

Tooth Growth Data (Statistical Inference Course Project Part 2)

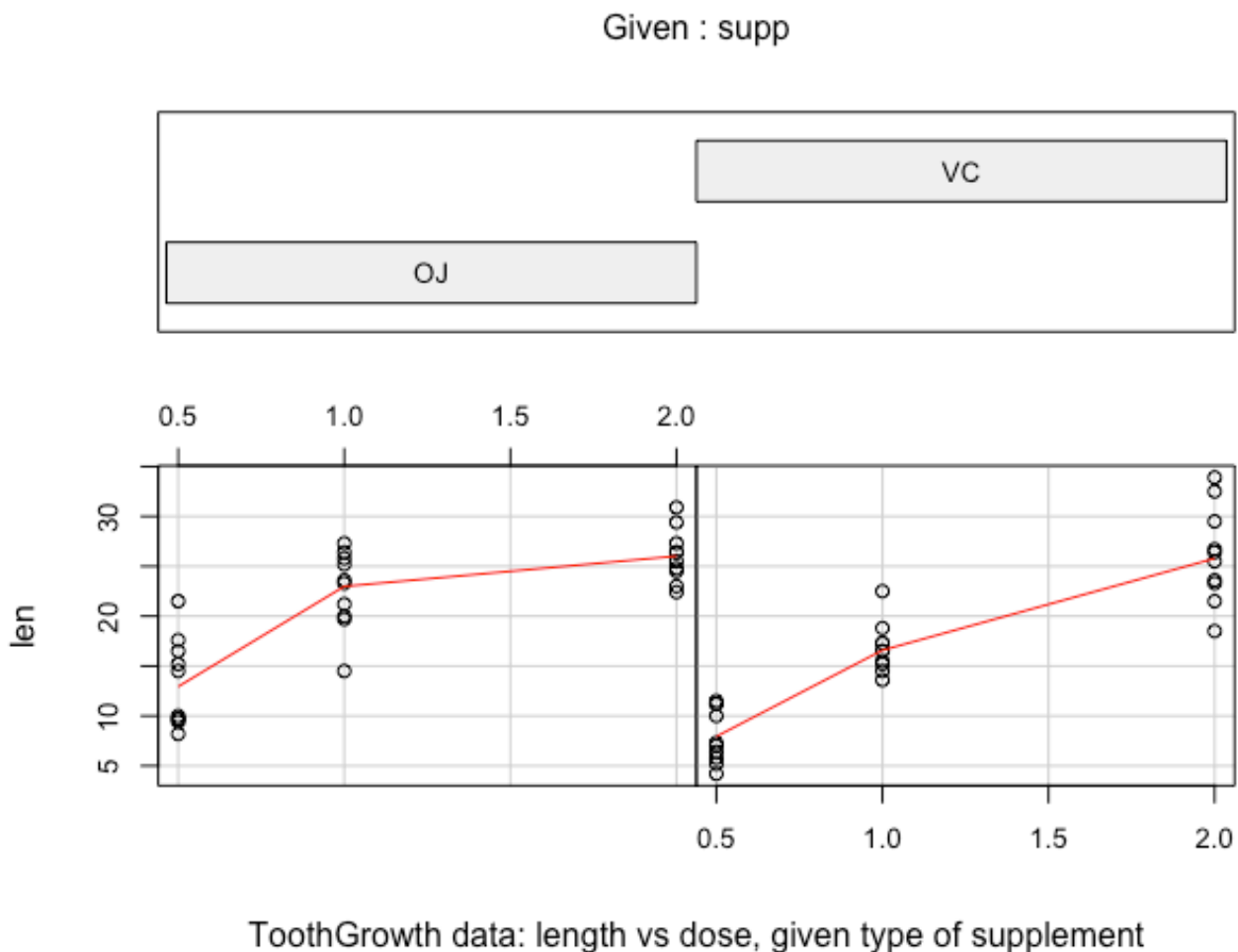
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1. Load the ToothGrowth data and perform some basic exploratory data analyses

