Statistical Inference Project Part 2

Overview

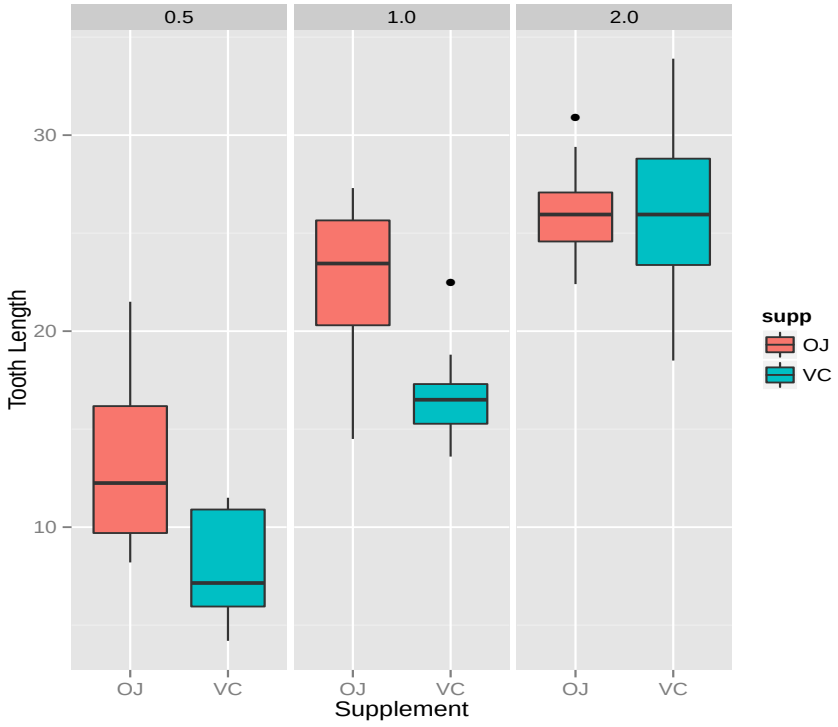
The second part of this project looks at the ToothGrowth data in the R datasets package. This is a set of 60 observations, looking at the growth of teeth in ten subjects given three doses of Vitamin C (0.5mg, 1mg and 2mg) either as orange juice or as ascorbic acid.

Data Summary

To get a summary of the data, we use ggplot to compare the various doses with the two different supplements using:

```
g <- ggplot(ToothGrowth, aes(x = supp,y = len, fill = supp)) +
  geom_boxplot() + facet_wrap(~dose) + xlab('Supplement') +
  ylab('Tooth Length')
print(g)
```

giving the graph:



Tooth Growth by Supplement and by Dose

The null hypothesis is that orange juice and ascorbic acid do not have a different affect on tooth growth. Assuming the populations are independent, using the t-test, we get:

```
t.test(len~supp, paired=F, var.equal=F, data=ToothGrowth)
```

gives a 95% confidence interval of

```
[ -0.1710156  7.5710156 ]
```

This contains 0, meaning that we cannot reject the null hypothesis.
If we compare the largest dose with the smallest dose,

```
TGsubset  <- subset(ToothGrowth, dose \%in\% c(0.5,2))
t.test(len ~ dose, paired=FALSE, var.equal=FALSE, data=TGsubset)
```

we get a 95% confidence interval of

```
[  -18.15617 -12.83383 ]
```

which tells us that a larger dose results in longer teeth.
If we now tease the data apart, looking at length of teeth versus the supplement for each dose,

```
TG05 <- subset(ToothGrowth, dose == 0.5)
TG10 <- subset(ToothGrowth, dose == 1)
TG20 <- subset(ToothGrowth, dose == 2)
t.test(len ~ supp, paired=FALSE, var.equal=FALSE, data=TG05)
t.test(len ~ supp, paired=FALSE, var.equal=FALSE, data=TG10)
t.test(len ~ supp, paired=FALSE, var.equal=FALSE, data=TG20)
```

we get, respectively, the 95% confidence intervals

```
[ 1.719057 8.780943 ]
[ 2.802148 9.057852 ]
[ -3.79807  3.63807 ]
```

suggesting that orange juice is better than ascorbic acid at dosage levels of 0.5mg and 1mg but not at 2mg.

Conclusion

This small example suggests that orange juice is a better delivery method than ascorbic acid for doses of 0.5mg and 1mg but not 2mg, when comparing the effect these supplements have on teeth growth.