Statistical Inference Project 1 - Part 2

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Overview

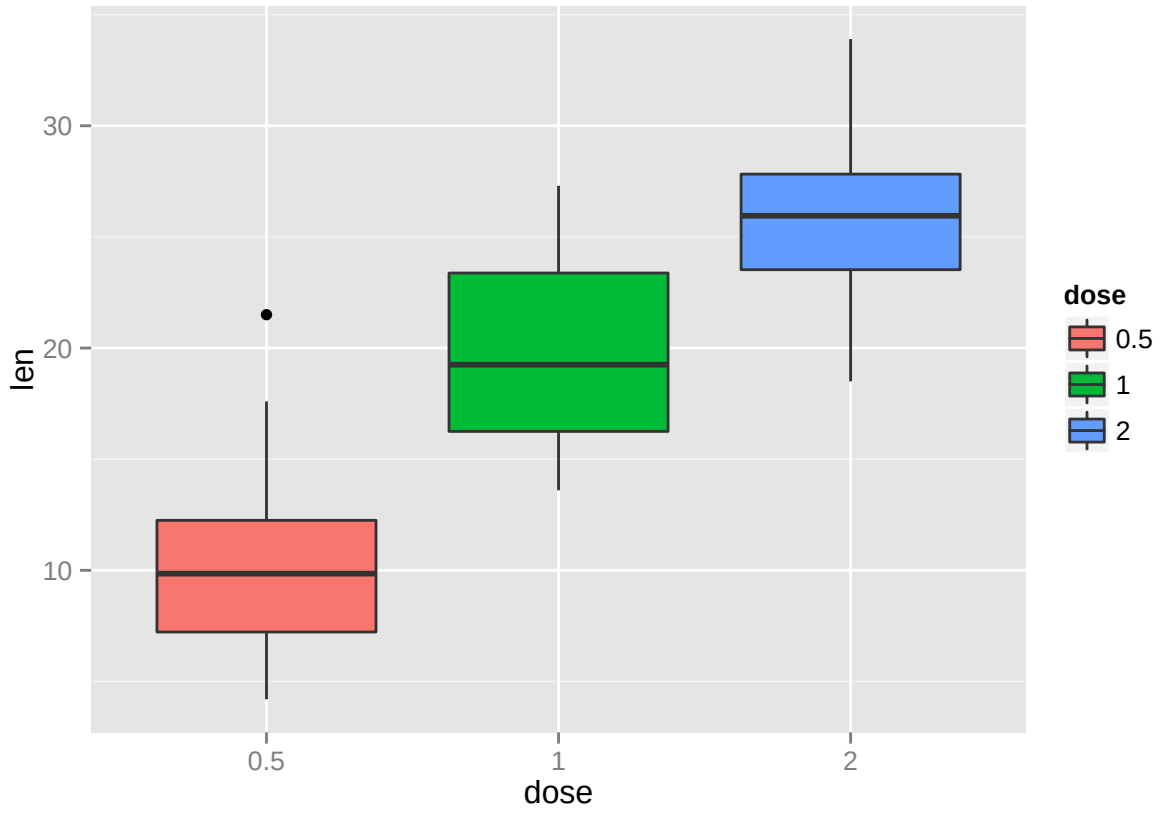
Analysis of the TootGrowth data in the R datasets package. The ToothGrowth dataset in R is data from a study titled "The Effect of Vitamin C on Tooth Growth in Guinea Pigs". The data records the length of the teeth in 10 guinea pigs at three levels of Vitamin C (0.5, 1, and 2mg) with thwo delivery methods (orange juice or ascorbic acid)

