Statistical Inference Project

Loading the ToothGrowth data and performing some basic exploratory data analyses

```
library(datasets)

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
```

```
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 ...
```

Providing a basic 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
```

```
# Compare means of the different delivery methods
tapply(ToothGrowth$len,ToothGrowth$supp, mean)
```

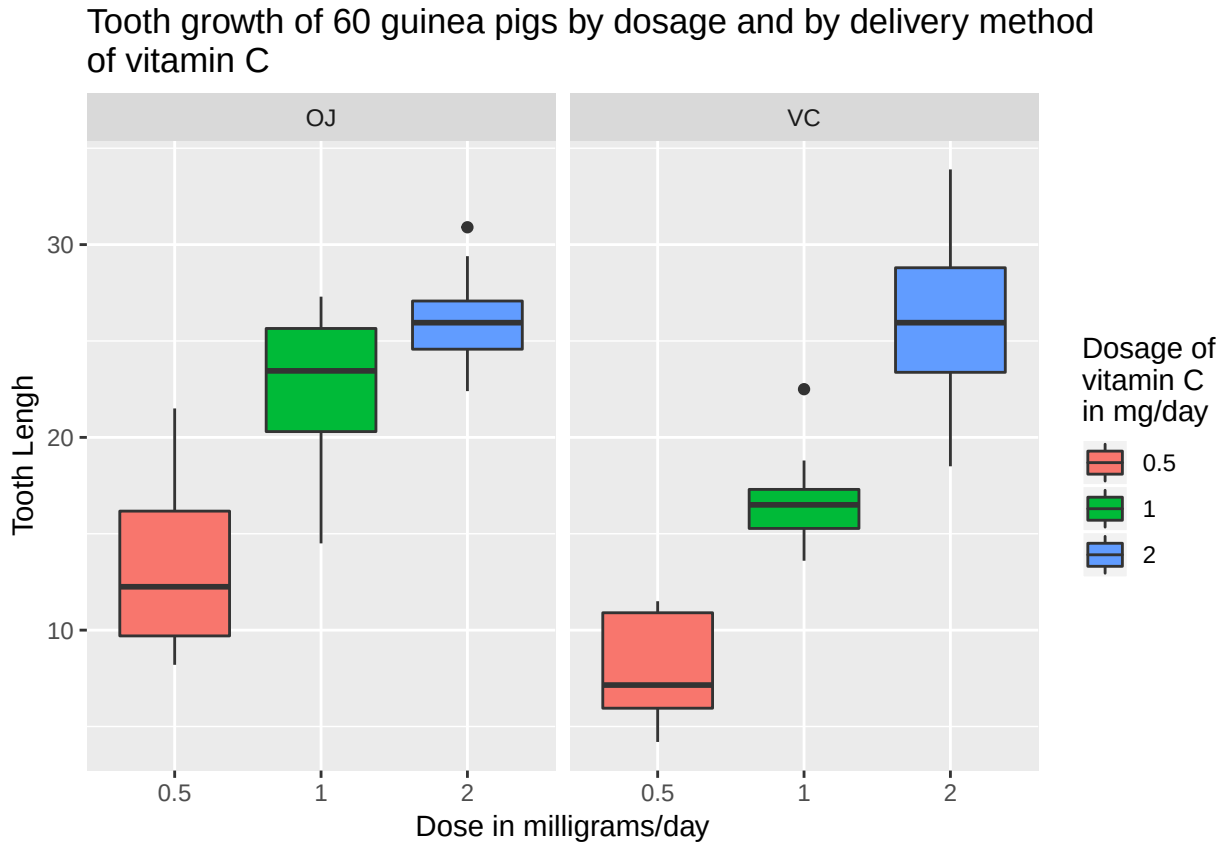
```
##       OJ       VC
## 20.66333 16.96333
```

```
# Make a plot to look at data graphically
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.4.4
```

```
ggplot(ToothGrowth, aes(factor(dose), len, fill = factor(dose))) +
      geom_boxplot() +

      facet_grid(.~supp) +
      labs(title = "Tooth growth of 60 guinea pigs by dosage and by delivery method\nof vitamin C",
           x = "Dose in milligrams/day",
           y = "Tooth Lengh") +
      scale_fill_discrete(name = "Dosage of\nvitamin C\nin mg/day")
```



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

```
t05 <- t.test(len ~ supp,
       data = rbind(ToothGrowth[(ToothGrowth$dose == 0.5) &
                                  (ToothGrowth$supp == "OJ"),],
                    ToothGrowth[(ToothGrowth$dose == 0.5) &
                                  (ToothGrowth$supp == "VC"),]),
       var.equal = FALSE)

t1 <- t.test(len ~ supp,
       data = rbind(ToothGrowth[(ToothGrowth$dose == 1) &
                                  (ToothGrowth$supp == "OJ"),],
                    ToothGrowth[(ToothGrowth$dose == 1) &
                                  (ToothGrowth$supp == "VC"),]),
       var.equal = FALSE)

t2 <- t.test(len ~ supp,
       data = rbind(ToothGrowth[(ToothGrowth$dose == 2) &
                                  (ToothGrowth$supp == "OJ"),],
                    ToothGrowth[(ToothGrowth$dose == 2) &
                                  (ToothGrowth$supp == "VC"),]),
       var.equal = FALSE)
# Make summary of the conducted t.tests, which compare the delivery methods by dosage
# take p-values and CI
```

```r
summaryBYsupp <- data.frame(
      "p-value" = c(t05$p.value, t1$p.value, t2$p.value),
      "Conf.Low" = c(t05$conf.int[1],t1$conf.int[1], t2$conf.int[1]),
      "Conf.High" = c(t05$conf.int[2],t1$conf.int[2], t2$conf.int[2]),
      row.names = c("Dosage 0.5","Dosage 1","Dosage 2"))
# Show the data table
summaryBYsupp
```

```
##                p.value  Conf.Low Conf.High
## Dosage 0.5 0.006358607  1.719057  8.780943
## Dosage 1   0.001038376  2.802148  9.057852
## Dosage 2   0.963851589 -3.798070  3.638070
```

Stating the conclusions and the assumptions needed for the conclusions.

With 95% confidence we reject the null hypothesis, stating that there is no difference in the tooth growth by the delivery method for .5 and 1 milligrams/day as We observe p-values less than the treshold of .05 and the confidence levels don't include 0. So, for dosage of .5 milligrams/day and 1 milligrams/day does matter the delivery method. With 95% confidence we fail to reject the null hypothesis, stating that there is no difference in the tooth growth by the delivery method for 2 milligrams/day. We observe p-values more than the treshold of .05 and the confidence levels include 0. So, for dosage of 2 milligrams/day the delivery method doesn't matter.