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Subject: CSE3050 – Data Visualization and Presentation
Date: 30th January, 2023
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Exercise Number – 1

Acquiring and Plotting Data

Q1. Load the in-build dataset from R and draw various basic plot in R using grid (Horizontal bar plot, Vertical bar plot, box plot, multiple box plot, plot with point and lines etc.,)

Aim: To draw various basic plots in R like line plot, scatterplot, boxplot, multiple boxplots, horizontal and vertical bar plots, pie chart and histogram of the built-in dataset names Airquality and showing them in a 3x3 grid.

Code:

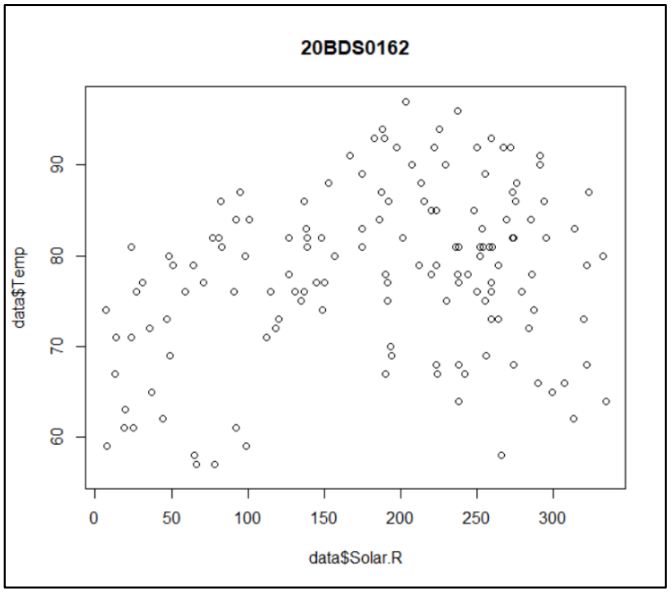
```
#20BDS0162 - SHOBHIT AGRAWAL

#Exercise 1

#Q1


#Loading the in-built dataset airquality


data = airquality

data


#Analyzing the data using various functions


str(data)

head(data)

tail(data)

summary(data)


#1.Using basic plot function to plot Solar.R vs Temp


plot(data$Solar.R,data$Temp,main = "20BDS0162")


#2.Using the barplot function


#Horizontal barplot
```

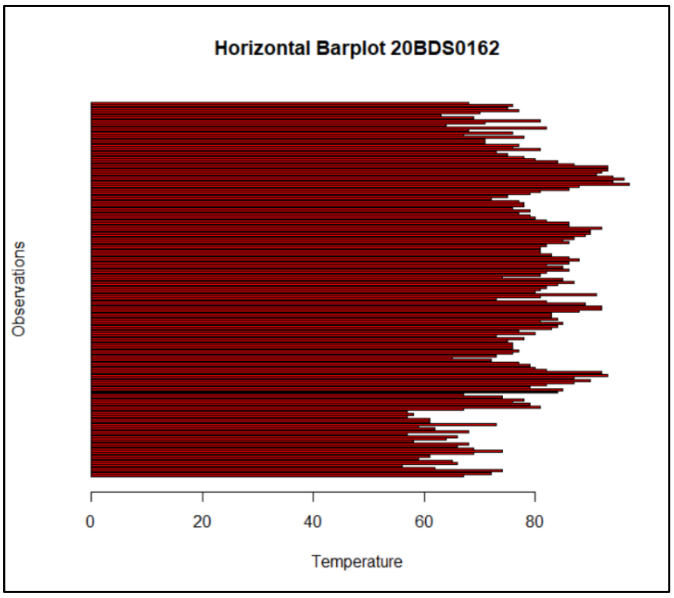
```
barplot(data$Temp, horiz = TRUE, main = "Horizontal Barplot 20BDS0162", col
      ="red", xlab = "Temperature", ylab = "Observations" )

#Vertical barplot
barplot(data$Temp, horiz = FALSE, main = "Vertical Barplot 20BDS0162", col ="green",
      xlab = "Observations", ylab = "Temperature")

#3.Boxplot

#One box plot
boxplot(data$Ozone, main="Single Boxplot 20BDS0162", col = "blue", notch = TRUE,
      outline = TRUE, border = "red")

#Multiple boxplot
boxplot(data$Ozone,data$Solar.R,data$Wind,data$Temp, notch = TRUE, col =
       c("red","green","blue","orange"), main = "Multiple Boxplots 20BDS0162")

#4.Plot with both points and lines

plot(data$Wind,type = "b",main = "Points and Lines 20BDS0162", col = "red", bg = "blue",pch = 24)

#5.Histogram

hist(data$Wind, col = "yellow", border = "green", main = "Histogram 20BDS0162")

#6.Pie Chart

pie(data$Month,labels = data$Month, main = "Pie Chart 20BDS0162")

#7.Visualizing all the above plots in a 3x3 grid
par(mfrow=c(3,3))
```

