Statistical Inference-Project Part 2

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Tuesday, March 17, 2015

PART 2

Now in the second portion of the class, we're going to analyze the ToothGrowth data in the R datasets package.

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

```
library(gplots)
```

```
## Warning: package 'gplots' was built under R version 3.1.3
```

```
## KernSmooth 2.23 loaded
## Copyright M. P. Wand 1997-2009
##
## Attaching package: 'gplots'
##
## The following object is masked from 'package:stats':
##
##     lowess
```

```
library(lattice)
data(ToothGrowth)
nrow(ToothGrowth)
```

```
## [1] 60
```

```
ncol(ToothGrowth)
```

```
## [1] 3
```

```
str(ToothGrowth)
```

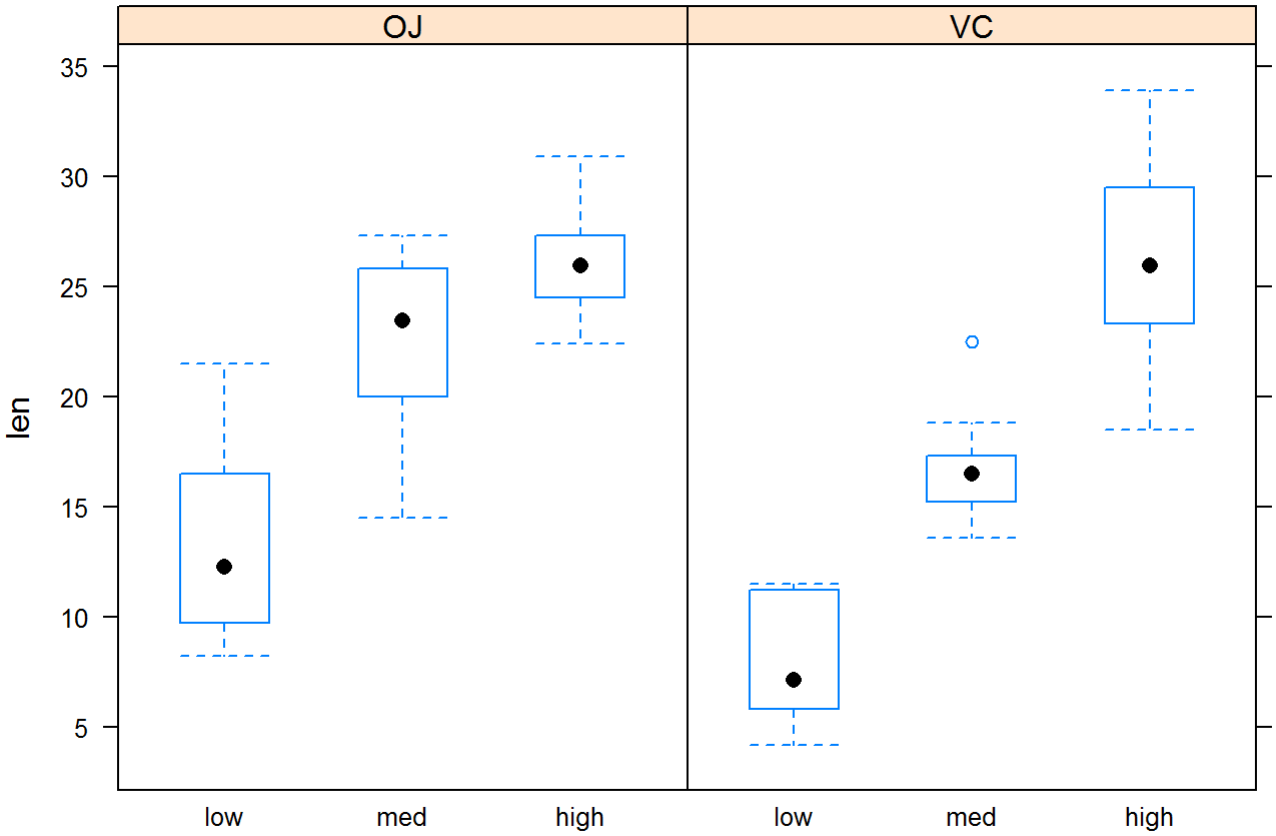
```
## 'data.frame':    60 obs. of  3 variables:
##  $ len : num  4.2 11.5 7.3 5.8 6.4 10 11.2 11.2 5.2 7 ...
##  $ supp: Factor w/ 2 levels "OJ","VC": 2 2 2 2 2 2 2 2 2 2 ...
##  $ dose: num  0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 ...
```

```
ToothGrowth$dose #We must consider 0.5, 1 and 2 as scales
```

```
##  [1] 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0
## [18] 1.0 1.0 1.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 0.5 0.5 0.5 0.5
## [35] 0.5 0.5 0.5 0.5 0.5 0.5 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 2.0
## [52] 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0
```

```
ToothGrowth$dose = factor(ToothGrowth$dose, levels=c(0.5,1.0,2.0),
                          labels=c("low","med","high"))
attach(ToothGrowth)
table(supp,dose)
```

```
##     dose
## supp low med high
##   OJ  10  10   10
##   VC  10  10   10
```



