Statistical_Infer_Part2.Rmd

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Instructions

1.Load the ToothGrowth data and perform some basic exploratory data analyses

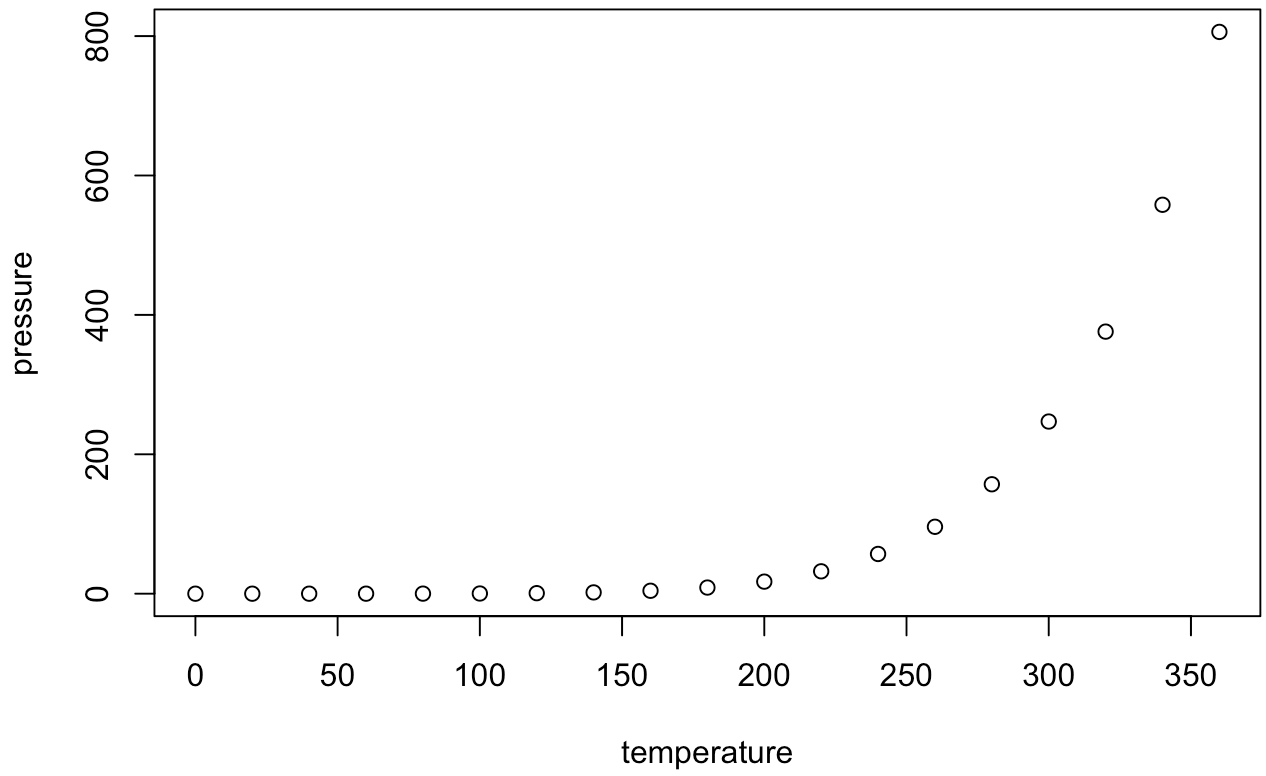
2.Provide a basic summary of the data.

3.Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose. (Only use the techniques from class, even if there's other approaches worth considering)

4.State your conclusions and the assumptions needed for your conclusions.

