Statistical Inference course project part 2: Basic Inferential Data Analysis

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Contents

Overview

We use the ToothGrowth data to look at the tooth growth for 10 subjects when taking Orange Juice and Vitamin C with different doses.

Load the ToothGrowth data

```
library(datasets)
```

Exploratory analysis

Data structure

First step is to take a quick look at the data and its structure

```
dim(ToothGrowth)
```

```
## [1] 60  3
```

```
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 ...
```

Data properties

Next we look at some of the data properties such as: 1. Missing data

```
dim(ToothGrowth)[1]
```

```
## [1] 60
```

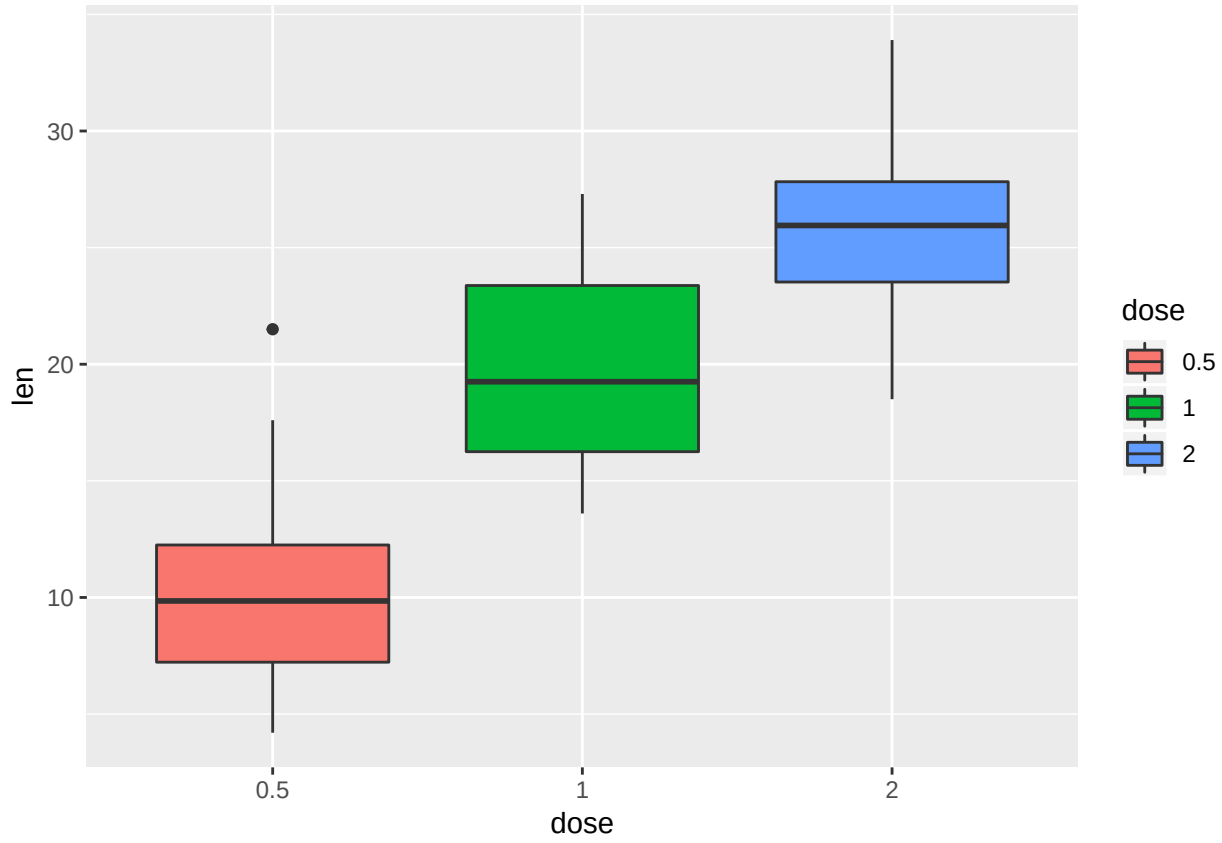
```
sum(complete.cases(ToothGrowth))
```

```
## [1] 60
```