2. Provide a basic summary of the data.

```
summary(ToothGrowth)
```

```
##       len        supp      dose
##  Min.   : 4.20   OJ:30   low :20
##  1st Qu.:13.07   VC:30   med :20
##  Median :19.25           high:20
##  Mean   :18.81
##  3rd Qu.:25.27
##  Max.   :33.90
```

```
aggregate(len,list(supp,dose), mean)
```

```
##   Group.1 Group.2     x
## 1      OJ     low 13.23
## 2      VC     low  7.98
## 3      OJ     med 22.70
## 4      VC     med 16.77
## 5      OJ    high 26.06
## 6      VC    high 26.14
```

```
aggregate(len,list(supp,dose), sd)
```

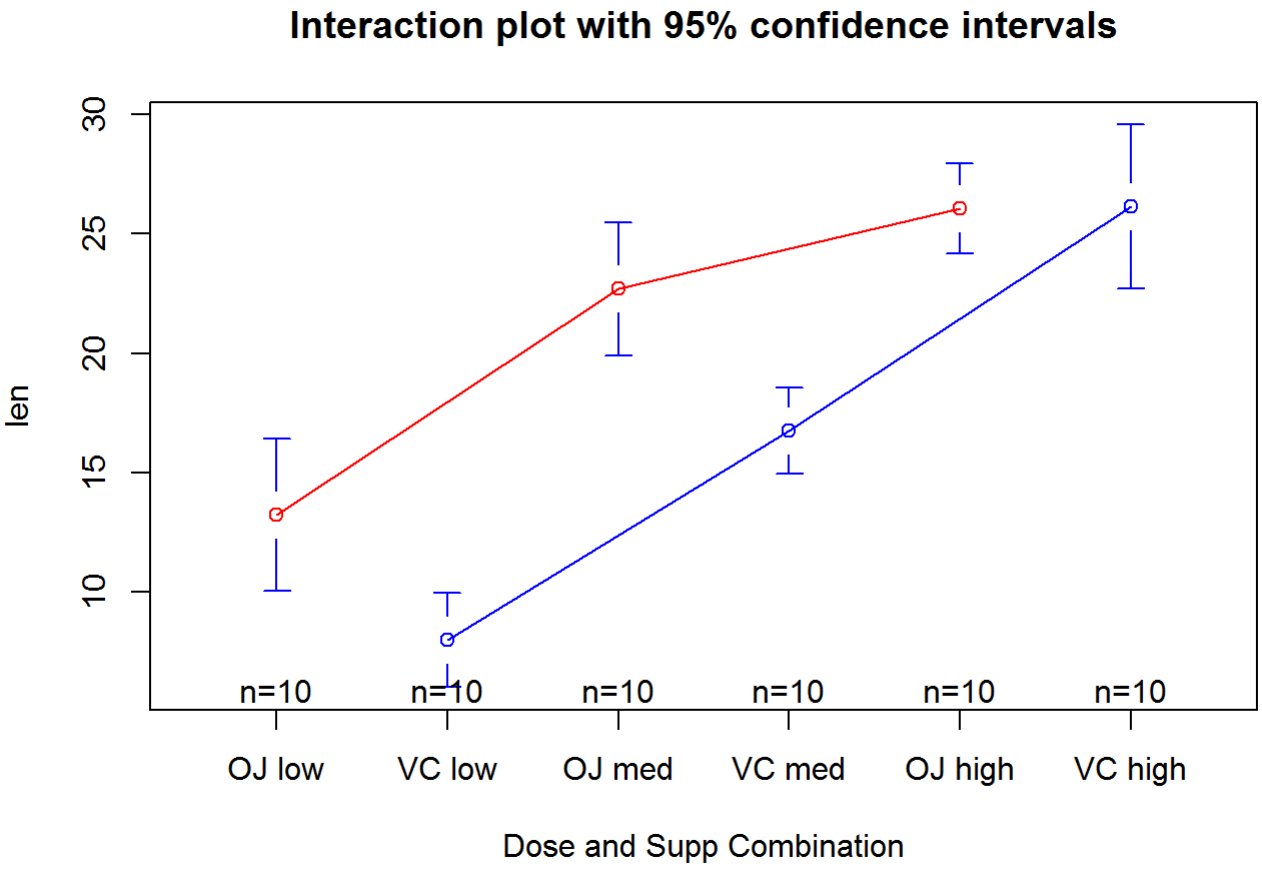
```
##   Group.1 Group.2        x
## 1      OJ     low 4.459709
## 2      VC     low 2.746634
## 3      OJ     med 3.910953
## 4      VC     med 2.515309
## 5      OJ    high 2.655058
## 6      VC    high 4.797731
```