Including Plots

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

Exploratory data Analysis

First me load the packages, and dataset

```
library(ggplot2)
library(knitr)
library(datasets)
```

Load the ToothGrowth data and perform basic Exploratory Data Analysis

```
data(ToothGrowth)
str(ToothGrowth)
```

```
## 'data.frame':    60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

```
head(ToothGrowth, 4)
```

```
##    len supp dose
## 1  4.2   VC  0.5
## 2 11.5   VC  0.5
## 3  7.3   VC  0.5
## 4  5.8   VC  0.5
```

```
tail(ToothGrowth, 4)
```

```
##     len supp dose
## 57 26.4   OJ    2
## 58 27.3   OJ    2
## 59 29.4   OJ    2
## 60 23.0   OJ    2
```

Calculate the summary of the data

```
summary(ToothGrowth)
```

```
##       len        supp         dose
##  Min.   : 4.20   OJ:30   Min.   :0.500
##  1st Qu.:13.07   VC:30   1st Qu.:0.500
##  Median :19.25           Median :1.000
##  Mean   :18.81           Mean   :1.167
##  3rd Qu.:25.27           3rd Qu.:2.000
##  Max.   :33.90           Max.   :2.000
```

Calculate the mean of the length

```
suppl_mean = split(ToothGrowth$len, ToothGrowth$supp)
sapply(suppl_mean, mean)
```

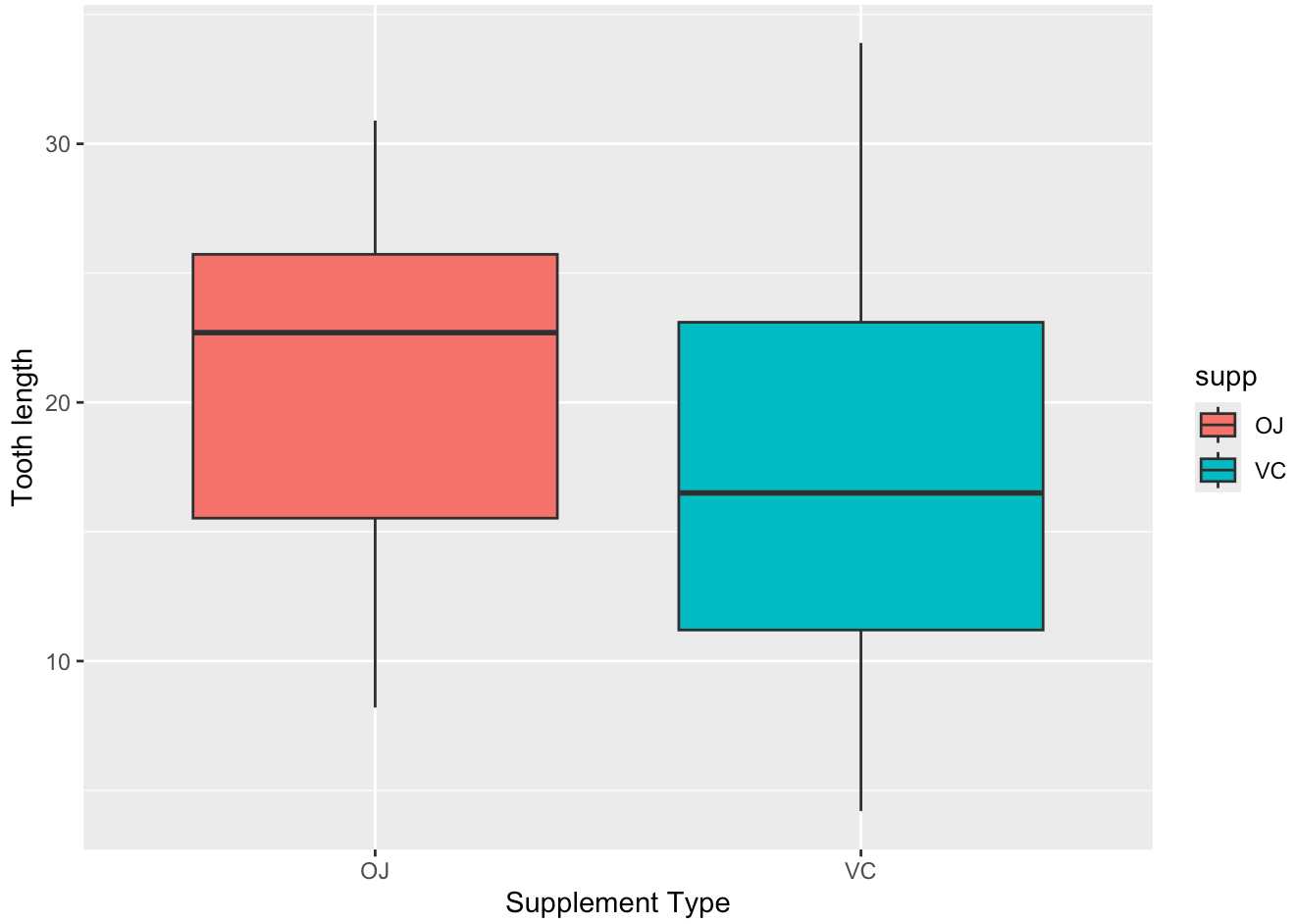
```
##       OJ       VC
## 20.66333 16.96333
```

