Statistical Inference Project 2

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Assignment Description

Load the ToothGrowth data and perform some basic exploratory data analyses

Provide a basic summary of the data.

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)

State your conclusions and the assumptions needed for your conclusions

1.Load the data and perform basic exploratory data analysis

```
#installing required packges
library(datasets)
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.2.2
```

```
#load the data
data("ToothGrowth")
#look at the structure of the data
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 ...
```

```
#quick summary of the data amd look at the first few rows 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)
```

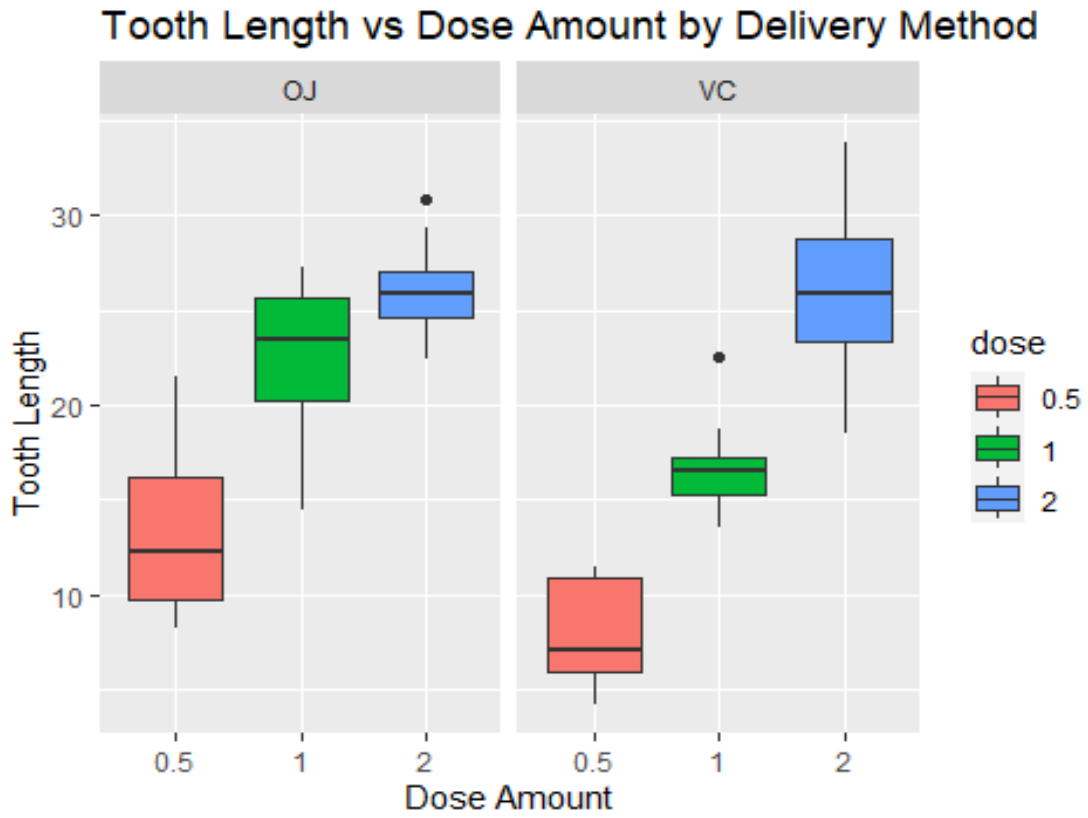
```
##    len supp dose
## 1  4.2   VC  0.5
## 2 11.5   VC  0.5
## 3  7.3   VC  0.5
## 4  5.8   VC  0.5
## 5  6.4   VC  0.5
## 6 10.0   VC  0.5
```

2. Summary of the data using plots

```
#converting dose to be a factor
ToothGrowth$dose <- as.factor(ToothGrowth$dose)
```