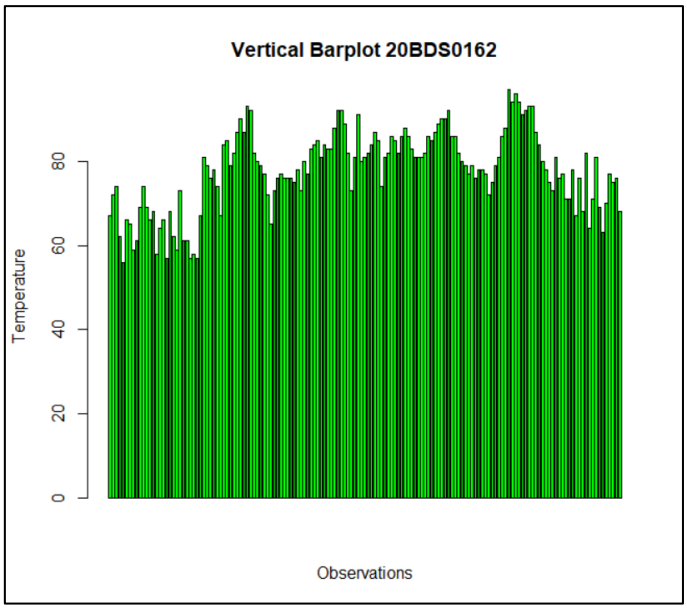
#8.Scatter Plot Matrix

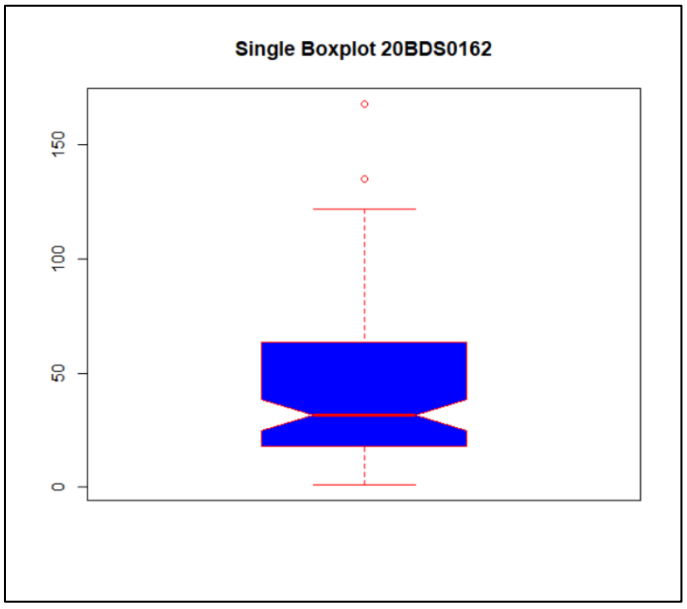
plot(data, main = "Scatter Plot Matrix 20BDS0162")

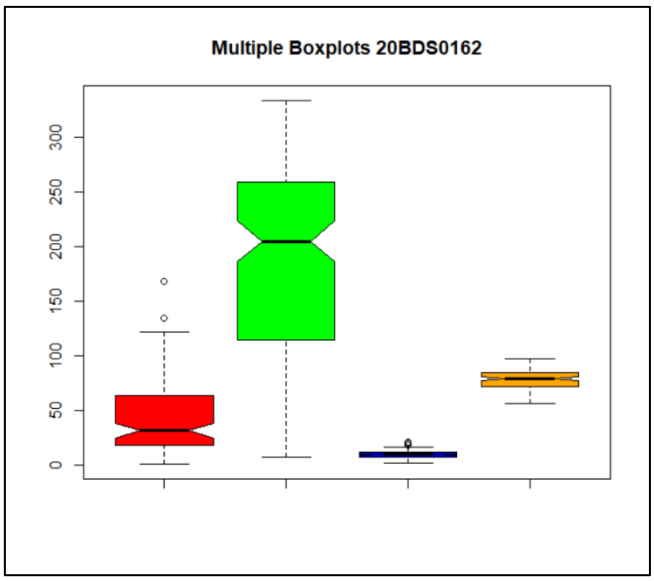
Output:

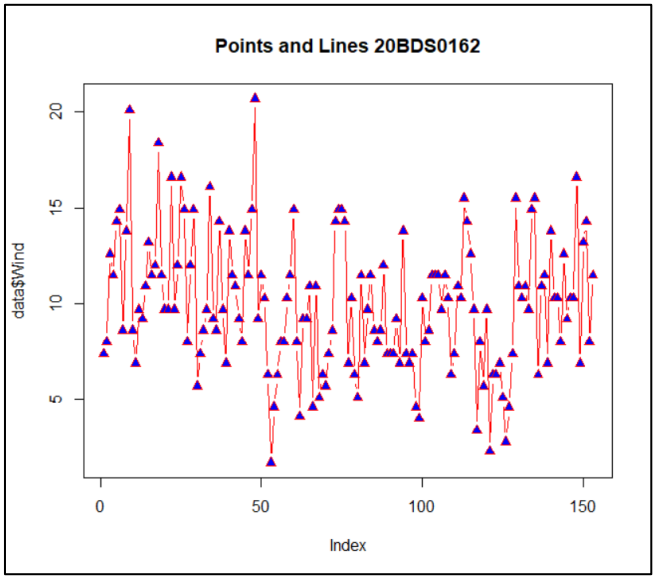


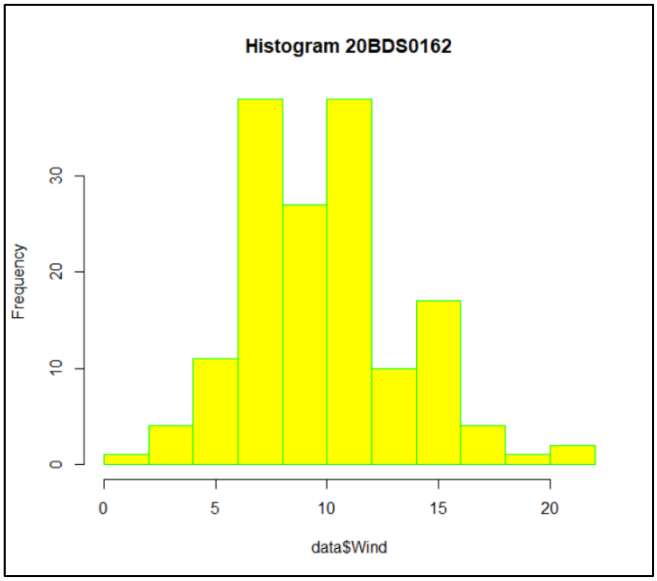


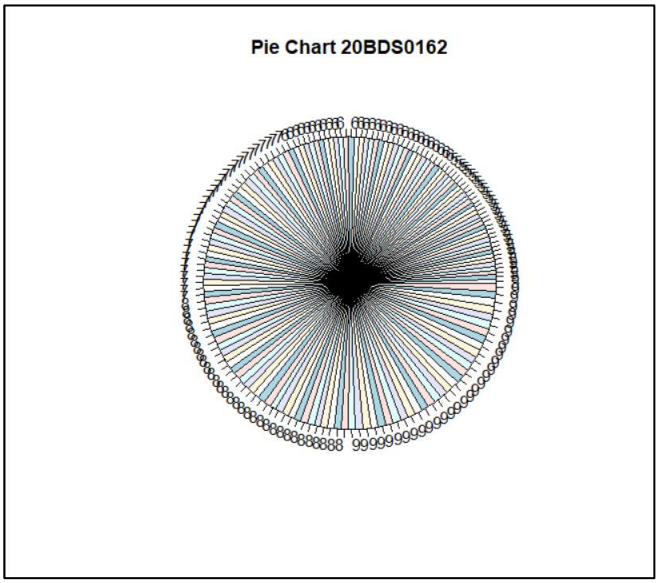


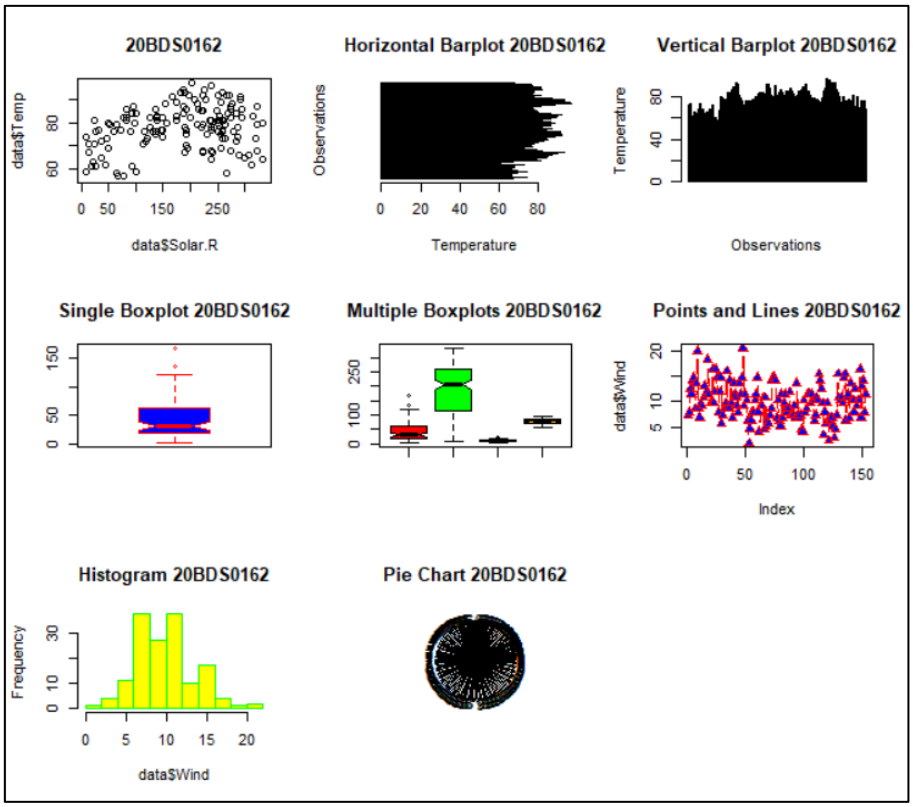


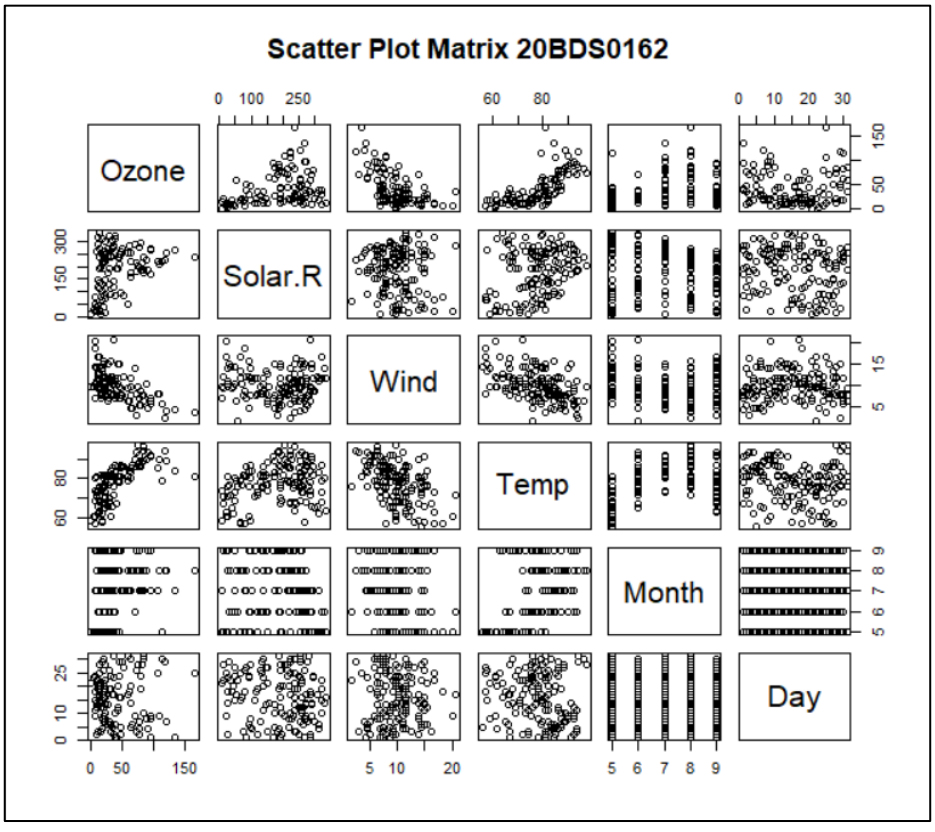

Multiple Boxplots 20BDS0162
0
50
100
150
200
250
300


Points and Lines 20BDS0162
data$Wind
5
10
15
20
0
50
100
150
Index


Histogram 20BDS0162
Frequency
0
10
20
30
0
5
10
15
20
data$Wind


Pie Chart 20BDS0162





Result:

We were able to plot all the basic plots in R for a built-in dataset available in R language.