```
suppl_mean
```

```
## $OJ
##  [1] 15.2 21.5 17.6  9.7 14.5 10.0  8.2  9.4 16.5  9.7 19.7 23.3 23.6 26.4 20.0
## [16] 25.2 25.8 21.2 14.5 27.3 25.5 26.4 22.4 24.5 24.8 30.9 26.4 27.3 29.4 23.0
##
## $VC
##  [1]  4.2 11.5  7.3  5.8  6.4 10.0 11.2 11.2  5.2  7.0 16.5 16.5 15.2 17.3 22.5
## [16] 17.3 13.6 14.5 18.8 15.5 23.6 18.5 33.9 25.5 26.4 32.5 26.7 21.5 23.3 29.5
```

Basic Exploratory Analysis, Graph below

```
ggplot(aes(x=supp, y=len), data=ToothGrowth) + geom_boxplot(aes(fill=supp))+
  xlab("Supplement Type") +ylab("Tooth length")
```



Get the confidence intervals

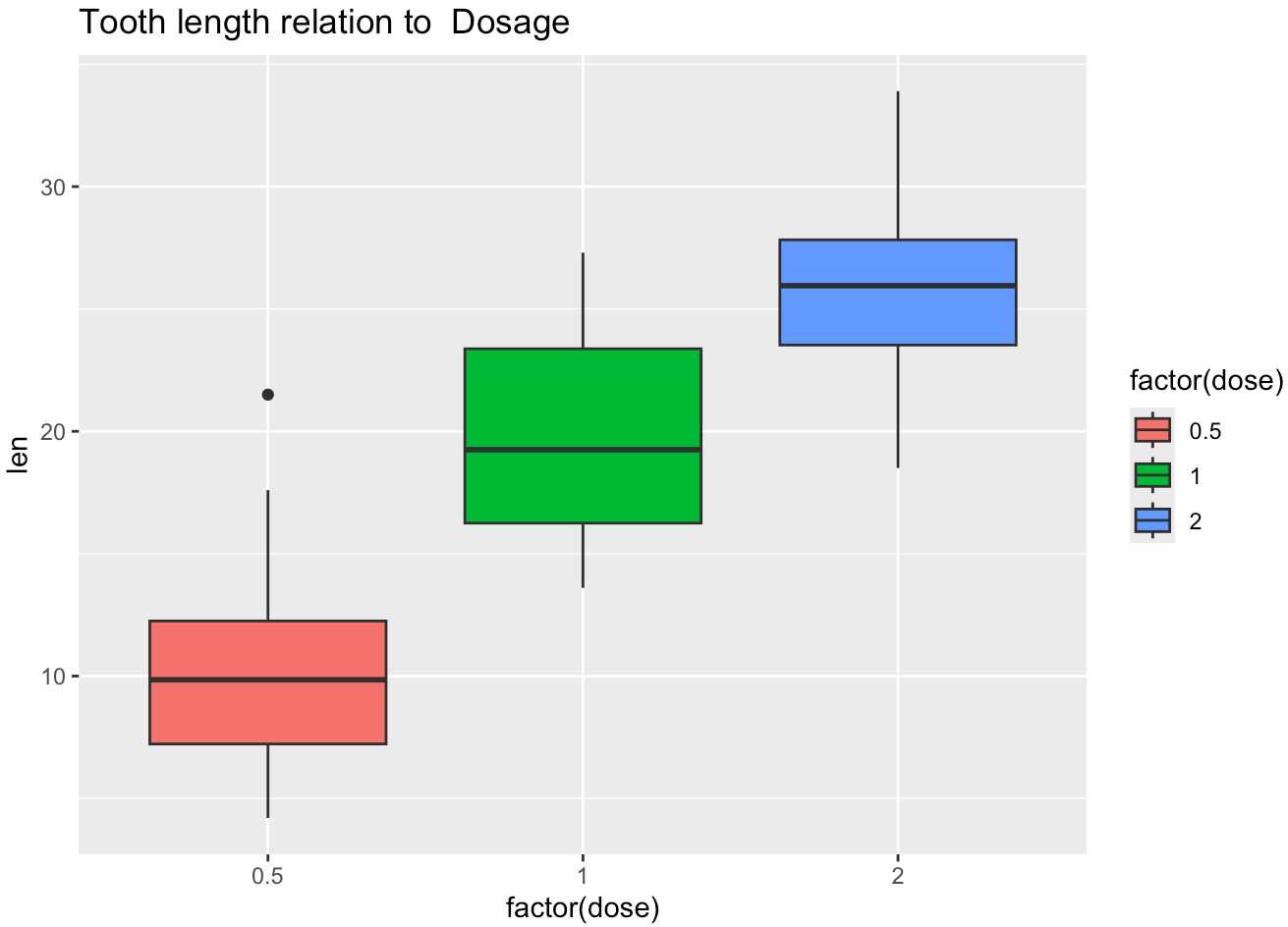
```
unique(ToothGrowth$dose)
```

