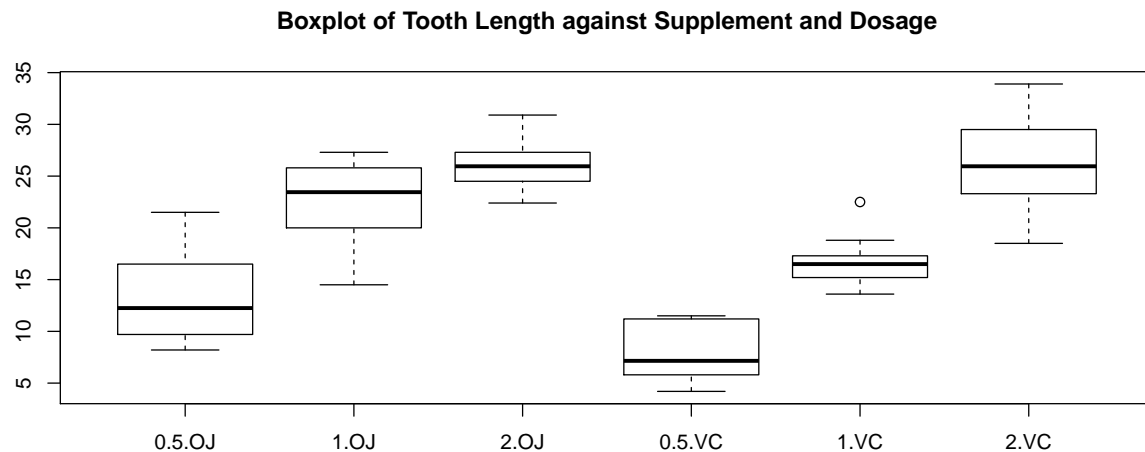


Analysis of ToothGrowth Dataset

The `ToothGrowth` dataset was an experiment of the effect of vitamin C on tooth growth in guinea pigs.

Exploratory Data Analysis

```
data(ToothGrowth)
boxplot(len ~ dose + supp, data = ToothGrowth, main = "Boxplot of Tooth Length against Supplement and Dose")
```



The boxplot showed the length against both supplement type and dosage. Except for the largest dosage, it seemed to suggest that supplement OJ was associated with larger tooth growth. For the largest dosage, the wide spread for supplement VC made the comparison inconclusive.

Data Summary

Since tooth length was the only numeric variable, we could use the `summary()` function on it to obtain the five-number summary and mean.

```
summary(ToothGrowth$len)
```

```
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##      4.2   13.1   19.2   18.8   25.3   33.9
```

Next we could look at the number of subjects for the different supplement and dosage using the `table()` function. The investigators set the same number of subject for each group.

```
with(ToothGrowth, table(supp, dose))
```

```
##      dose
## supp 0.5  1  2
##   OJ  10 10 10
##   VC  10 10 10
```

Hypothesis Test

The hypothesis tests were done comparing the mean length of tooth growth between the supplements at each dosage levels. The alternative hypothesis was that the mean length was not equal. It was not assumed that the length for the groups had equal variance. The confidence interval were shown as followed.

```
d0.5 <- t.test(len ~ supp, data = subset(ToothGrowth, dose == 0.5))
d1.0 <- t.test(len ~ supp, data = subset(ToothGrowth, dose == 1))
d2.0 <- t.test(len ~ supp, data = subset(ToothGrowth, dose == 2))
rbind(d0.5 = d0.5$conf.int, d1.0 = d1.0$conf.int, d2.0 = d2.0$conf.int)
```

```
##      [,1] [,2]
## d0.5 1.719 8.781
## d1.0 2.802 9.058
## d2.0 -3.798 3.638
```

It could be observed that zero was not included in the confidence interval for the first 2 dosages: 0.5 and 1.0 mg. Hence, it could be concluded that the mean lengths were significantly different from zero with 95% confidence. The p-values were **0.0064** and **0.001** respectively. In both instance, the confidence interval were positive, showing that supplement OJ was associated with larger tooth growth than supplement VC.

However, the confidence interval for the largest dosage of 2.0 mg contained zero, so the difference in mean lengths were not significantly different from zero. The p-value of 0.9639 was very large. This could mean that at larger dosage, both supplements had very similar effects on tooth growth.

Conclusion

For smaller dosages of 0.5 and 1.0 mg, supplement OJ showed greater effect on tooth growth than supplement VC. However, at a large dosage of 2.0 mg, the appeared to be as effective. Therefore, it could not be concluded that supplement OJ was better than supplement VC for all dosage levels. Perhaps an experiment with a larger sample size could be conducted to clear that doubt.

The assumptions made for the analysis was that tooth growth was normally distributed for each group, not necessarily with the same mean or variance. In addition, the samples were assumed to be independent and not paired.