Q2. Load in-built dataset mtcars and visualize data using visualization library ggplot.

Aim: To use the visualization library ggplot2 and plot various plots using it on the built-in dataset mtcars in R.

Code:

```
#Q2

library(lattice)

library(ggplot2)


data = mtcars

data


#1.Scatter Plot

ggplot(data = data, aes(x = wt,y = mpg,color = as.factor(cyl)))+

  geom_point()+xlab("Weight")+ylab("Mileage")+ggtitle("WT vs MPG 20BDS0162")


#2.Line Plot

ggplot(data = data, aes(x = wt,y = mpg,color = as.factor(cyl)))+

  geom_line()+xlab("Weight")+ylab("Mileage")+ggtitle("WT vs MPG 20BDS0162")


#3.Plot with both line and point

ggplot(data = data, aes(x = wt,y = mpg,color = as.factor(cyl)))+geom_point()+

  geom_line()+xlab("Weight")+ylab("Mileage")+ggtitle("WT vs MPG 20BDS0162")


#4.Plot with size attribute

ggplot(data = data, aes(x = wt,y = mpg,color = as.factor(cyl),size = qsec))+

  geom_point()+xlab("Weight")+ylab("Mileage")+ggtitle("WT vs MPG 20BDS0162")


#5.Plot with shape attribute

ggplot(data = data, aes(x = wt,y = mpg,shape = as.factor(cyl),color = as.factor(cyl),size = qsec))+

  geom_point()+xlab("Weight")+ylab("Mileage")+ggtitle("WT vs MPG 20BDS0162")
```

#6.Histogram

```
ggplot(data = data, aes(x = wt))+geom_histogram(color="blue",fill="yellow",bins=7)+ggtitle("WT vs MPG 20BDS0162")+xlab("Weight")+ylab("Count")
```

#7.Boxplot

```
data$gear = as.factor(data$gear)
```

```
ggplot(data = data, aes(x = gear,y = disp))+geom_boxplot(color = "red", fill = "yellow")+ggtitle("WT vs MPG 20BDS0162")+xlab("Weight")
```

```
data
```

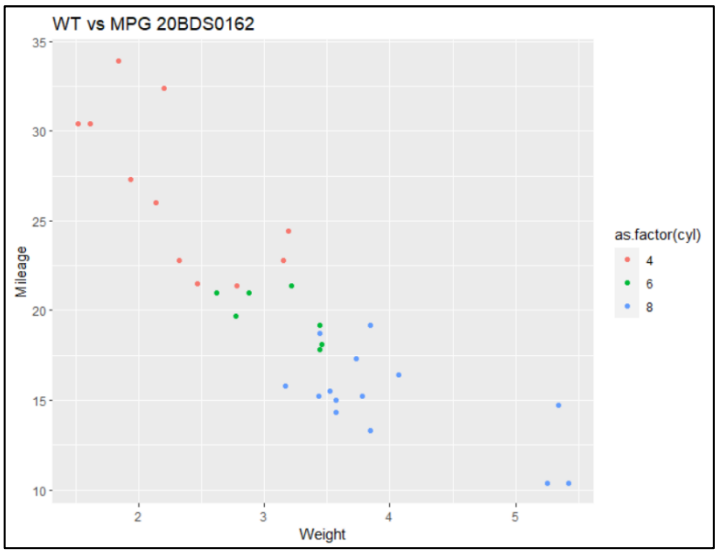
#8.Column Chart

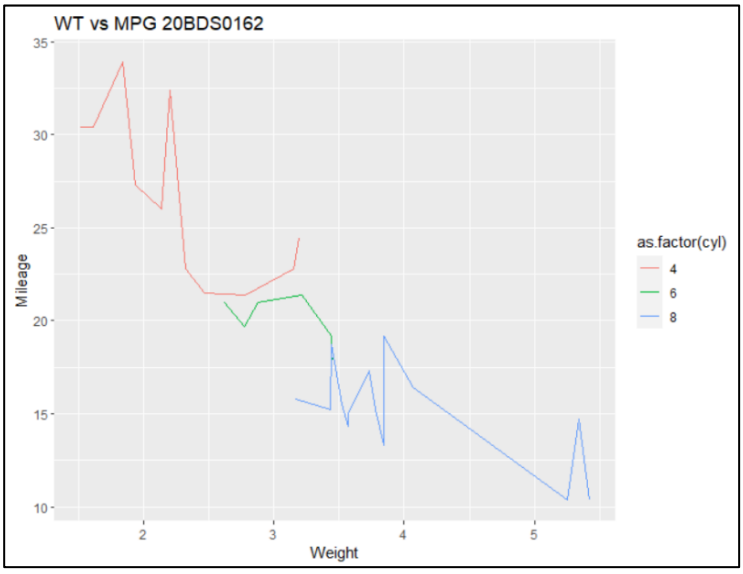
```
ggplot(data = data,
       aes(x = gear,y = mpg,color = gear))+
  geom_col() + xlab("Gear") + ylab("Mpg")+
  ggtitle("Gear vs Mpg 20BDS0162")
```

