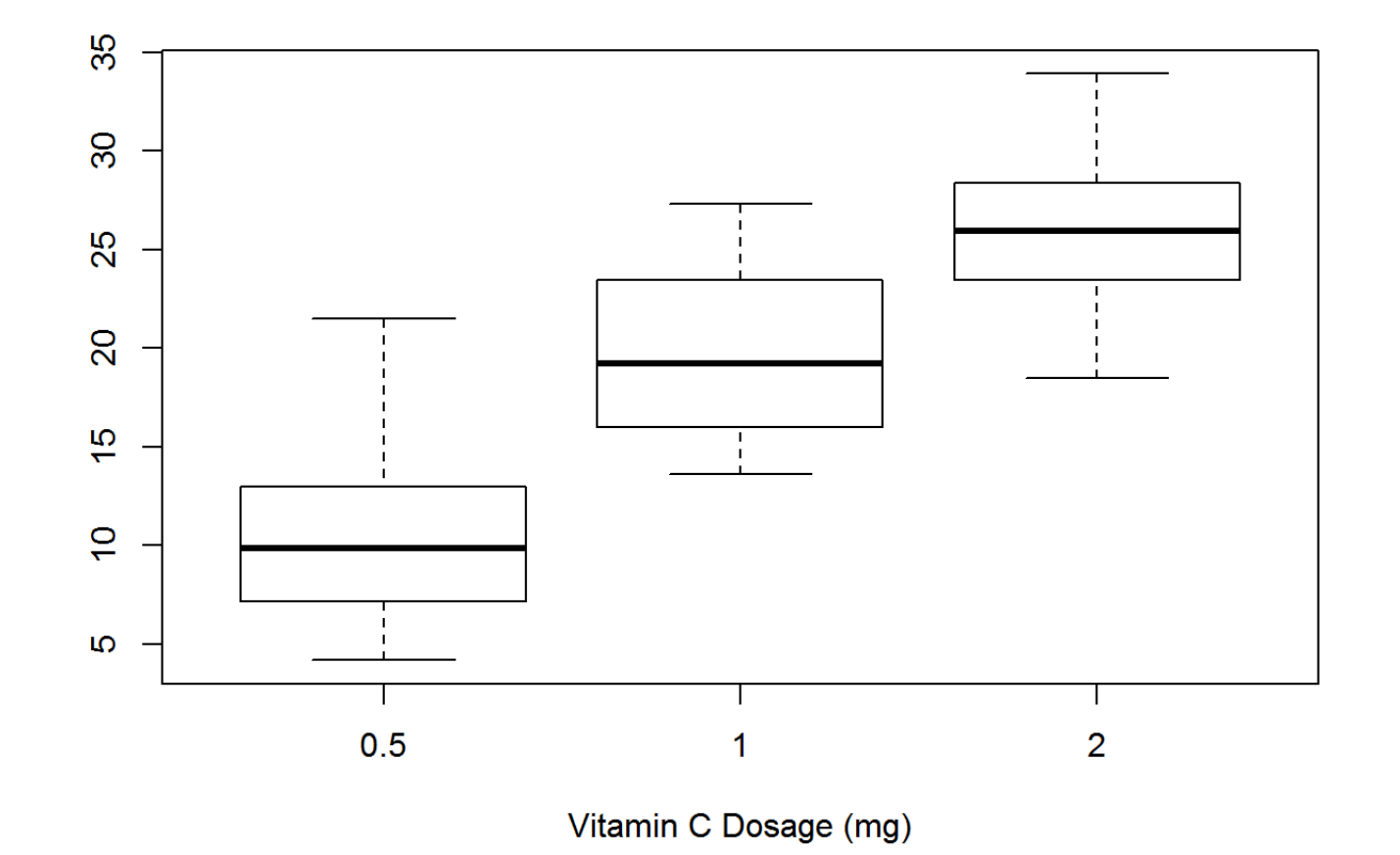# Statistical Inference Assignment (Part 2)

PART A: Comparing Tooth Growth by Dosage

(1)&(2) Preliminary Analysis & Summary Analysis of Dose vs Length of Teeth

```
data(ToothGrowth);boxplot(ToothGrowth$len~ToothGrowth$dose, height=2 ,xlab="Vitamin C Dosage
  (mg)")
```



```
#creating three different subsets of data, for Low, Medium and High dose
doseLow <- subset(ToothGrowth, dose == 0.5);doseMedium <-subset(ToothGrowth, dose == 1);dose
High <- subset(ToothGrowth, dose ==2)
#standard deviation for Low dose, Medium Dose, High Dose
paste(sd(doseLow$len),sd(doseMedium$len),sd(doseHigh$len), sep=" ")
```

```
## [1] "4.49976315166172 4.41543643905882 3.77415030520987"
```

```
#summary of each of the doese: Low, Medium, High
summary(doseLow$len);summary(doseMedium$len); summary(doseHigh$len)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    4.20    7.22    9.85   10.60   12.20   21.50
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    13.6    16.2    19.2    19.7    23.4    27.3
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    18.5    23.5    26.0    26.1    27.8    33.9
```

(3)Confidence Level and Hyposthesis

H0 Null Hypothesis: The differences in the means is 0
HA ALternative Hypothesis: THe differences in the means is not equal to 0

```
#T-test of means of Low dose and medium dose
t.test(doseMedium$len, doseLow$len, mu=0, paired=FALSE, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  doseMedium$len and doseLow$len
## t = 6.477, df = 38, p-value = 1.266e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##    6.276 11.984
## sample estimates:
## mean of x mean of y
##    19.73     10.61
```

```
#T-test of means of medium dose and high dose
t.test(doseHigh$len, doseMedium$len, paired=FALSE, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  doseHigh$len and doseMedium$len
## t = 4.901, df = 38, p-value = 1.811e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##   3.736 8.994
## sample estimates:
## mean of x mean of y
##    26.10     19.73
```

```
#T.test of means of low dose and high dose
t.test(doseHigh$len, doseLow$len, paired=FALSE, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  doseHigh$len and doseLow$len
## t = 11.8, df = 38, p-value = 2.838e-14
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  12.84 18.15
## sample estimates:
## mean of x mean of y
##     26.10     10.61
```

(4)Conclusion

Null Hypothesis is rejected.
For all T-test, there is less than 0.01% that the difference of means of the 2 groups compared to be 0.

