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```

Statistical inference

Saurabh Yadav

A Simulation Exercise

Simulating exponential variables

```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.5.1
```

```
n<-1000
col<-40
expovar<-rexp(n*col,0.2)
```

creating matrix for the exponential variables

```
mat<-matrix(expovar,n,col)
```

taking the mean of the 40 exponential variables

```
expomean<-apply(mat, 1, mean)
```

Comparisons

Comparison between sample mean and the theoretical mean

1.mean of the population

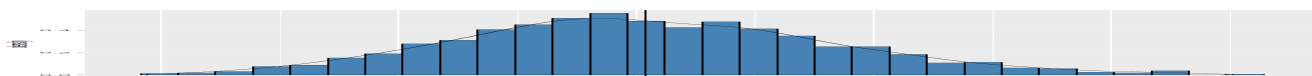
```
mean(expovar)
```

```
## [1] 5.037608
```

plotting the distribution of averages

```
ggplot(data.frame(expomean),aes(expomean))
+geom_histogram(aes(y=..density..),col="black",fill="steelblue")
+geom_density(col="black")+geom_vline(aes(xintercept=mean(expomean, na.rm=T)))
+labs(x="averages of 40 variables")
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



RESULT

1.The plot shows the distribution of averages is normally distributed and follows the Central Limit Theorem

2.The population mean and the mean of averages are approximate beacause the plot is centered around the population mean

PART-2 Basic inferential data analysis

Loading the tooth data

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

Subsetting the tooth growth data on the basis of the supp

```
vc<-subset(ToothGrowth, supp=="VC")  
oj<-subset(ToothGrowth, supp=="OJ")
```

Arranging the datasets on the basis of doses

```
newvc<-c()  
newvc$dose0.5<-vc$len[vc$dose==0.5]  
newvc$dose1<-vc$len[vc$dose==1]  
newvc$dose2<-vc$len[vc$dose==2]  
newvc<-data.frame(newvc)  
newoj<-c()  
newoj$dose0.5<-oj$len[oj$dose==0.5]  
newoj$dose1<-oj$len[oj$dose==1]  
newoj$dose2<-oj$len[oj$dose==2]  
newoj<-data.frame(newoj)
```

Taking the mean of the length of the tooth growth for different doses

```
lengthmeanvc<-apply(newvc, 2, mean)  
lengthmeanoj<-apply(newoj, 2, mean)
```

converting it into a marix

```
lengthmeanvc<-data.frame(matrix(lengthmeanvc))  
lengthmeanoj<-data.frame(matrix(lengthmeanoj))
```

giving new column names

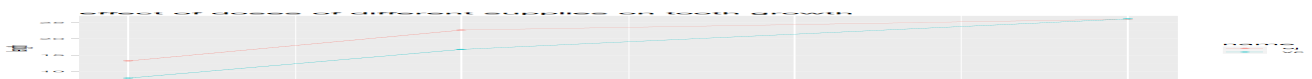
```
colnames(lengthmeanvc)<-"len"  
rownames(lengthmeanvc)<-c("dose0.5", "dose1", "dose2")  
colnames(lengthmeanoj)<-"len"  
rownames(lengthmeanoj)<-c("dose0.5", "dose1", "dose2")
```

adding new coloumn

```
lengthmeanvc$dose<-c(0.5,1,2)  
lengthmeanvc$name<-c("vc", "vc", "vc")  
lengthmeanoj$dose<-c(0.5,1,2)  
lengthmeanoj$name<-c("oj", "oj", "oj")  
finaldata<-rbind(lengthmeanoj, lengthmeanvc)
```

plotting

```
ggplot(finaldata, aes(x=dose, y=len, color=name))+geom_point()+geom_line()  
+labs(title="effect of doses of different supplies on tooth growth")  
+labs(x="DOSES", y="length")
```




```
len<-lengthmeanvc
colnames(len)<-c("lenVC", "dose")
len$lenOJ<-lengthmeanoj$len
```

Using confidence intervals and/or hypothesis tests to compare tooth growth by supp and dose

Confidence interval for dose 0.5

```
t.test(oj$len[oj$dose==0.5],vc$len[vc$dose==0.5],paired = F)$conf.int
```

```
## [1] 1.719057 8.780943
## attr("conf.level")
## [1] 0.95
```

RESULT: The t test between the supp vc and oj for dose=0.5 gives the interval 1.719057 to 8.780943. Which means the dose of 0.5 for oj is way more effective for tooth growth.

Confidence interval for dose 1

```
t.test(oj$len[oj$dose==1],vc$len[vc$dose==1],paired = F)$conf.int
```

```
## [1] 2.802148 9.057852
## attr("conf.level")
## [1] 0.95
```

RESULT: The t test between the supp vc and oj for dose=1 gives the interval 2.802148 to 9.057852. Which means the dose of 1 for oj is way more effective for tooth growth.

Confidence interval for dose 2

```
t.test(oj$len[oj$dose==2],vc$len[vc$dose==2],paired = F)$conf.int
```

```
## [1] -3.79807 3.63807
## attr("conf.level")
## [1] 0.95
```

RESULT: The t test between the supp vc and oj for dose=2 gives the interval -3.79807 to 3.63807. Which means the dose of 2 for both vc and oj are approximately same. This can also be shown by the plot which clearly shows that dose 2 for both affect the tooth growth in a same way.

Conclusion

The effect of two medications are similar when the dose is 2.

The oj is more effective in tooth growth when the doses are 0.5 and 1