The data contains no missing values

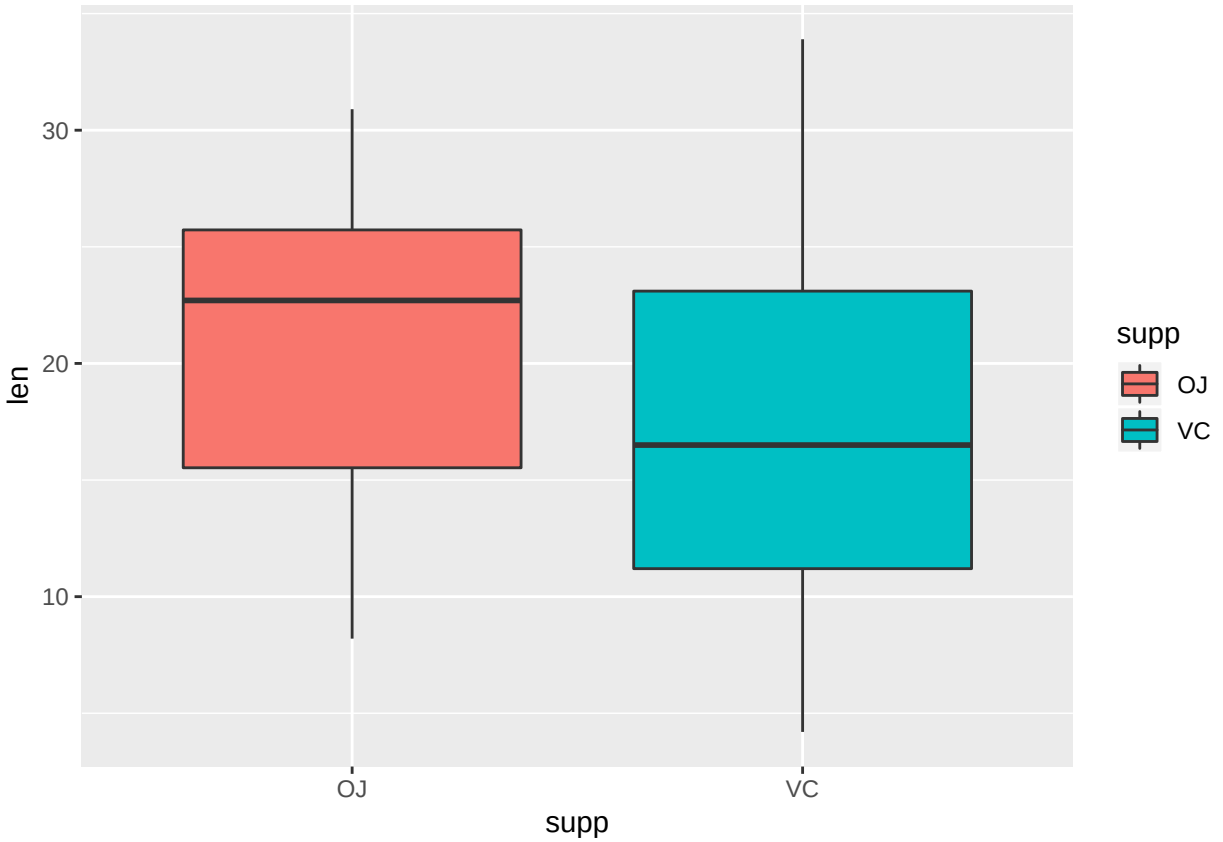
2. Boxplots to represent the 5 number summary for each group by dose

```
ToothGrowth$dose <- as.factor(ToothGrowth$dose)
ggplot(ToothGrowth, aes(x = dose, y = len, fill = dose)) + geom_boxplot()
```



So there is very obvious increase in tooth length with increasing the dose.

```
ggplot(ToothGrowth, aes(x = supp, y = len, fill = supp)) + geom_boxplot()
```



Orange juice treatment appears to give a more predictable and better result by having a higher median growth in length and a smaller range, but it is interesting to look at the extreme results of the Vitamin C in case the treatment works better for these cases.

Hypothesis testing

Here we test the effect of the dose and the method of intaking Vitamin C on the teeth growth

Dose effect

Our null hypothesis will be that different doses, do not affect the growth length, the data is not paired as they are for different subjects.

```
t.test(ToothGrowth$len[which(ToothGrowth$dose == 1)], ToothGrowth$len[which(ToothGrowth$dose == .5)], pa
```

```
##
##  Welch Two Sample t-test
##
## data:  ToothGrowth$len[which(ToothGrowth$dose == 1)] and ToothGrowth$len[which(ToothGrowth$dose == 0
## t = 6.4766, df = 37.986, p-value = 1.268e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##   6.276219 11.983781
## sample estimates:
## mean of x mean of y
```

```
##    19.735    10.605
```

The test shows the following:

- The p-value < 0.05 which indicates signifacnt result and we reject the null hypothesis.
- The confidence interval does not contain 0 therefore we can infer that a dose of 1 mg is better than 0.5 mg.

```
t.test(ToothGrowth$len[which(ToothGrowth$dose == 2)], ToothGrowth$len[which(ToothGrowth$dose == 1)], pa
```

```
##
##  Welch Two Sample t-test
##
## data:  ToothGrowth$len[which(ToothGrowth$dose == 2)] and ToothGrowth$len[which(ToothGrowth$dose == 1
## t = 4.9005, df = 37.101, p-value = 1.906e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  3.733519 8.996481
## sample estimates:
## mean of x mean of y
##    26.100    19.735
```

The results of the 2 mg dose vs the 1 mg dose shows similar results that the 2 mg is better than the 1 mg.

The method of intake

```
t.test(ToothGrowth$len[which(ToothGrowth$supp == "OJ")], ToothGrowth$len[which(ToothGrowth$supp == "VC"
```

```
##
##  Welch Two Sample t-test
##
## data:  ToothGrowth$len[which(ToothGrowth$supp == "OJ")] and ToothGrowth$len[which(ToothGrowth$supp ==
## t = 1.9153, df = 55.309, p-value = 0.06063
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.1710156  7.5710156
## sample estimates:
## mean of x mean of y
##  20.66333  16.96333
```

The test shows the following:

- The p-value > 0.05 which indicates non-signifacnt result and we fail to reject the null hypothesis, though it is relatively close to our $\alpha = 0.5$.
- The confidence interval does contain 0 therefore the results is insignificant.