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)

Here, i've chosen to work with a factor of (dose) hence i prefer to go ahead with Anova test as they may provide deeper insight. We then use Tukey's HSD (honest significant difference) test,or the Tukey–Kramer method, which is a single-step multiple comparison procedure and statistical test. It can be used on raw data or in conjunction with an ANOVA (Post-hoc analysis) to find means that are significantly different from each other.

```
anova <- aov(len ~ supp * dose, data=ToothGrowth)
TukeyHSD(anova)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = len ~ supp * dose, data = ToothGrowth)
##
## $supp
##       diff       lwr       upr     p adj
## VC-OJ -3.7 -5.579828 -1.820172 0.0002312
##
## $dose
##            diff       lwr       upr   p adj
## med-low   9.130  6.362488 11.897512 0.0e+00
## high-low 15.495 12.727488 18.262512 0.0e+00
## high-med  6.365  3.597488  9.132512 2.7e-06
##
## $`supp:dose`
##                  diff        lwr        upr     p adj
## VC:low-OJ:low   -5.25 -10.048124 -0.4518762 0.0242521
## OJ:med-OJ:low    9.47   4.671876 14.2681238 0.0000046
## VC:med-OJ:low    3.54  -1.258124  8.3381238 0.2640208
## OJ:high-OJ:low  12.83   8.031876 17.6281238 0.0000000
## VC:high-OJ:low  12.91   8.111876 17.7081238 0.0000000
## OJ:med-VC:low   14.72   9.921876 19.5181238 0.0000000
## VC:med-VC:low    8.79   3.991876 13.5881238 0.0000210
## OJ:high-VC:low  18.08  13.281876 22.8781238 0.0000000
## VC:high-VC:low  18.16  13.361876 22.9581238 0.0000000
## VC:med-OJ:med   -5.93 -10.728124 -1.1318762 0.0073930
## OJ:high-OJ:med   3.36  -1.438124  8.1581238 0.3187361
## VC:high-OJ:med   3.44  -1.358124  8.2381238 0.2936430
## OJ:high-VC:med   9.29   4.491876 14.0881238 0.0000069
## VC:high-VC:med   9.37   4.571876 14.1681238 0.0000058
## VC:high-OJ:high  0.08  -4.718124  4.8781238 1.0000000
```



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

Assumption: The sample components are independent and identically distributed.

Conclussion: The Tukey contrast reveals details that there are no statistical evidence for other ‘noisy’ variables which are relevant, therefore it is evident that changes in dose and size (independent variables) won’t affect lenght (dependent variable).