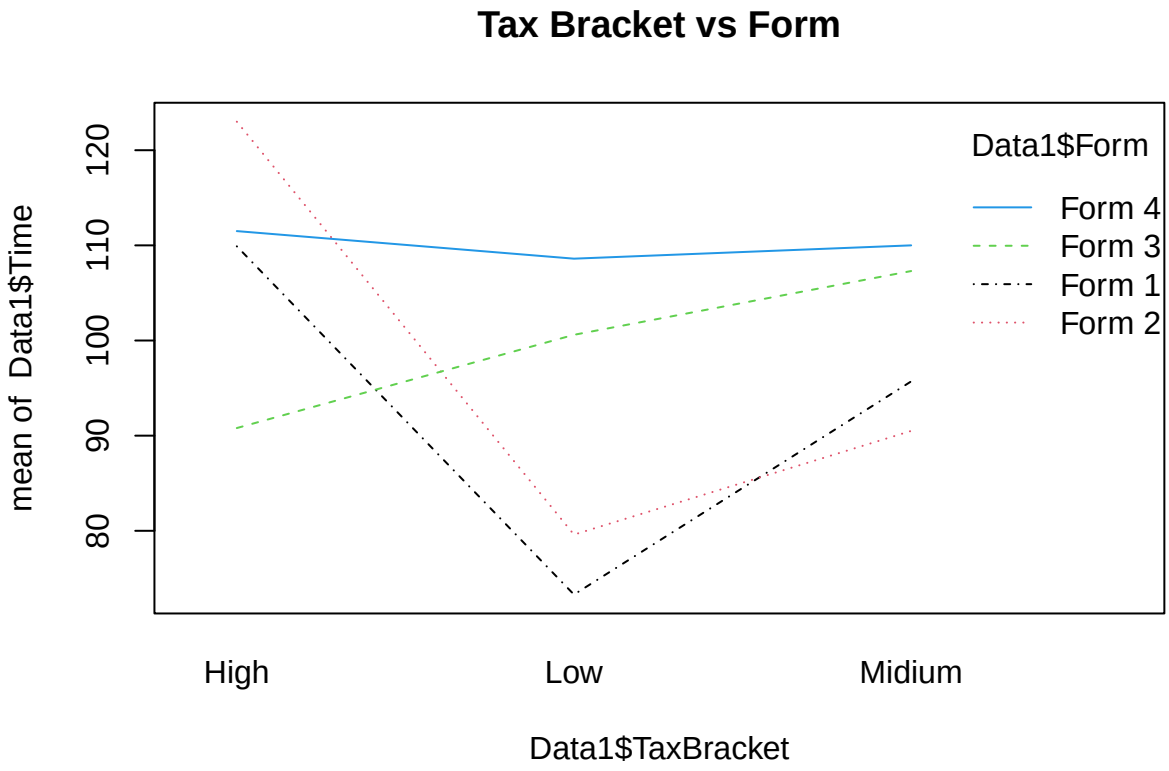
```
# Clear the environment
rm(list = ls())
# Load readxl library
library(readxl)
# Read this excel file
Prob1 <- read_excel("Example3.xlsx", sheet = "Prob1")
# Problem 1: ANOVA 2-factor
# Create data frames
v1 <- data.frame(Time = Prob1[, 2], Bracket = Prob1[, 1],  Form = rep("Form 1", 30))
names(v1)[names(v1) == "Form.1"] <- "Time"
v2 <- data.frame(Time = Prob1[, 3], Bracket = Prob1[, 1],  Form = rep("Form 2", 30))
names(v2)[names(v2) == "Form.2"] <- "Time"
v3 <- data.frame(Time = Prob1[, 4], Bracket = Prob1[, 1],  Form = rep("Form 3", 30))
names(v3)[names(v3) == "Form.3"] <- "Time"
v4 <- data.frame(Time = Prob1[, 5], Bracket = Prob1[, 1],  Form = rep("Form 4", 30))
names(v4)[names(v4) == "Form.4"] <- "Time"
# Set seed
set.seed(6359)
# Combine vectors
Data1 <- rbind(v1, v2, v3, v4)
# Rename
names(Data1)[names(Data1) == "Tax.Bracket"] <- "TaxBracket"
# ANOVA 2-factor analysis. Use a 5% Level of Significance.
ANOVA2 <- aov(Time ~ TaxBracket + Form + TaxBracket:Form, data=Data1)
# Summary
summary(ANOVA2)
```

```
##                  Df Sum Sq Mean Sq F value Pr(>F)
## TaxBracket        2   6719    3359   4.113 0.0190 *
## Form              3   4668    1556   1.905 0.1331
## TaxBracket:Form   6  11706    1951   2.388 0.0332 *
## Residuals       108  88217     817
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Mean of time difference between brackets
tapply(Data1$Time, list(Data1$TaxBracket, Data1$Form), mean)
```

```
##         Form 1 Form 2 Form 3 Form 4
## High     109.9  123.0   90.8  111.5
## Low       73.3   79.6  100.6  108.6
## Midium    95.7   90.5  107.3  110.0
```

```r
# Interaction Plot
interaction.plot(Data1$TaxBracket, Data1$Form, Data1$Time, lwd = 1, col = 1:6, main = "Tax Bracket vs F
```



2-Factor ANOVA

a. Can we conclude differences exist between the 4 forms?

- Tax Bracket: P-Value < Alpha => Reject
- Form: P-Value > Alpha => Fail to Reject
- Tax Bracket & Form: P-Value < Alpha => Reject

Yes. We can conclude that differences exist between 4 form.

b. Can we conclude taxpayers in different tax brackets require different amount of time?

Yes, we can conclude that taxpayers in different tax brackets require different amount of time based on the average time taken to fill out the form. For instance, the overall average of Low is 90.525, Medium is 100.875 and High is 108.8.

c. Is there an evidence of interaction between the two factors? Explain what it means.

Yes, there is an evidence that there is an interaction between the two factors.We are looking at 2 factors Tax Bracket and Form. Based on the summary of ANOVA 2-factor, the P-Value of two factors are smaller than Alpha = 0.5 thus we Reject the null hypothesis. Moreover, we can also use interaction plot to find evidence of interaction between two factors.
