

# inferential\_assignment\_1\_part2

*treepruner*

*September 24, 2015*

## Description

This part of the exercise analyzes the effect of citamin C on tooth growth in guinea pigs. The ToothGrowth data in the R datasets package.

The response is the length of odontoblasts (teeth) in each of 10 guinea pigs at each of three dose levels of Vitamin C (0.5, 1, and 2 mg) with each of two delivery methods (orange juice or ascorbic acid).

## Assumptions

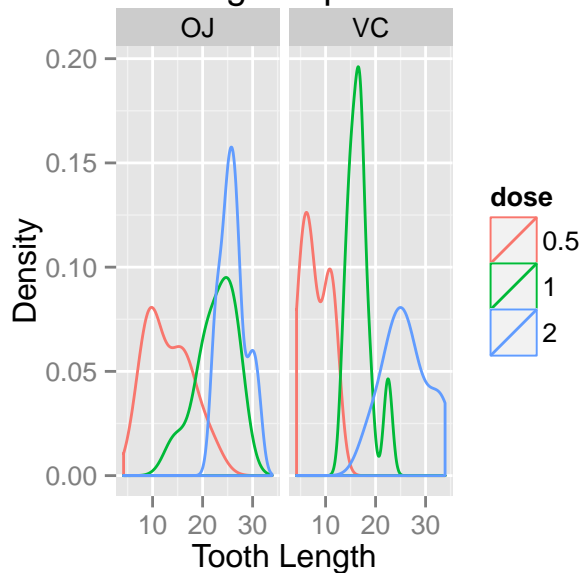
I assumed that the guinea pigs were randomly assigned to the treatment groups and each guinea pig only received on type of supplement, e.g., they were NOT paired observations.

## Exploratory Data Analyses

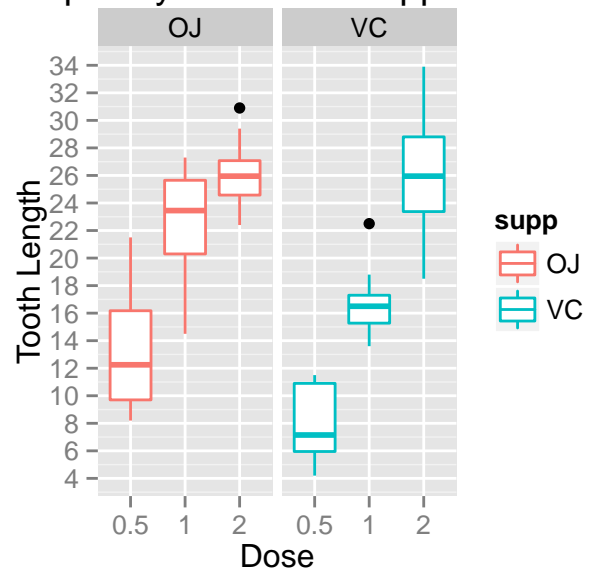
Determine the variables, class and sample values.

```
## '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 ...
```

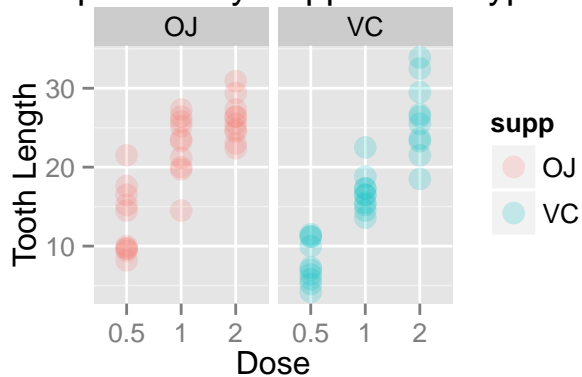
Examining Shape of Data



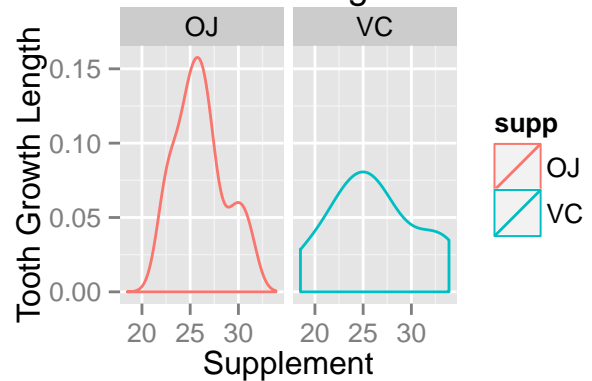
Boxplot by Dose and Supplement



## Comparison by Supplement Type



## Tooth Growth at Highest Dose



## Data Summary

```
## Source: local data frame [6 x 9]
## Groups: supp
##
##   supp dose n() mean(len) median(len) IQR(len) sd(len) min(len) max(len)
## 1   OJ  0.5  10    13.23     12.25    6.475  4.459709     8.2    21.5
## 2   OJ  1    10    22.70     23.45    5.350  3.910953    14.5    27.3
## 3   OJ  2    10    26.06     25.95    2.500  2.655058    22.4    30.9
## 4   VC  0.5  10     7.98      7.15    4.950  2.746634     4.2    11.5
## 5   VC  1    10    16.77     16.50    2.025  2.515309    13.6    22.5
## 6   VC  2    10    26.14     25.95    5.425  4.797731    18.5    33.9
```

## Use Confidence Intervals and/or Hypothesis on ToothGrowth

### Test 1

The highest dose of each supplement has the highest growth. At this level the mean and the median are approximately the same for each supplement, but VC has a wider spread than OJ. Is this difference significant? Perform a T Test on the dose2 subset.

```
##
## Welch Two Sample t-test
##
## data: len by supp
## t = -0.0461, df = 14.04, p-value = 0.9639
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -3.79807  3.63807
## sample estimates:
## mean in group OJ mean in group VC
##           26.06           26.14
```

The 95% confidence interval for Test 1 contains 0, so we can not reject the NULL hypothesis that there is no difference between the means of the groups.

## Test 2

There is an overlap in the boxplots for OJ at doses 1 and 2. Is this difference significant?

```
##
## Welch Two Sample t-test
##
## data: len by dose
## t = -2.2478, df = 15.842, p-value = 0.0392
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -6.5314425 -0.1885575
## sample estimates:
## mean in group 1 mean in group 2
## 22.70 26.06
```

The 95% confidence interval for Test 2 does not contain 0 and the p value is less than .05, so these results are significantly different from each other.

## Test 3

There is an overlap in the boxplots dose .5. Is this difference significant?

```
##
## Welch Two Sample t-test
##
## data: len by supp
## t = 3.1697, df = 14.969, p-value = 0.006359
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 1.719057 8.780943
## sample estimates:
## mean in group OJ mean in group VC
## 13.23 7.98
```

The 95% confidence interval for Test 3 does not contain 0 and the p value is less than .05, so these results are significantly different from each other.

## Conclusions

There sample sizes were very small, only 10 observations per supplement and dose combinations. The T-test is valid for small sample sizes.

If you want to maximize guinea pig tooth growth either orange juice or Vitamin C at dose = 2mg are effective and there isn't a significant difference in their performance. Choose the supplement based upon price or availability.

If you want to minimize guinea pig tooth growth, Vitamin C at the 0.5 mg dose is significantly lower than orange juice at 0.5 mg.