

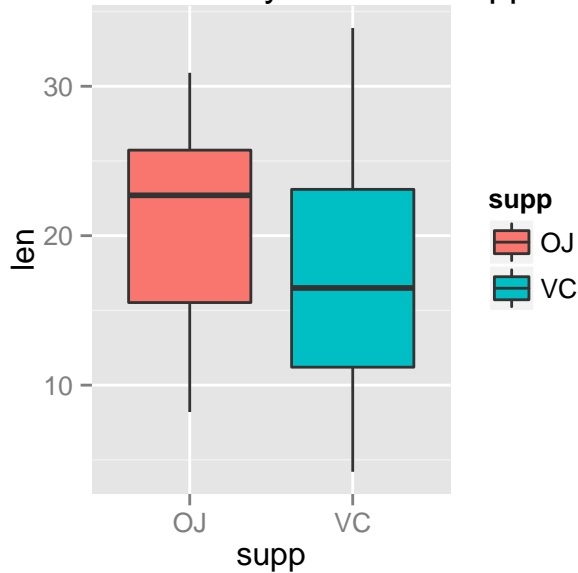
Project Report for Basic Inferential Data Analysis

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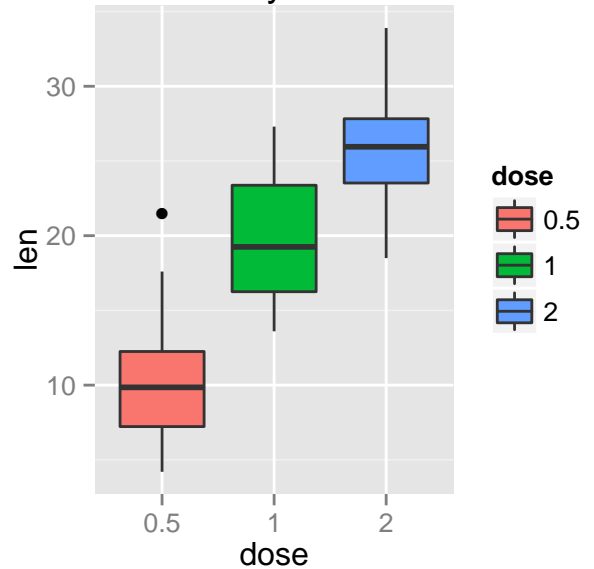
Exploratory Analyses on ToothGrowth Data

Exploratory plots:

Tooth Growth by Different Supp



Tooth Growth by Different Dose



Based on the exploratory plot, in terms of supplements, OJ seems to contribute to a higher tooth growth compared with VC; in terms of dose, a higher dose seems to increase the length of tooth growth. Both observations require hypothesis testing.

Basic Summary of the 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

Basic Summary of Tooth Growth by Supp

Basic Summary of Tooth Growth by Dose

3. Use confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose. (Only use the techniques from class, even if there's other approaches worth considering)

Comparisons of Tooth Growth by Supp

Assuming that the data of tooth growth by OJ and VC are both normally distributed, and the population variances are unequal.

H0: there is no difference between tooth growth by VC and tooth growth by OJ ($VC = OJ$).

Ha: the tooth growth by VC is larger than the tooth growth by OJ ($VC > OJ$).

```
##
##  Welch Two Sample t-test
##
## data:  OJ and VC
## 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
```

According to the statistical test, the confidence interval did not exclude zero, and the p-value is not less than 0.05.

Therefore, the null hypothesis is not rejected. There is no difference between tooth growth by VC and tooth growth by OJ.

Comparisons of Tooth Growth by Dose

Dose 0.5 v.s. Dose 1.0

Assuming that the data of tooth growth by dose 0.5 and dose 1.0 are normally distributed, and the population variances are equal.

H0: there is no difference between tooth growth by dose 0.5 and tooth growth by dose 1.0 (dose 0.5 = dose 1.0).

Ha: the tooth growth by dose 0.5 is smaller than the tooth growth by dose 1.0 (dose 0.5 < dose 1.0).

```
##
##  Two Sample t-test
##
## data:  len by dose
## t = -6.4766, df = 38, p-value = 1.266e-07
## alternative hypothesis: true difference in means is not equal to 0
```

```
## 95 percent confidence interval:
## -11.983748 -6.276252
## sample estimates:
## mean in group 0.5    mean in group 1
##          10.605          19.735
```

According to the statistical test, both the lower and upper limit of the confidence interval is smaller than zero, and the p-value is much smaller than 0.05.

Therefore, the null hypothesis is rejected. The tooth growth by dose 0.5 is smaller than the tooth growth by dose 1.0.

Dose 0.5 v.s. Dose 2.0

Assuming that the data of tooth growth by dose 0.5 and dose 2.0 are normally distributed, and the population variances are not equal.

H0: there is no difference between tooth growth by dose 0.5 and tooth growth by dose 2.0 (dose 0.5 = dose 2.0).

Ha: the tooth growth by dose 0.5 is smaller than the tooth growth by dose 2.0 (dose 0.5 < dose 2.0).

```
##
## 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
```

According to the statistical test, both the lower and upper limit of the confidence interval is smaller than zero, and the p-value is much smaller than 0.05.

Therefore, the null hypothesis is rejected. The tooth growth by dose 0.5 is smaller than the tooth growth by dose 2.0.

Dose 0.5 v.s. Dose 2.0

Assuming that the data of tooth growth by dose 1.0 and dose 2.0 are normally distributed, and the population variances are not equal.

H0: there is no difference between tooth growth by dose 1.0 and tooth growth by dose 2.0 (dose 1.0 = dose 1.0).

Ha: the tooth growth by dose 1.0 is smaller than the tooth growth by dose 2.0 (dose 1.0 < dose 2.0).

```
##
## 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
```

According to the statistical test, both the lower and upper limit of the confidence interval is smaller than zero, and the p-value is much smaller than 0.05.

Therefore, the null hypothesis is rejected. The tooth growth by dose 1.0 is smaller than the tooth growth by dose 2.0.