```
## [1] 0.5 1.0 2.0
```

Unique dose groups are 0.5, 1, 2

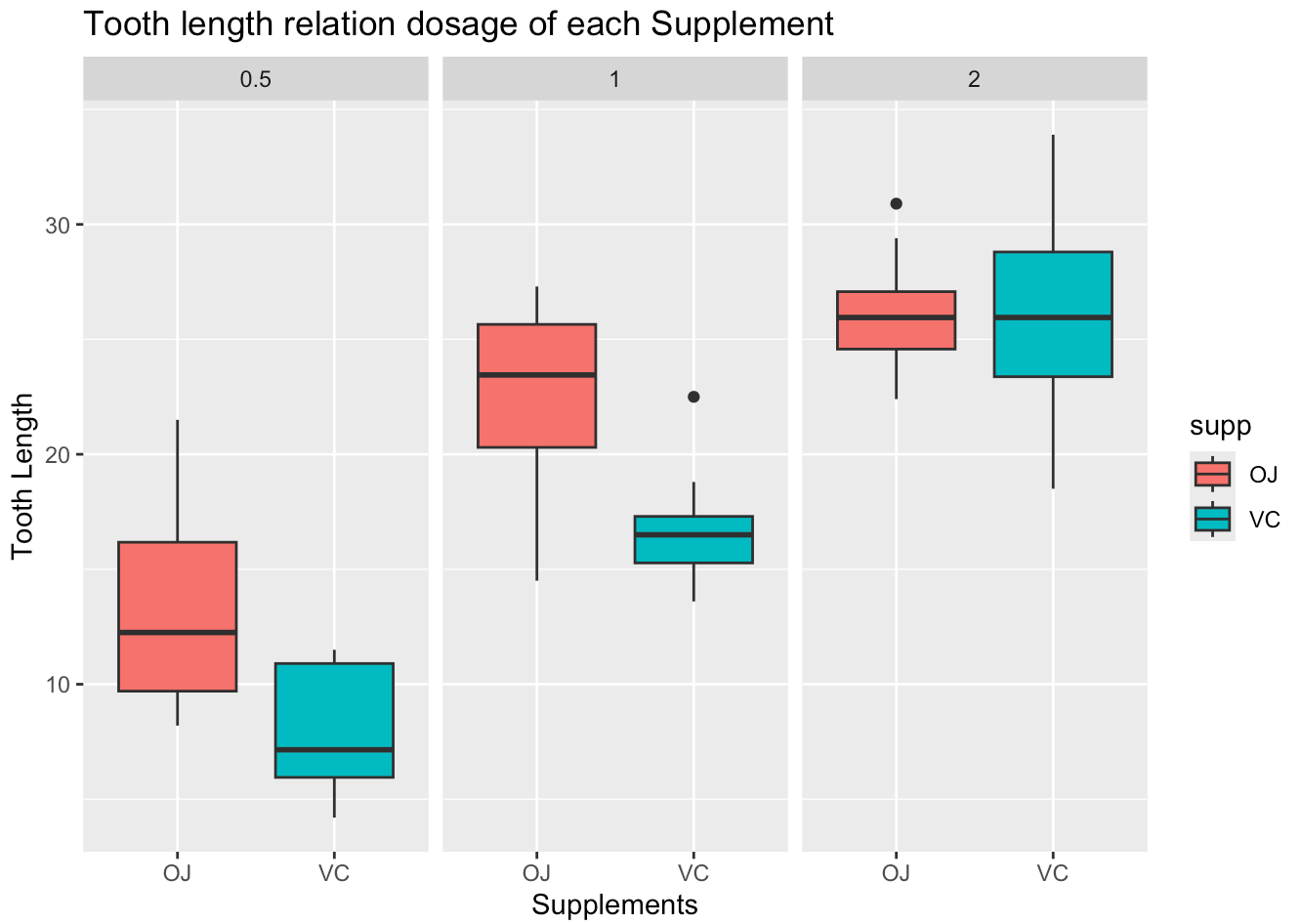
Graph below, shows the relationship between Tooth Length and Dosages