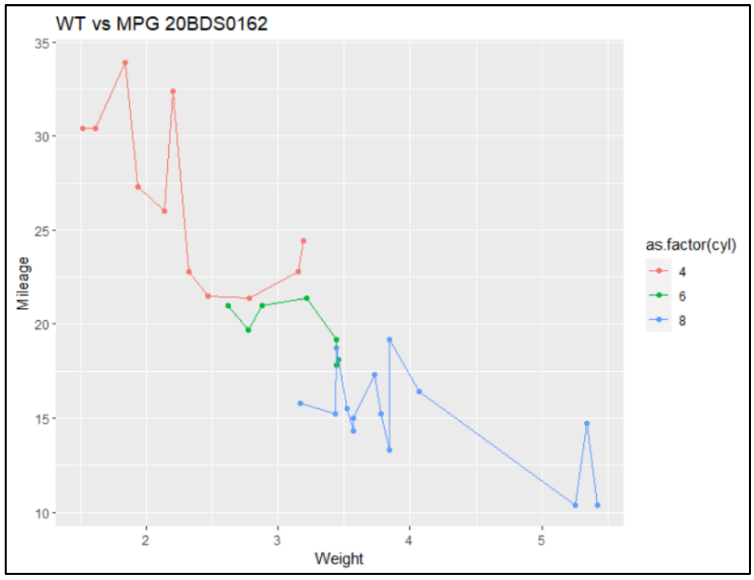
#9.Line Plot with weight

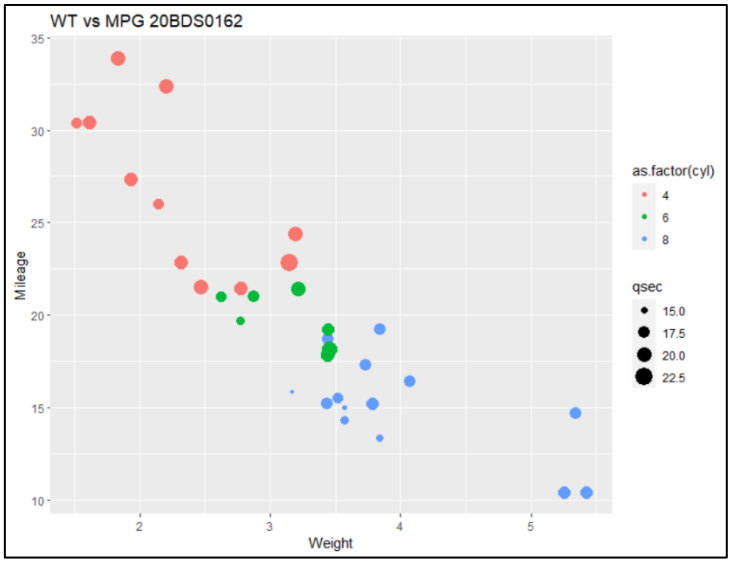
```
ggplot(data = data, aes(x = wt,y = mpg,color = as.factor(cyl), size = qsec))+
  geom_line()+xlab("Weight")+ylab("Mileage")+ggtitle("WT vs MPG 20BDS0162")
```

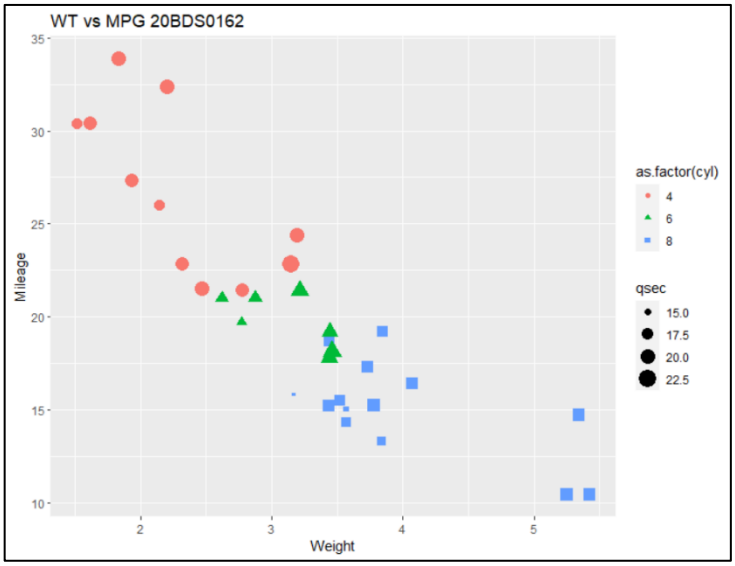
Output:

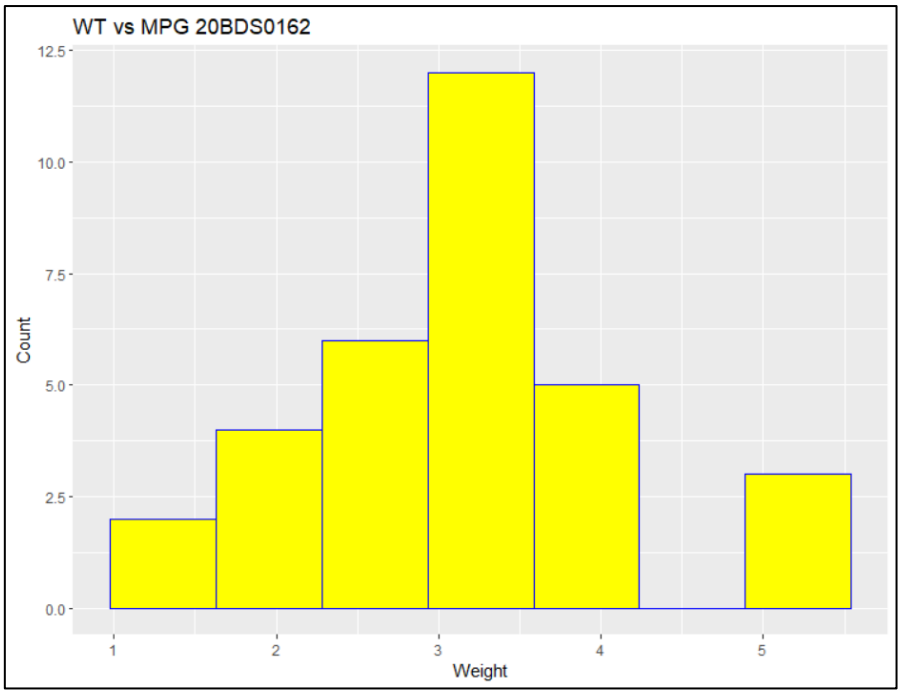

WT vs MPG 20BDS0162
Mileage
Weight
as.factor(cyl)
4
6
8

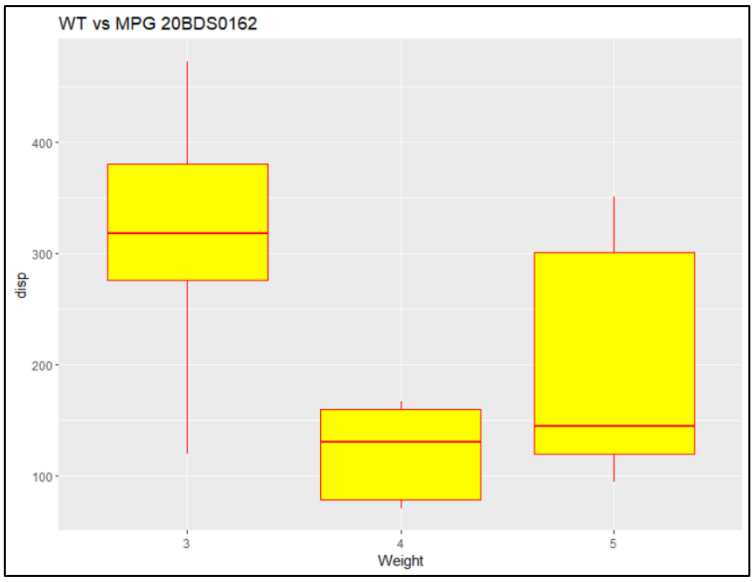

WT vs MPG 20BDS0162
Mileage
Weight
as.factor(cyl)
4
6
8

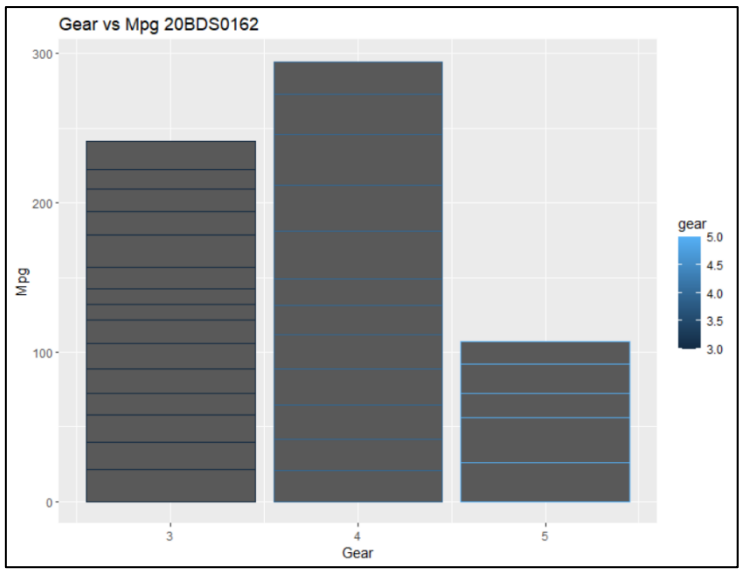

WT vs MPG 20BDS0162
Mileage
Weight
as.factor(cyl)
4
6
8

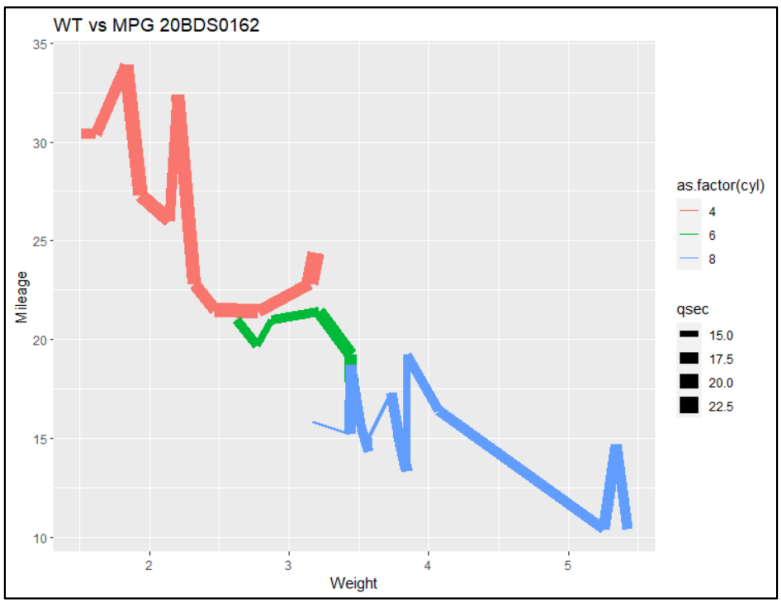

WT vs MPG 20BDS0162
Mileage
Weight
as.factor(cyl)
4
6
8
qsec
15.0
17.5
20.0
22.5


WT vs MPG 20BDS0162
Mileage
Weight
as.factor(cyl)
4
6
8
qsec
15.0
17.5
20.0
22.5


WT vs MPG 20BDS0162
Count
Weight







Result: We were able to successfully plot various plots for the mtcars dataset in R using the ggplot2 library.