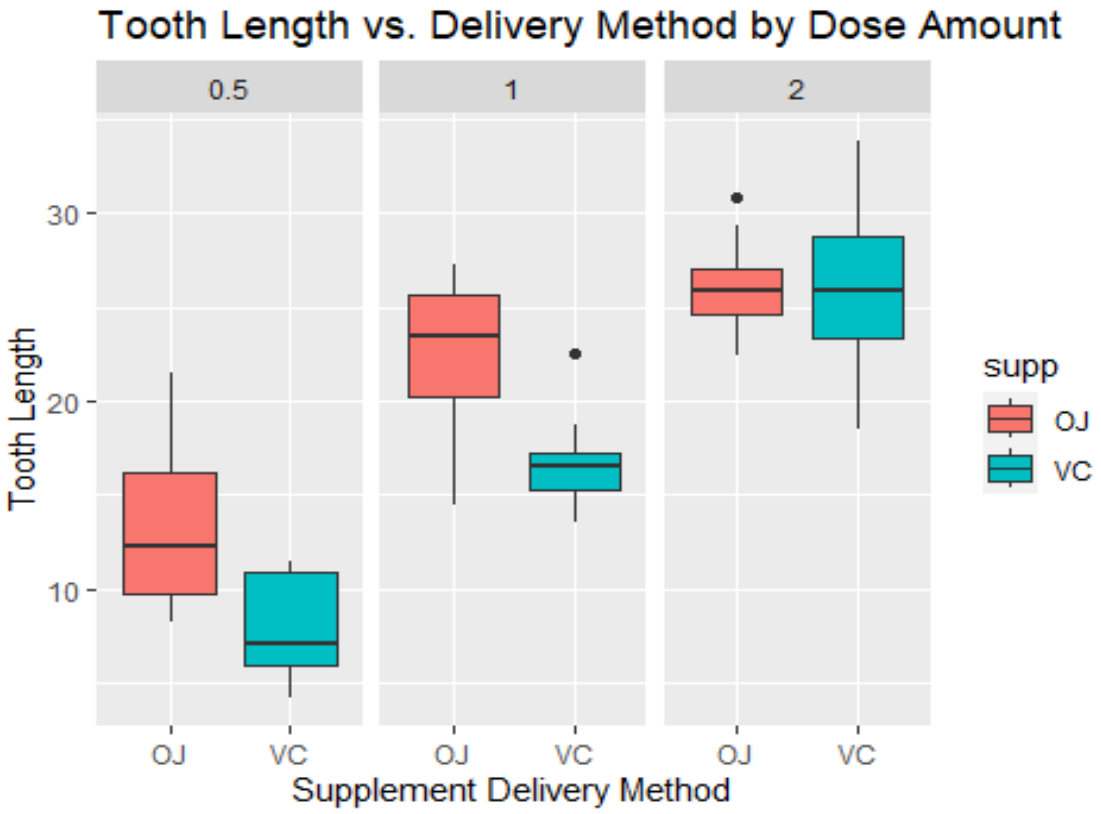
#Plot length by dose amount,broken by supplement delivery method

```
ggplot(aes(x=dose,y=len),data = ToothGrowth)+
geom_boxplot(aes(fill=dose))+xlab("Dose Amount")+ylab("Tooth
Length")+facet_grid(~supp)+ggtitle("Tooth Length vs Dose Amount by Delivery
Method")
```



#plot length by supplement delivery method, broken by dose amount

```
ggplot(aes(x=supp, y=len), data= ToothGrowth)+geom_boxplot(aes(fill=supp))+
xlab("Supplement Delivery Method")+ylab("Tooth Length")+facet_grid(~ dose)+
  ggtitle("Tooth Length vs. Delivery Method by Dose Amount")
```



3. Using Confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose

```
#T-test
t.test(len~supp,data = ToothGrowth)

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

The p-value is 0.06 and the confidence interval contains 0 as well so we fail to reject the null hypothesis that supplement types have no effect on the tooth length

#Comparing the dose amount using t-test

```r
#subset the data per dose amount level 0.5 and 1.0
subl <- subset(ToothGrowth,dose %in% c(0.5,1.0))
t.test(len~dose, data = subl)
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -6.4766, df = 37.986, p-value = 1.268e-07
## alternative hypothesis: true difference in means between group 0.5 and
group 1 is not equal to 0
## 95 percent confidence interval:
##  -11.983781  -6.276219
## sample estimates:
## mean in group 0.5   mean in group 1
##            10.605            19.735
```

```r
#subset data per dose amount level 0.5 and 2.0
#subset the data per dose amount level 0.5 and 1.0
subl2 <- subset(ToothGrowth,dose %in% c(0.5,2.0))
t.test(len~dose, data = subl2)
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -11.799, df = 36.883, p-value = 4.398e-14
## alternative hypothesis: true difference in means between group 0.5 and
group 2 is not equal to 0
## 95 percent confidence interval:
##  -18.15617 -12.83383
## sample estimates:
## mean in group 0.5   mean in group 2
##            10.605            26.100
```

```r
#subsrt data per dose amount level 1.0 and 2.0
subl3 <- subset(ToothGrowth,dose %in% c(1.0,2.0))
t.test(len~dose, data = subl3)
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -4.9005, df = 37.101, p-value = 1.906e-05
## alternative hypothesis: true difference in means between group 1 and group
2 is not equal to 0
## 95 percent confidence interval:
##  -8.996481 -3.733519
## sample estimates:
## mean in group 1 mean in group 2
##          19.735          26.100
```

4. Conclusions and Assumptions

Conclusions: 1. Supplement delivery method has no effect on tooth growth 2. Tooth groeth increase with increase in dose amount Assumptions: 1. The sample is a representation of an entire population 2. the distribution of the population follows the Central Limit Theorem