```
ggplot(aes(x = factor(dose), y = len), data = ToothGrowth) +
 geom_boxplot(aes(fill = factor(dose))) +
 ggtitle("Tooth length relation to  Dosage")
```



Graph below show the tooth Length realation to dosage of each supplement

```
ggplot(aes(x=supp, y=len), data=ToothGrowth) +
  geom_boxplot(aes(fill=supp)) + xlab("Supplements") +
  ylab("Tooth Length") + facet_grid(~ dose) +
  ggtitle("Tooth length relation dosage of each Supplement")
```



Hypothesis test defined below :

$H0$: tooth length does not depend of different supplements Ha: tooth length are effected by different supplement

```
t.test(len ~ supp, ToothGrowth[ToothGrowth$dose == .5, ])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = 3.1697, df = 14.969, p-value = 0.006359
## alternative hypothesis: true difference in means between group OJ and group VC is not
equal to 0
## 95 percent confidence interval:
##  1.719057 8.780943
## sample estimates:
## mean in group OJ mean in group VC
##            13.23             7.98
```

```
t.test(len ~ supp, ToothGrowth[ToothGrowth$dose == 1, ])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = 4.0328, df = 15.358, p-value = 0.001038
## alternative hypothesis: true difference in means between group OJ and group VC is not
equal to 0
## 95 percent confidence interval:
##  2.802148 9.057852
## sample estimates:
## mean in group OJ mean in group VC
##            22.70            16.77
```

```
t.test(len ~ supp, ToothGrowth[ToothGrowth$dose == 2, ])
```

```
##
##  Welch Two Sample t-test
##
## data:  len by supp
## t = -0.046136, df = 14.04, p-value = 0.9639
## alternative hypothesis: true difference in means between group OJ and group VC is not
equal to 0
## 95 percent confidence interval:
##  -3.79807  3.63807
## sample estimates:
## mean in group OJ mean in group VC
##            26.06            26.14
```

Conclusion

we reject the Null Hypothesis, give more explanation on each test, CHATGPT use.