Exercise Number - 2

Statistical Analysis – Univariate, Bivariate, Multivariate – plotting and coloring for maps

Q1. Load the gapminder dataset and perform statistical analysis using tidyverse and dplyr libraries.

Aim: To use the gapminder dataset in R and use various function of dplyr and tidyr libraries like filter, sort, arrange, etc… and perform statistical analysis.

Code:

```
#20BDS0162 - SHOBHIT AGRAWAL

#Exercise 2

#Q1


#Loading the libraries


library(dplyr)

library(tidyr)

library(gapminder)

library(ggplot2)


View(gapminder)

str(gapminder)

glimpse(gapminder) #dplyr for glimpse


#1.Extract continent 'Asia'

filter(gapminder,continent == "Asia")

gapminder %>% filter(continent == "Asia")


#2.Extract year 1957

gapminder %>% filter(year == "1957")


#3.Extract year as 2002 and country china

gapminder %>% filter(year == "2002" & country == "China")

gapminder %>% filter(year == "2002", country == "China")
```

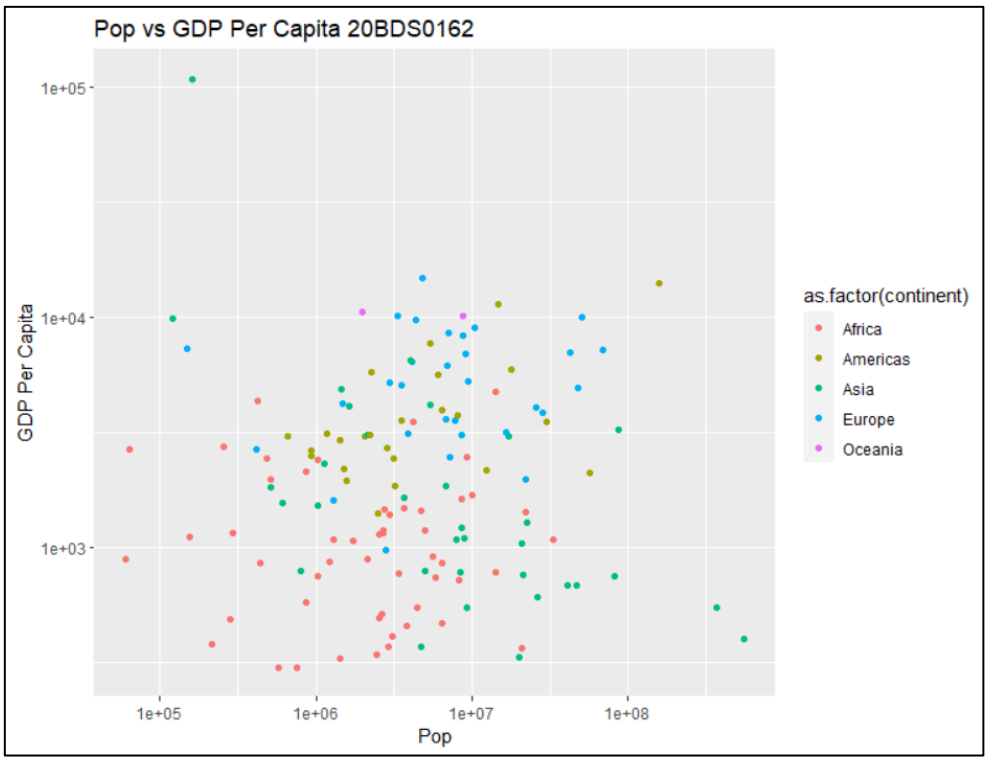
```
#4.Sort lifeExp in desc order
sort(gapminder$lifeExp,decreasing = TRUE)
arrange(gapminder,desc(lifeExp))

#5.1957 and pop in desc order
arrange(filter(gapminder,year == "1957"),desc(pop))

#6.a.lifeExp in months
data = gapminder
data

#updating the same column
data$lifeExp = data$lifeExp*12

#6.b.adding a new column
data = mutate(data,lifeExpMonths = lifeExp*12)
data

#gapminder_1952
gapminder_1952 = gapminder %>% filter(year == "1952")
gapminder_1952

View(gapminder_1952)

#7.Visualize scatter plot for pop and gdpPercap for gapminder_1952
ggplot(data = gapminder_1952,
       aes(x = pop,y = gdpPercap,color = as.factor(continent))) +
  geom_point() + scale_x_log10() + scale_y_log10() + xlab("Pop") + ylab("GDP Per Capita") +
  ggtitle("Pop vs GDP Per Capita 20BDS0162")

#8.Scatter plot pop and lifeExp group by continent based on population size
```

