Course Project

Overview

This report is broken into two parts, each doing separate analyses. The first investigates the exponential distribution in R and compare it with the Central Limit Theorem. Part two is an analysis of the ToothGrowth data in the R datasets package.

Part 2

This is an anlysis of the ToothGrowth dataset in R. The aim of the analysis is to summarize the data, as well as compare tooth growth by supp and dose.

Analysis

First, the ggplot2 library and ToothGrowth datasets are loaded:

```
library(ggplot2)
data("ToothGrowth")
```

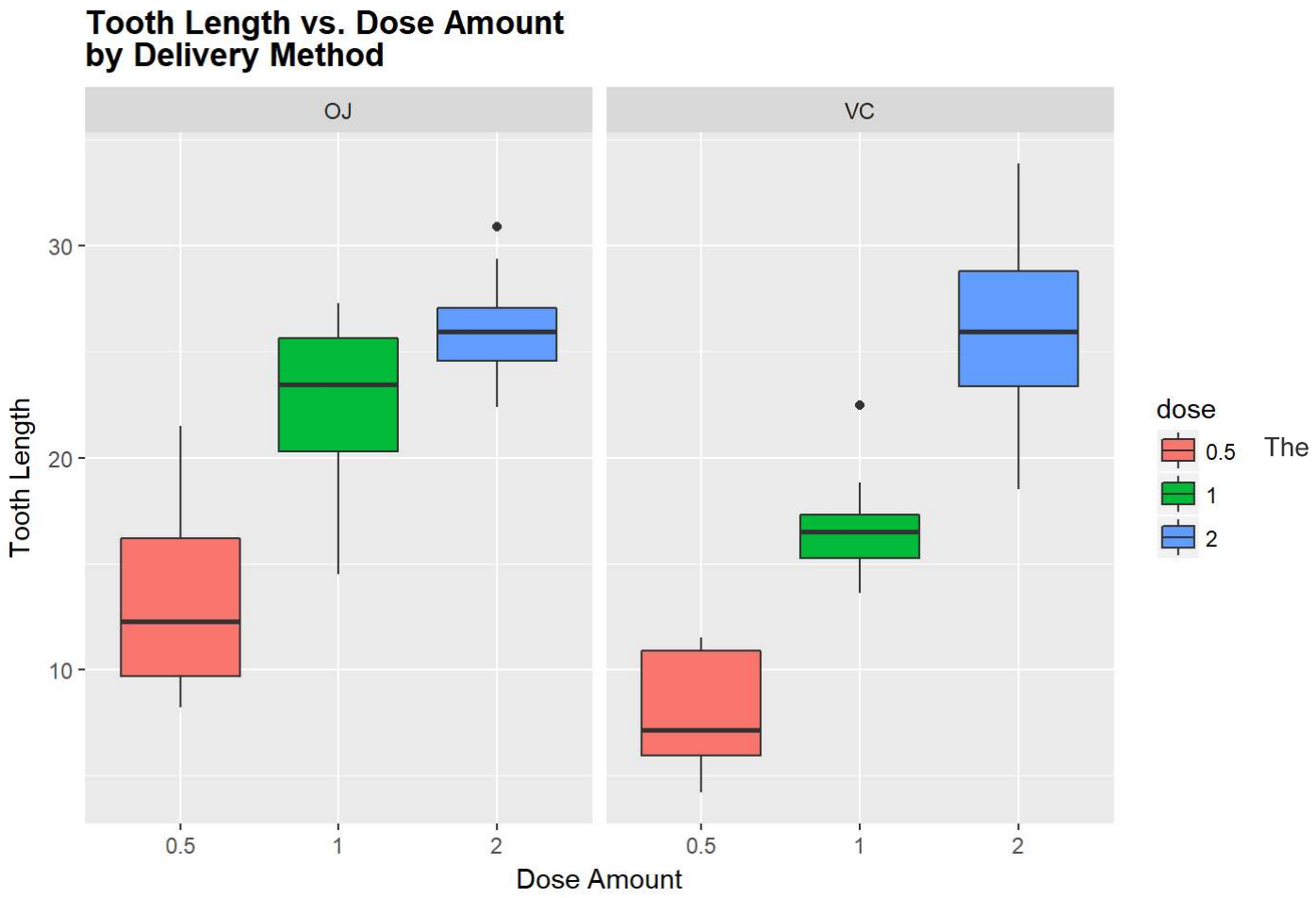
Next, a quick summary of the data is produced:

```
data("ToothGrowth")
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
```

