Statistical Inference Project Part 2 Saran Shanmugam

Overview

The response is the length of odontoblasts (cells responsible for tooth growth) in 60 guinea pigs. Each animal received one of three dose levels of vitamin C (0.5, 1, and 2 mg/day) by one of two delivery methods, (orange juice or ascorbic acid (a form of vitamin C and coded as VC). In this project, we are going to run the hypothesis to run tooth growth due to various dosage levels and supplements. The hypothesis test we are going to use is the Student's T test.

```
library(datasets)
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 ...
```

Summary of the Data

This section will provide a brief 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
```

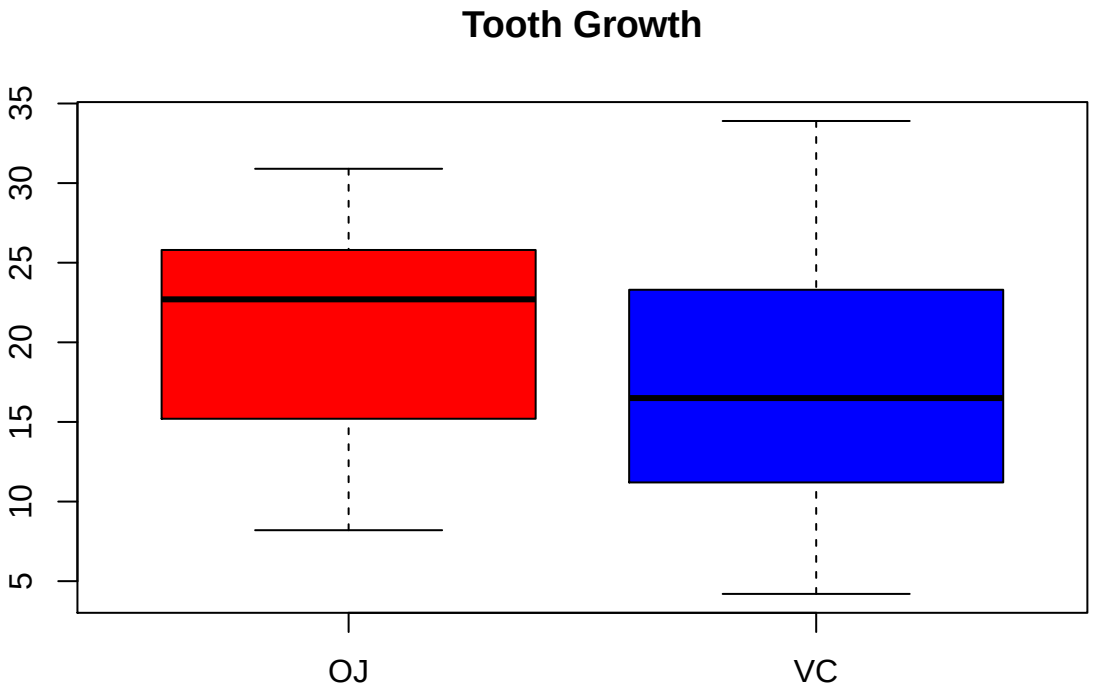
```
head(ToothGrowth)
```