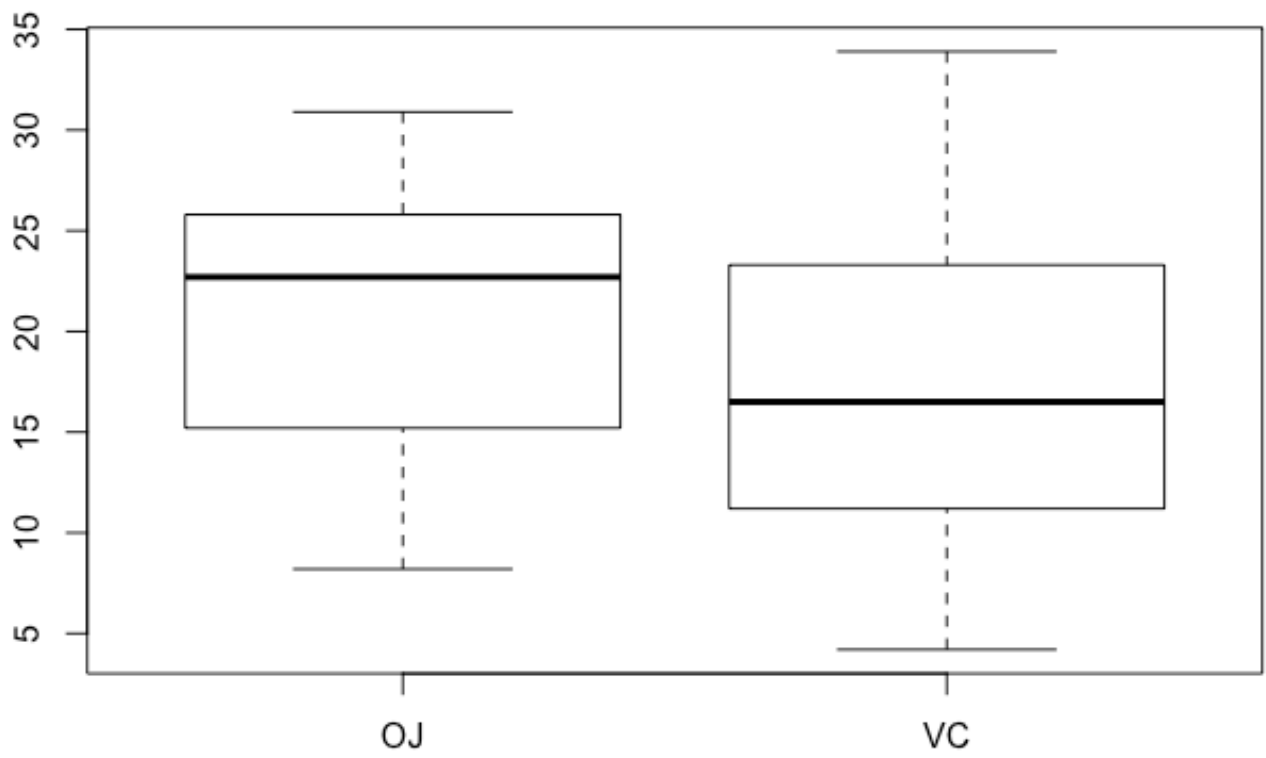
The following packages are used for this analysis:

```
library(graphics)
library(datasets)
```

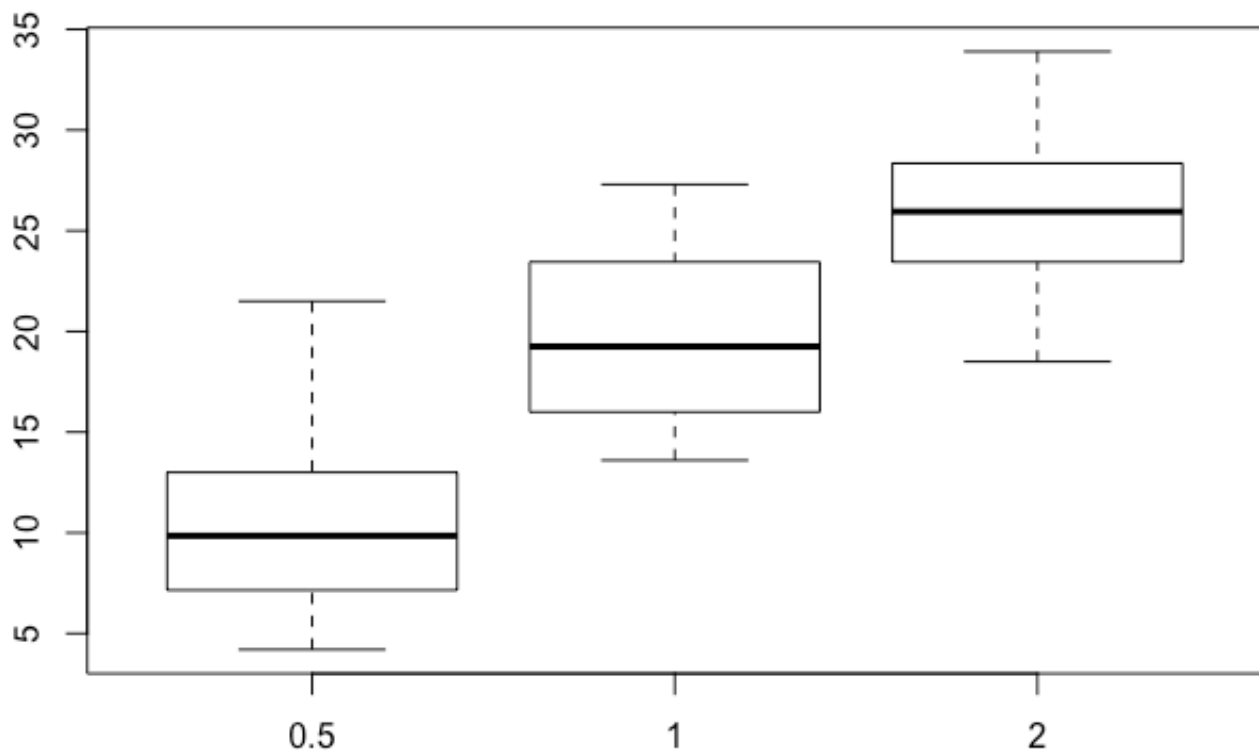
```
require(graphics)
coplot(len ~ dose | supp, data = ToothGrowth, panel = panel.smooth,
       xlab = "ToothGrowth data: length vs dose, given type of supplement")
```



```
##Box len ~ supp
boxplot(len ~ supp, ToothGrowth)
```



```
##Box len ~ dose  
boxplot(len ~ dose, ToothGrowth)
```