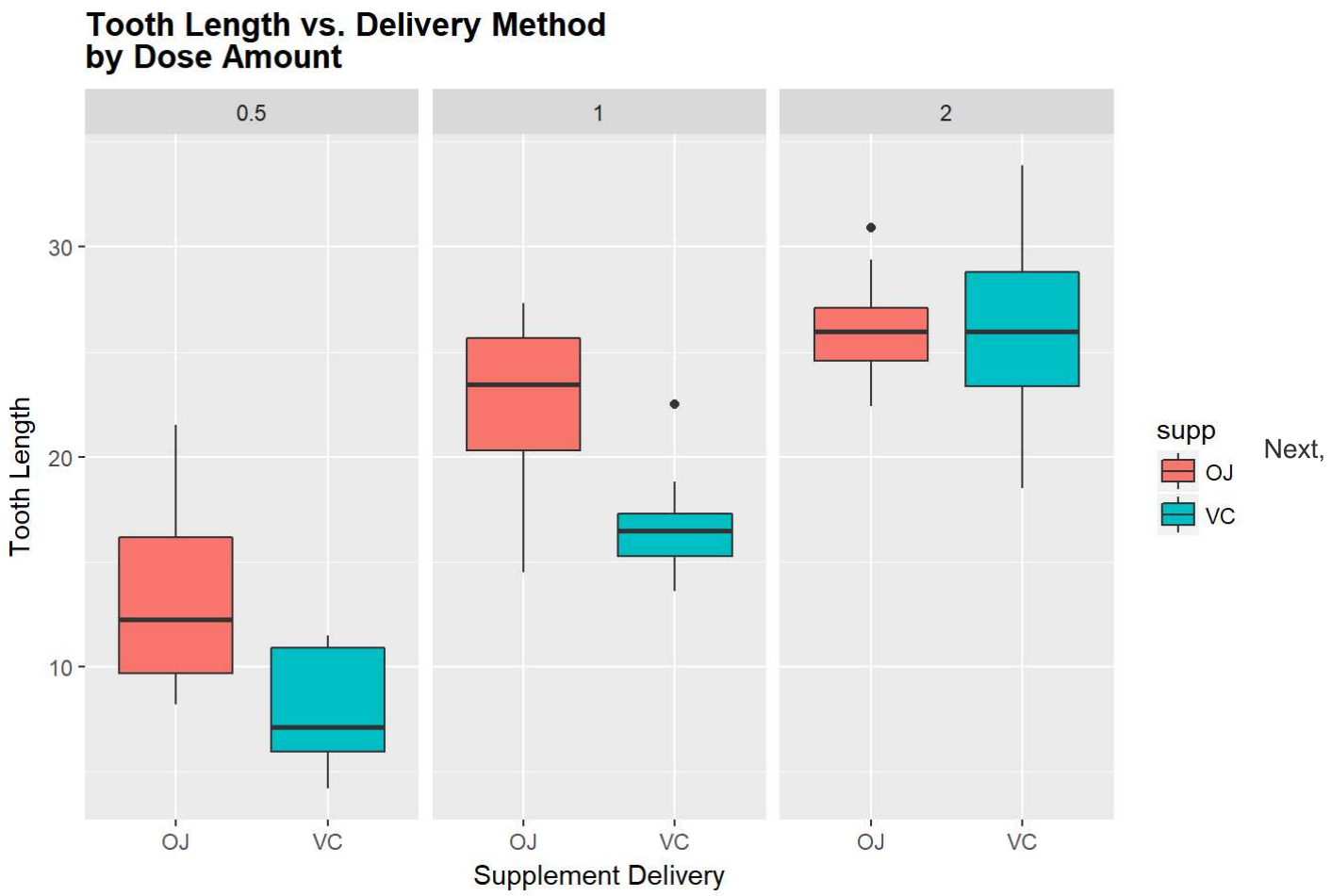
Once we have a better idea of the dataset, we create plots to explore how supp and dose affect tooth growth. The first plot shows confidence intervals for tooth growth by dose amount, for each delivery method.

```
ToothGrowth$dose<-as.factor(ToothGrowth$dose)
ggplot(aes(x=dose, y=len), data=ToothGrowth) + geom_boxplot(aes(fill=dose)) + xlab("Dose Amount")
+ ylab("Tooth Length") + facet_grid(~ supp) + ggtitle("Tooth Length vs. Dose Amount \nby Delivery
 Method") +
  theme(plot.title = element_text(lineheight=.8, face="bold"))
```



The following plot shows confidence intervals for tooth growth by delivery method, for each dose amount.

```
ggplot(aes(x=supp, y=len), data=ToothGrowth) + geom_boxplot(aes(fill=supp)) + xlab("Supplement Del
ivery") + ylab("Tooth Length") + facet_grid(~ dose) + ggtitle("Tooth Length vs. Delivery Method \n
by Dose Amount") +
  theme(plot.title = element_text(lineheight=.8, face="bold"))
```



Next,

tooth growth by supplement is compared using a t-test:

```
t.test(len~supp,data=ToothGrowth)
```

```
##
##  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
```

The p-value of .06 is larger than the 5% significan level, so we cannot say that supplements have a statistically significant effect on tooth growth.

Finally, tooth growth by dose is compared using a t-test fo three different dose pairs:

```
ToothGrowth_sub <- subset(ToothGrowth, ToothGrowth$dose %in% c(1.0,0.5))
t.test(len~dose,data=ToothGrowth_sub)
```

```
##
##  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
```

```
ToothGrowth_sub <- subset(ToothGrowth, ToothGrowth$dose %in% c(0.5,2.0))
t.test(len~dose,data=ToothGrowth_sub)
```

```
##
##  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
```

```
ToothGrowth_sub <- subset(ToothGrowth, ToothGrowth$dose %in% c(1.0,2.0))
t.test(len~dose,data=ToothGrowth_sub)
```

```
##
##  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
```

The p-value for each of the t-tests was very small, and statistically significant at the 5% signifcance level.

Conclusion

Based on these results, we can conclude that supplements do not appear to have a statistically significant relationship with tooth growth. However, increased dosage does have a statistically signifanct positive effect on tooth growth.