Basic Data Summry

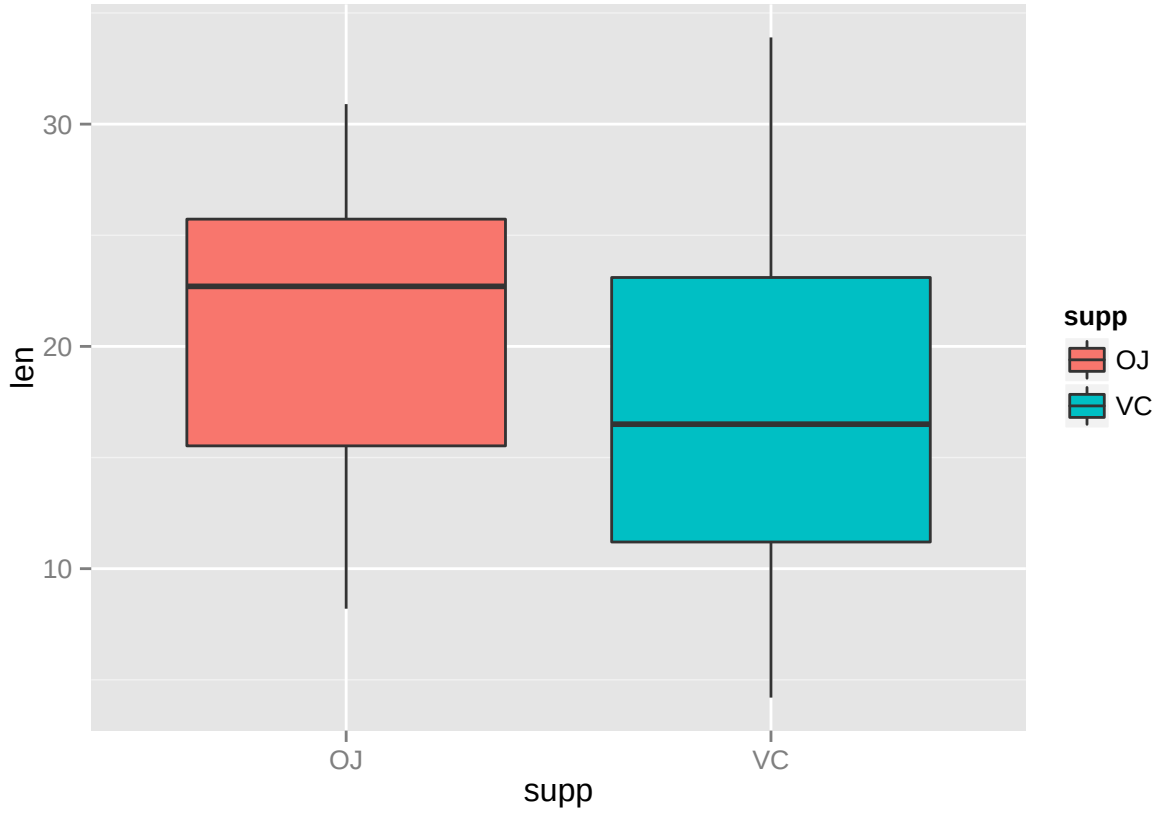
```
# load the data
library(ggplot2)
tooth_data <- data.frame(ToothGrowth)
summary(tooth_data)
```

```
##       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
```

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




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



###

Tests to compare tooth growth by supplement type and dose Using a t-test to see if supplement type has any effect on tooth growth

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

```
##
##  Welch Two Sample t-test
##
## data:  len by 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 in group OJ mean in group VC
##         20.66333         16.96333
```

The p-value is 0.06, which indicates that the type of supplement likely has no significant effect on tooth growth.

Perform a pair-wise t-test analysis on changes in dosage to see the effect of dose on tooth length

```
doses_0.5_1 <- subset(tooth_data, dose %in% c(0.5, 1))
doses_0.5_2 <- subset(tooth_data, dose %in% c(0.5, 2))
doses_1_2 <- subset(tooth_data, dose %in% c(1, 2))

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

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## 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:
##  -11.983781  -6.276219
## sample estimates:
## mean in group 0.5   mean in group 1
##            10.605            19.735
```

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

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## t = -11.799, df = 36.883, p-value = 4.398e-14
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -18.15617 -12.83383
## sample estimates:
## mean in group 0.5   mean in group 2
##            10.605            26.100
```

```r
t.test(len ~ dose, data = doses_1_2)
```

```
##
##  Welch Two Sample t-test
##
## data:  len by dose
## 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:
##  -8.996481 -3.733519
## sample estimates:
## mean in group 1 mean in group 2
##          19.735          26.100
```

For all three pairs, the p-value is less than 0.05 and the confidence interval doesn't contain zero. This indicates that tooth growth increases as dose level increases.

Conclusions

1. Supplement type has no effect on tooth growth.
2. Inreasing the dose level leads to increased tooth growth.

Assumptions

We assume the experiment was performed by randomly assigning guniea pigs to dosage levels and supplement type. We assume the guniea pigs in this experiment are representative of all guniea pigs. We assume all of the variances in the groups are equal in the t-tests.