Inferential Data Analysis

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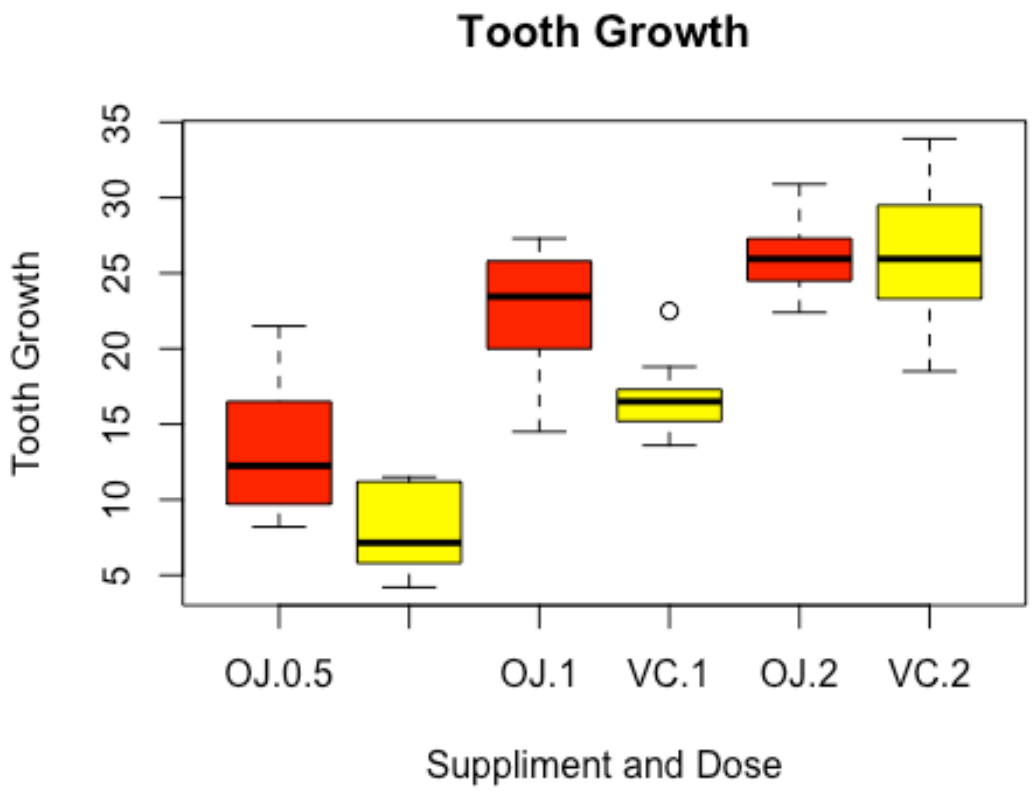
Part 2: Basic Inferential Data Analysis Instructions

```
## Summary of the Toothgrowth 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
```




```
## Unpaired t test for hypothesis whether mean length of supp factor VC is
equal to OJ for dosage 0.5
```

```
##
##  Welch Two Sample t-test
##
## data:  ToothGrowth1[ToothGrowth1$supp == "OJ", ]$len and
ToothGrowth1[ToothGrowth1$supp == "VC", ]$len
## 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 of x mean of y
##     13.23      7.98

## Unpaired t test for hypothesis whether mean length of supp factor VC is
equal to OJ for dosage 1.0

##
##  Welch Two Sample t-test
##
## data:  ToothGrowth2[ToothGrowth2$supp == "OJ", ]$len and
ToothGrowth2[ToothGrowth2$supp == "VC", ]$len
## t = 4.0328, df = 15.358, p-value = 0.001038
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  2.802148 9.057852
## sample estimates:
## mean of x mean of y
##     22.70     16.77

## Unpaired t test for hypothesis whether mean length of supp factor VC is
equal to OJ for dosage 2.0

##
##  Welch Two Sample t-test
##
## data:  ToothGrowth3[ToothGrowth3$supp == "OJ", ]$len and
ToothGrowth3[ToothGrowth3$supp == "VC", ]$len
## t = -0.046136, 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 of x mean of y
##     26.06     26.14

## Unpaired t test for hypothesis whether mean length of dosage 0.5 is equal
to 1 for supp OJ

##
##  Welch Two Sample t-test
##
```

```
## data:  ToothGrowth4[ToothGrowth4$dose == 0.5, ]$len and
ToothGrowth4[ToothGrowth4$dose == 1, ]$len
## t = -5.0486, df = 17.698, p-value = 8.785e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -13.415634  -5.524366
## sample estimates:
## mean of x mean of y
##     13.23     22.70

## Unpaired t test for hypothesis whether mean length of dosage 0.5 is equal
to 2 for supp OJ

##
##  Welch Two Sample t-test
##
## data:  ToothGrowth4[ToothGrowth4$dose == 0.5, ]$len and
ToothGrowth4[ToothGrowth4$dose == 2, ]$len
## t = -7.817, df = 14.668, p-value = 1.324e-06
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -16.335241  -9.324759
## sample estimates:
## mean of x mean of y
##     13.23     26.06

## Unpaired t test for hypothesis whether mean length of dosage 1 is equal to
2 for supp OJ

##
##  Welch Two Sample t-test
##
## data:  ToothGrowth4[ToothGrowth4$dose == 1, ]$len and
ToothGrowth4[ToothGrowth4$dose == 2, ]$len
## 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 of x mean of y
##     22.70     26.06

## Unpaired t test for hypothesis whether mean length of dosage 0.5 is equal
to 1 for supp VC

##
##  Welch Two Sample t-test
##
## data:  ToothGrowth5[ToothGrowth5$dose == 0.5, ]$len and
ToothGrowth5[ToothGrowth5$dose == 1, ]$len
## t = -7.4634, df = 17.862, p-value = 6.811e-07
```

```
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -11.265712  -6.314288
## sample estimates:
## mean of x mean of y
##      7.98     16.77

## Unpaired t test for hypothesis whether mean length of dosage 0.5 is equal
to 2 for supp VC

##
##  Welch Two Sample t-test
##
## data:  ToothGrowth5[ToothGrowth5$dose == 0.5, ]$len and
ToothGrowth5[ToothGrowth5$dose == 2, ]$len
## t = -10.388, df = 14.327, p-value = 4.682e-08
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -21.90151 -14.41849
## sample estimates:
## mean of x mean of y
##      7.98     26.14

## Unpaired t test for hypothesis whether mean length of dosage 1 is equal to
2 for supp VC

##
##  Welch Two Sample t-test
##
## data:  ToothGrowth5[ToothGrowth5$dose == 1, ]$len and
ToothGrowth5[ToothGrowth5$dose == 2, ]$len
## t = -5.4698, df = 13.6, p-value = 9.156e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -13.054267  -5.685733
## sample estimates:
## mean of x mean of y
##     16.77     26.14
```

Assumptions

- Populations groups are independent i.e 60 unique pigs are incorporated in the study
- Variances between populations are different
- Random population has been used
- Population was comprised of similar guinea pigs

Conclusions

- If all the preceding assumptions are true, we may infer that there is a significant difference between tooth length and dose levels across both delivery methods.
- A higher dose level consistently led to longer teeth.

- It also appears that orange juice is a better delivery method with a larger impact on tooth length for a given dose of Vitamin C, but above a maximum dose level there is no further improvement.