2. Provide a basic summary of the data.

```
print(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
## 7  11.2    VC  0.5
## 8  11.2    VC  0.5
## 9   5.2    VC  0.5
## 10  7.0    VC  0.5
## 11 16.5    VC  1.0
## 12 16.5    VC  1.0
## 13 15.2    VC  1.0
## 14 17.3    VC  1.0
## 15 22.5    VC  1.0
## 16 17.3    VC  1.0
## 17 13.6    VC  1.0
## 18 14.5    VC  1.0
## 19 18.8    VC  1.0
## 20 15.5    VC  1.0
```

```
## 21 23.6 VC 2.0
## 22 18.5 VC 2.0
## 23 33.9 VC 2.0
## 24 25.5 VC 2.0
## 25 26.4 VC 2.0
## 26 32.5 VC 2.0
## 27 26.7 VC 2.0
## 28 21.5 VC 2.0
## 29 23.3 VC 2.0
## 30 29.5 VC 2.0
## 31 15.2 OJ 0.5
## 32 21.5 OJ 0.5
## 33 17.6 OJ 0.5
## 34 9.7 OJ 0.5
## 35 14.5 OJ 0.5
## 36 10.0 OJ 0.5
## 37 8.2 OJ 0.5
## 38 9.4 OJ 0.5
## 39 16.5 OJ 0.5
## 40 9.7 OJ 0.5
## 41 19.7 OJ 1.0
## 42 23.3 OJ 1.0
## 43 23.6 OJ 1.0
## 44 26.4 OJ 1.0
## 45 20.0 OJ 1.0
## 46 25.2 OJ 1.0
## 47 25.8 OJ 1.0
## 48 21.2 OJ 1.0
## 49 14.5 OJ 1.0
## 50 27.3 OJ 1.0
## 51 25.5 OJ 2.0
## 52 26.4 OJ 2.0
## 53 22.4 OJ 2.0
## 54 24.5 OJ 2.0
## 55 24.8 OJ 2.0
## 56 30.9 OJ 2.0
## 57 26.4 OJ 2.0
## 58 27.3 OJ 2.0
## 59 29.4 OJ 2.0
## 60 23.0 OJ 2.0
```

```
summary(ToothGrowth)
```

```
##      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
```

```
#Different doses
unique(ToothGrowth$dose)
```

```
## [1] 0.5 1.0 2.0
```

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)

```
t.test(len ~ supp, ToothGrowth, paired = FALSE, var.equal = FALSE, conf.level = 0.95)
```

```
##
## 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
```

```
t.test(len ~ supp, ToothGrowth[ToothGrowth$dose == 0.5, ], paired = FALSE, var.equal = FALSE, conf.level = 0.95)
```

```
##
## 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
```

```
t.test(len ~ supp, ToothGrowth[ToothGrowth$dose == 1, ], paired = FALSE, var.equal = FALSE, conf.level = 0.95)
```

```
##
## Welch Two Sample t-test
##
## data: len by supp
## 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 in group OJ mean in group VC
## 22.70 16.77
```

```
t.test(len ~ supp, ToothGrowth[ToothGrowth$dose == 2, ], paired = FALSE, var.equal = FALSE, conf.level = 0.95)
```

```
##
## Welch Two Sample t-test
##
## data: len by supp
## 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 in group OJ mean in group VC
## 26.06 26.14
```

```
t.test(len ~ dose, ToothGrowth[ToothGrowth$dose != 2, ], paired = FALSE, var.equal = FALSE, conf.level = 0.95)
```

```
##
## 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, ToothGrowth[ToothGrowth$dose != 1, ], paired = FALSE, var.equal = FALSE, conf.level = 0.95)
```

```
##
## 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
```

```
t.test(len ~ dose, ToothGrowth[ToothGrowth$dose != 0.5, ], paired = FALSE, var.equal = FALSE, conf.level = 0.95)
```

```
##
## 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
```

4. State your conclusions and the assumptions needed for your conclusions.

Assumptions:

1. The Data is not Paired. It is a Two Sample T Test.
2. From the box plots we can assume the variances are not equal.

Conclusion: 1. Supplement type has no effect on tooth growth. (this is seen in the first 3 T test) 2. The dose level does have an effect on tooth growth. (this can be seen in the last 3 t test)