Statistical Inference: Peer Assessment 2nd Part

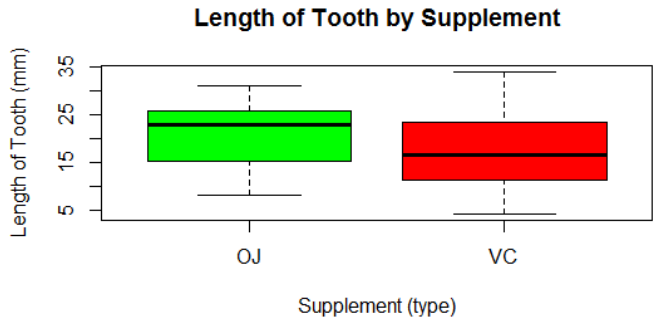
We have been tasked with analysing the ToothGrowth dataset. Two types of supplements are used. Vitamin C and Ascorbic Acid. For our purposes, the variable “len” is the length of the tooth in mm, and “supp” is the supplement type. The dosage is 0.5, 1 and 2 mg.

Loading and Processing the data

```
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 ...steps      date interval month

summary(ToothGrowth)

##       len        supp     dose
##  Min.   : 4.20   OJ:30   0.5:20
##  1st Qu.:13.07   VC:30   1  :20
##  Median :19.25           2  :20
##  Mean   :18.81
##  3rd Qu.:25.27
##  Max.   :33.90
```

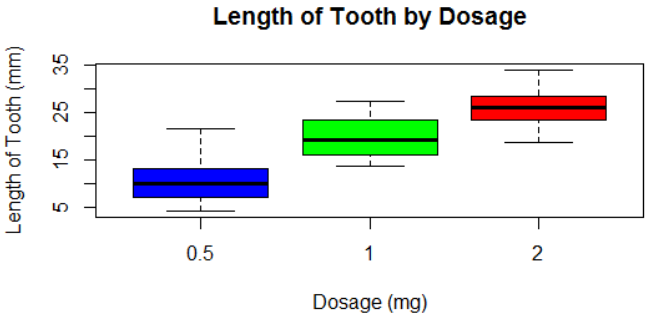
We are now going to create three plots. The first being a boxplot of the supplement taken vs. the tooth length in mm.

```
boxplot(ToothGrowth$len~ToothGrowth$supp, col=c("green", "red"),
      main="Length of Tooth by Supplement", ylab="Length of Tooth (mm)",xlab="Supplement (type)")
```



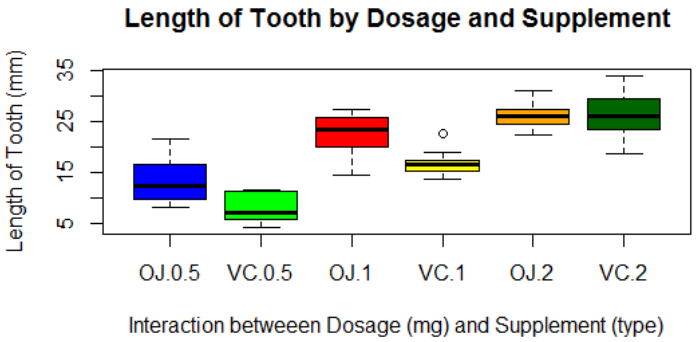
The second plot looks at the affect of the dosage on the length of the tooth. At face value there appears to be a mild but noticable difference between the 0.5 and 1 mg dosage. After 1 mg, the affect peters off.

```
boxplot(ToothGrowth$len~ToothGrowth$dose, col=c("blue", "green", "red"),
      main="Length of Tooth by Dosage", ylab="Length of Tooth (mm)",
      xlab="Dosage (mg)")
```



In the last plot, we show the interaction between the dosage and supplement types. It appears that both supplements increase the length of the tooth.

```
boxplot(len~ interaction(supp, dose), data=ToothGrowth, col=c("blue", "green", "red", "yellow", "orange", "darkgreen"),
    main="Length of Tooth by Dosage and Supplement", ylab="Length of Tooth (mm)",
    xlab="Interaction betweeen Dosage (mg) and Supplement (type)")
```



Testing the confidence intervals and hypothesis tests to verify the above plots' results.

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

##  Welch Two Sample t-test
## data:  len by supp
## t = 1.915, df = 55.31, p-value = 0.06063
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.171  7.571
## sample estimates:
## mean in group OJ mean in group VC
##            20.66            16.96
```

The p-value is 0.06063 with a confidence interval that has a zero reading, therefore, we cannot reject the null hypothesis that different supplements have had no affect on tooth length.

We now create three sub-groups based on dosage levels.

```
ToothGrowth.doses_0.5_1.0 <- subset (ToothGrowth, dose %in% c(0.5, 1.0))
ToothGrowth.doses_0.5_2.0 <- subset (ToothGrowth, dose %in% c(0.5, 2.0))
ToothGrowth.doses_1.0_2.0 <- subset (ToothGrowth, dose %in% c(1.0, 2.0))
```

We then test the following:

```
t.test(len ~ dose, data = ToothGrowth.doses_0.5_1.0)

##  Welch Two Sample t-test
## data:  len by dose
## t = -6.477, df = 37.99, p-value = 1.268e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.984  -6.276
## sample estimates:
## mean in group 0.5   mean in group 1
##           10.61           19.73

t.test(len ~ dose, data = ToothGrowth.doses_0.5_2.0)

##  Welch Two Sample t-test
## data:  len by dose
## t = -11.8, df = 36.88, p-value = 4.398e-14
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -18.16 -12.83
## sample estimates:
## mean in group 0.5   mean in group 2
##           10.61           26.10

t.test(len ~ dose, data = ToothGrowth.doses_1.0_2.0)

##  Welch Two Sample t-test
## data:  len by dose
## t = -4.901, df = 37.1, p-value = 1.906e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -8.996 -3.734
## sample estimates:
## mean in group 1 mean in group 2
##           19.73           26.10
```

This indicates that increasing the dosage has a positive effect on the length of the tooth.

Conclusion

We can therefore surmise from the above information that there is a clear indication that an increase in dosage levels from 0.5 to 1mg has a significant enough effect. Beyond that it does not have a marked effect on the teeth