PART B: Comparing Tooth Growth by Delivery Method

(1)&(2) Preliminary Analysis & Summary Analysis of Delivery Method vs Length of Teeth

```
plot(ToothGrowth$supp, ToothGrowth$len); suppOrangeJuice <- subset(ToothGrowth, supp=="OJ");
  suppAscorbicAcid <- subset(ToothGrowth, supp=="VC")
```
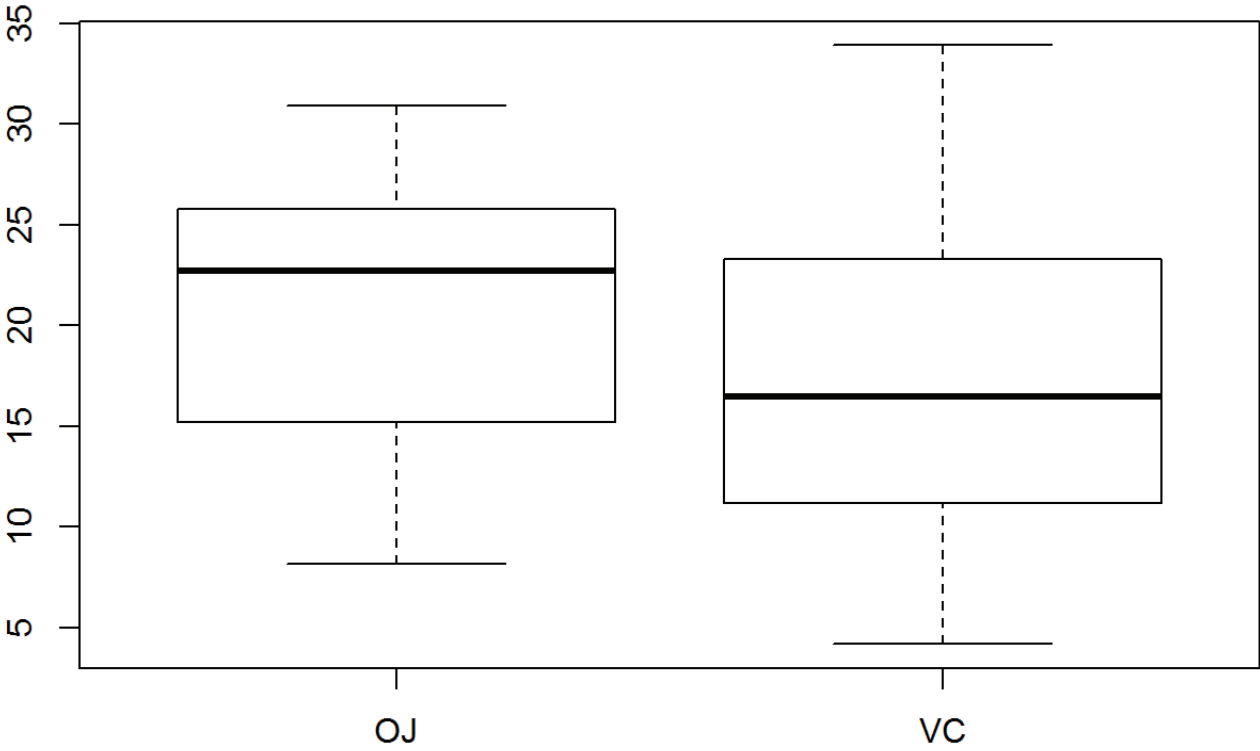


```
sd(suppOrangeJuice$len)
```

```
## [1] 6.606
```

```
sd(suppAscorbicAcid$len)
```

```
## [1] 8.266
```

```
# Summary of Ascorbic Acid and Orange Juice
summary(suppAscorbicAcid$len); summary(suppOrangeJuice$len)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     4.2    11.2    16.5    17.0    23.1    33.9
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     8.2    15.5    22.7    20.7    25.7    30.9
```

(3)Confidence Level and Hyposthesis

H0 Null Hypothesis: The differences in the means is 0
HA ALternative Hypothesis: THe differences in the means is not equal to 0

```
#t.test(suppOrangeJuice$len, suppAscorbicAcid$len,  paired=FALSE, var.equal=FALSE)$conf
t.test(suppOrangeJuice$len, suppAscorbicAcid$len, paired=FALSE, var.equal=TRUE)
```

```
##
##  Two Sample t-test
##
## data:  suppOrangeJuice$len and suppAscorbicAcid$len
## t = 1.915, df = 58, p-value = 0.06039
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.167  7.567
## sample estimates:
## mean of x mean of y
##     20.66     16.96
```

(4)Conclusion

Null Hypothesis is rejected.
For each T-test, there is approximately 6% probability that the difference of means of the 2 groups compared to be 0.