```
##    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
## 5  6.4   VC  0.5
## 6 10.0   VC  0.5
```

Exploration of the Data

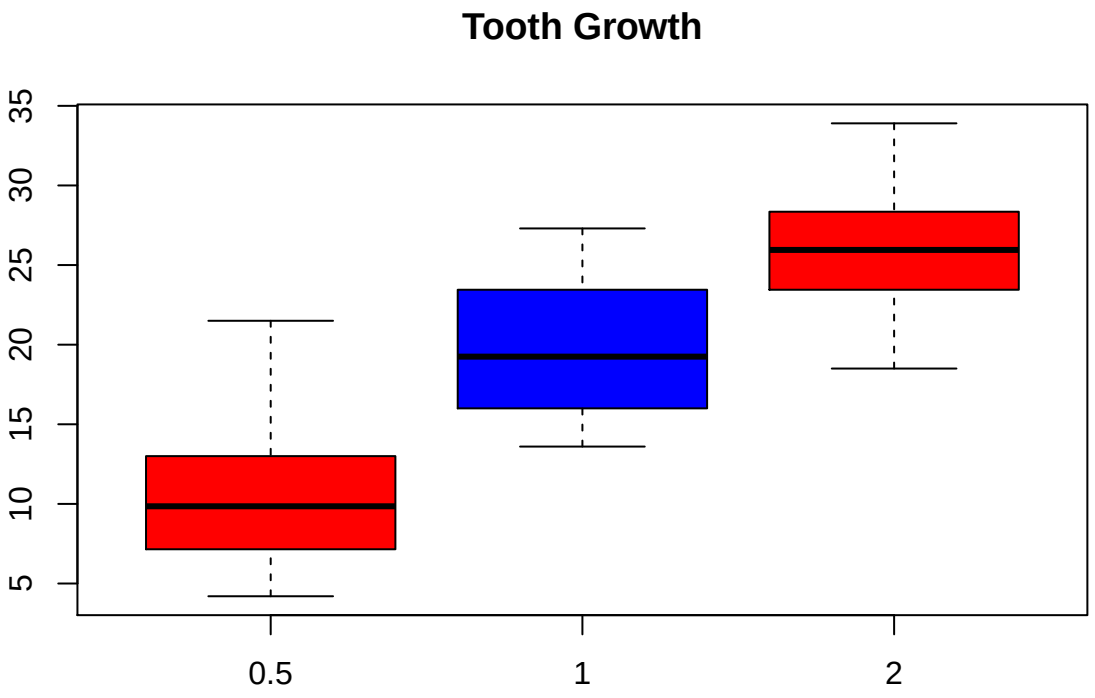
This section will explore the data briefly

```
boxplot(len~supp, data=ToothGrowth, notch=FALSE,
col=(c("red","blue")), main="Tooth Growth", xlab="Supplement vs Length of Tooth")
```



we can see that the supplements does not significantly affect the tooth growth.

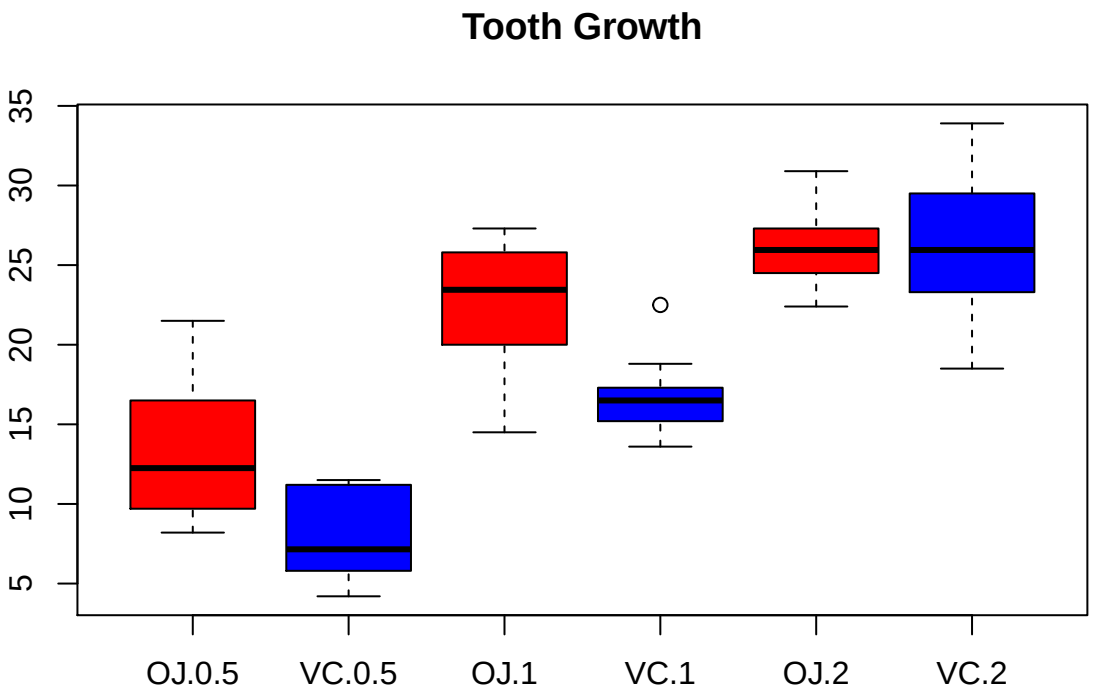
```
 boxplot(len~dose, data=ToothGrowth, notch=FALSE,
col=(c("red","blue")), main="Tooth Growth", xlab="Dosage Levels vs Length of Tooth")
```



Dosage Levels vs Length of Tooth

We can see that the dosage levels affect the length of the tooth.

