

Part-2

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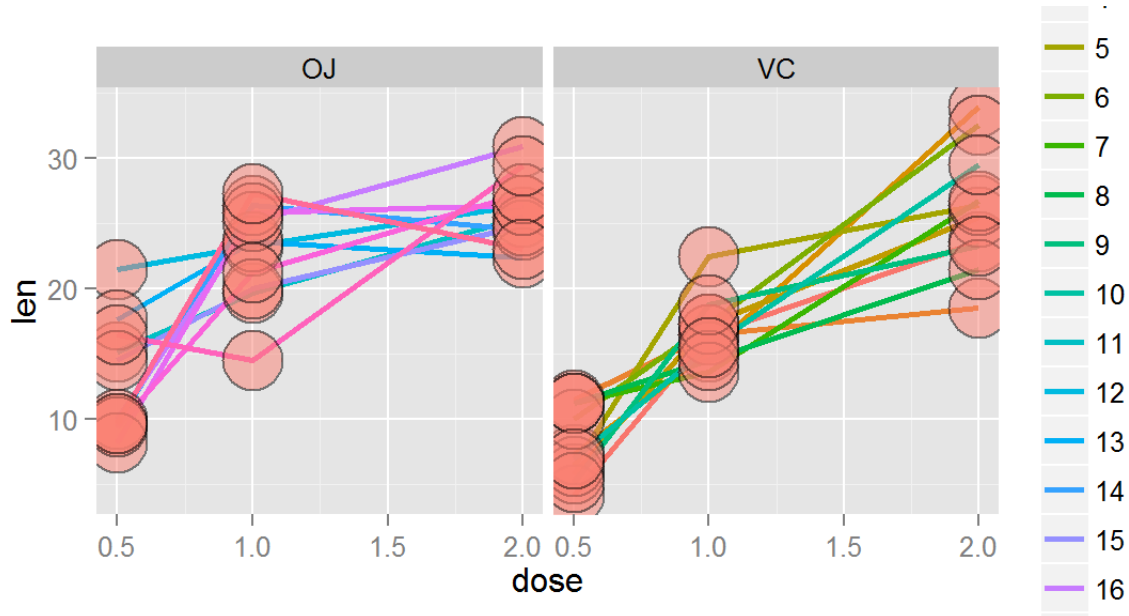
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Analysis of the ToothGrowth data in the R datasets package.

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

Plotting the data

```
library(ggplot2)
id<-factor(c(rep(1:10,3),rep(11:20,3)))
tooth<-cbind(ToothGrowth, id=id)
g <- ggplot(tooth, aes(x = dose, y = len, group = factor(id)))
g <- g + facet_grid(. ~ supp)
g <- g + geom_line( size = 1, aes(colour = id)) + geom_point(size =10, pch = 21, fill = "salmon", alpha = .5)
g
```



2. Provide a basic summary of the data.

```
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 ...
```

```
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
```

```
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
```

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

```
vcg1<-tooth$len[1:10]
vcg2<-tooth$len[11:20]
vcg3<-tooth$len[21:30]

difference<-vcg3-vcg1
mn<-mean(difference)
s<-sd(difference)
n<-10

mn + c(-1,1)*qt(.975, n-1)*s/sqrt(n)
```

```
## [1] 13.9643 22.3557
```

```
t.test(difference)
```

```
##
## One Sample t-test
##
## data: difference
## t = 9.7912, df = 9, p-value = 4.264e-06
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 13.9643 22.3557
## sample estimates:
## mean of x
## 18.16
```

For Supp VC we reject the null hypothesis with $p = 4.2642558 \times 10^{-6}$

```
vcg1<-tooth$len[31:40]
vcg2<-tooth$len[41:50]
vcg3<-tooth$len[51:60]

difference<-vcg3-vcg1
mn<-mean(difference)
s<-sd(difference)
n<-10

mn + c(-1,1)*qt(.975, n-1)*s/sqrt(n)
```

```
## [1] 8.956042 16.703958
```

```
t.test(difference)
```

```
##
## One Sample t-test
##
## data: difference
## t = 7.4919, df = 9, p-value = 3.724e-05
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
## 8.956042 16.703958
## sample estimates:
## mean of x
## 12.83
```

For Supp OJ we reject the null hypothesis with $p = 3.7241016 \times 10^{-5}$

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

Conclusion: Teeth grew with both Supp VC and OJ. However, teeth grew more on average with Supp VC than with Supp OJ.

Assumptions: It was assumed that there were two groups of 10 guinea pigs (one group on each Supp) and that the data within Supp group was paired.