```
 boxplot(len~supp*dose, data=ToothGrowth, notch=FALSE,
col=(c("red","blue")), main="Tooth Growth", xlab="Supplement vs Dosage Levels")
```



Supplement vs Dosage Levels

Assumptions

Based on the above boxplots, we know what the Supplements affect the length of the Tooth significantly. But the supplements does not.

Populations of the Guinea pigs from which the samples are drawn are normally distributed and Standard Deviations are also equal

Hypothesis test

```
#Supplement comparison
ToothGrowth.VC <- subset(ToothGrowth, supp == "VC")
 ToothGrowth.OJ <- subset(ToothGrowth, supp == "OJ")
 t.test(ToothGrowth.VC$len,ToothGrowth.OJ$len)
```

```
##
##  Welch Two Sample t-test
##
## data:  ToothGrowth.VC$len and ToothGrowth.OJ$len
## t = -1.9153, df = 55.309, p-value = 0.06063
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -7.5710156  0.1710156
## sample estimates:
## mean of x mean of y
##  16.96333  20.66333
```

As the confidence levels include 0, we cannot reject the null hypothesis that there is no significant difference in the impact of tooth length due to the 2 supplements.

```
 #Dosage comparison between 0.5 mg and 1 mg
ToothGrowth.05<- subset(ToothGrowth, dose == 0.5)
 ToothGrowth.10 <- subset(ToothGrowth, dose  == 1.0)
ToothGrowth.20 <- subset(ToothGrowth, dose == 2.0)
 t.test(ToothGrowth.05$len,ToothGrowth.10$len)
```

```
##
##  Welch Two Sample t-test
##
## data:  ToothGrowth.05$len and ToothGrowth.10$len
## t = -6.4766, df = 37.986, p-value = 1.268e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.983781  -6.276219
## sample estimates:
## mean of x mean of y
##    10.605    19.735
```

Comparison between Dosages 0.5 mg and 1.0 mg: As the confidence levels does not include 0, we can reject the null hypothesis that there is no significant difference in the impact of tooth length due to 0.5 mg and 1.0 mg dosage levels(there is a significant difference in tooth length)

```r
#Dosage comparison between 1 mg and 2 mg
t.test(ToothGrowth.10$len,ToothGrowth.20$len)
```

```
##
##  Welch Two Sample t-test
##
## data:  ToothGrowth.10$len and ToothGrowth.20$len
## t = -4.9005, df = 37.101, p-value = 1.906e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -8.996481 -3.733519
## sample estimates:
## mean of x mean of y
##    19.735    26.100
```

Comparison between Dosages 1 mg and 2 mg: As the confidence levels does not include 0, we can reject the null hypothesis that there is no significant difference in the impact of tooth length due to 1 mg and 2 mg dosage levels(there is a significant difference in tooth length)

Conclusion

Based on the above observations, we can say that the length of the tooth growth is impacted when Vitamin C dosage increases and it is proportionate. Supplement appears to not make a significant difference.