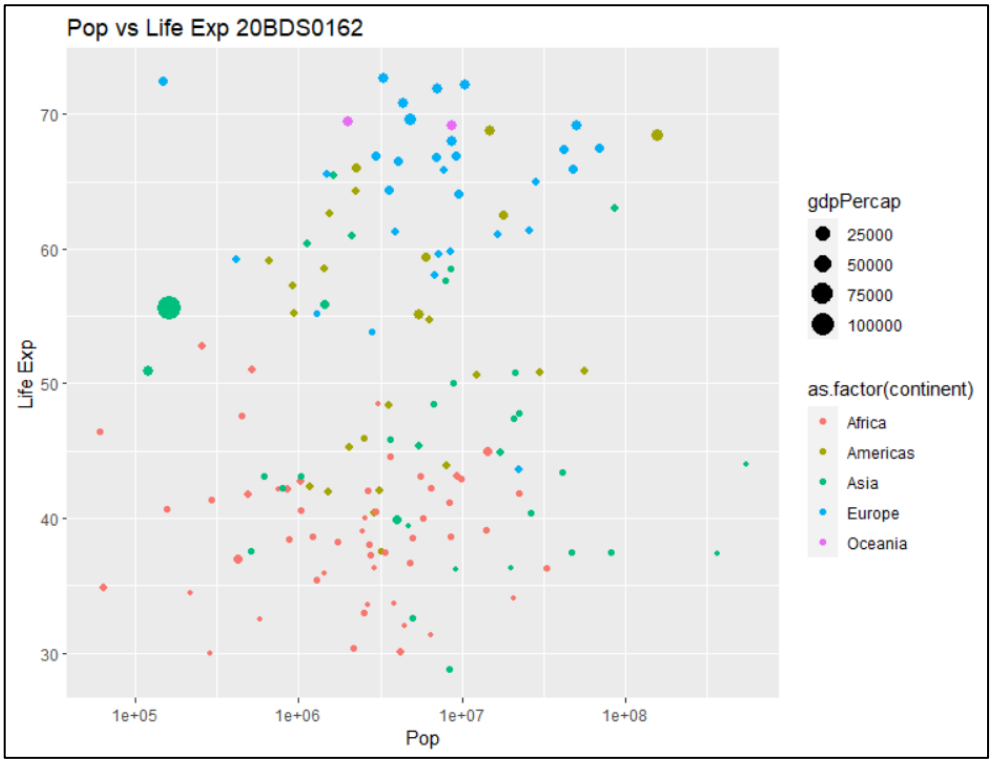
```
ggplot(data = gapminder_1952,
      aes(x = pop,y = lifeExp,color = as.factor(continent),size = gdpPercap))+
  geom_point() + scale_x_log10() + xlab("Pop") + ylab("Life Exp") +
  ggtitle("Pop vs Life Exp 20BDS0162")

#9.Sub-graph
ggplot(data = gapminder_1952,
      aes(x = pop,y = lifeExp, color = continent))+
  geom_point() + scale_x_log10() + facet_wrap(~continent)+ xlab("Pop") + ylab("Life Exp") +
  ggtitle("Pop vs Life Exp 20BDS0162")

#10.Sub-graph for year-DS:gapminder
ggplot(data = gapminder,
      aes(x = pop,y = lifeExp, color = continent))+
  geom_point() + scale_x_log10() + facet_wrap(~year) + xlab("Pop") + ylab("Life Exp") +
  ggtitle("Pop vs Life Exp 20BDS0162")

#11.Summarize - median lifeExp, DS:gapminder
gapminder%>%summarize(MedianLifeExp = median(lifeExp))

#12.1957, median - lifeExp, max - gdpPercap
gapminder %>% filter(year == 1957) %>%
  summarize(MedianLifeExp = median(lifeExp),MaxgdpPercap = max(gdpPercap))

#13.group by year, median lifeExp
#store in object by_year
data = gapminder
by_year <- data %>% group_by(year)%>% summarize(MedianLifeExp = median(lifeExp))
by_year

#14.Visualize year vs MedianLifeExp:by_year
```

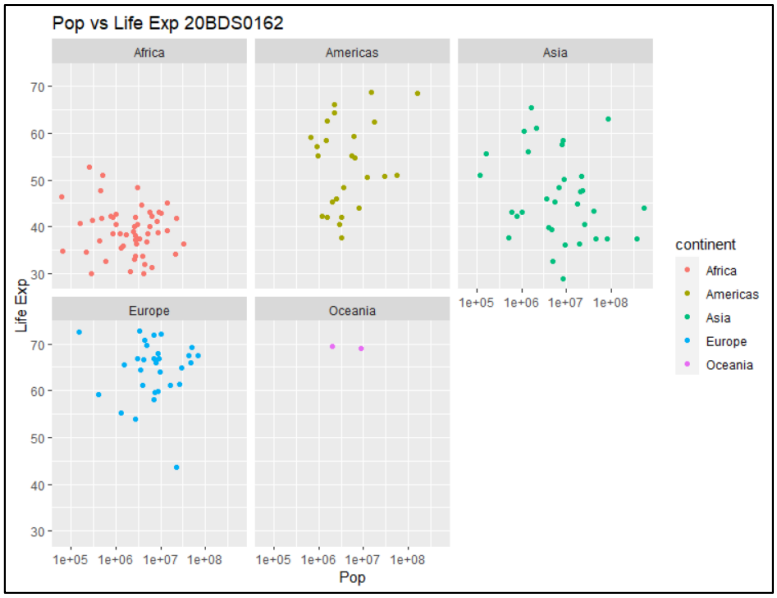
```
ggplot(data = by_year,
       aes(x = year,y = MedianLifeExp))+
  geom_point() + expand_limits(y = 0) + xlab("Year") + ylab("Median Life Exp")+
  ggtitle("Year vs Median Life Exp 20BDS0162")

#15.summarize the median gdpPercap by year and continent and save it in
#by_year_continent
data = gapminder

by_year_continent <- data %>%
  group_by(year,continent)%>%
  summarize(MedianGdpPercap = median(gdpPercap))

by_year_continent

#16.Visualise year vs MedianGdpPercap
#16.1.Line plot
ggplot(data = by_year_continent,
       aes(x = year,y = MedianGdpPercap,color = continent))+
  geom_line() + geom_point() + xlab("Year") + ylab("Median GDP Per Capita")+
  ggtitle("Year vs Median GDP Per Capita 20BDS0162")

#16.2.Boxplot
ggplot(data = by_year_continent,
       aes(x = year,y = MedianGdpPercap,color = continent))+
  geom_boxplot() + xlab("Year") + ylab("Median GDP Per Capita")+
  ggtitle("Year vs Median GDP Per Capita 20BDS0162")

#16.3.Column chart
ggplot(data = by_year_continent,
       aes(x = year,y = MedianGdpPercap,color = continent))+
```

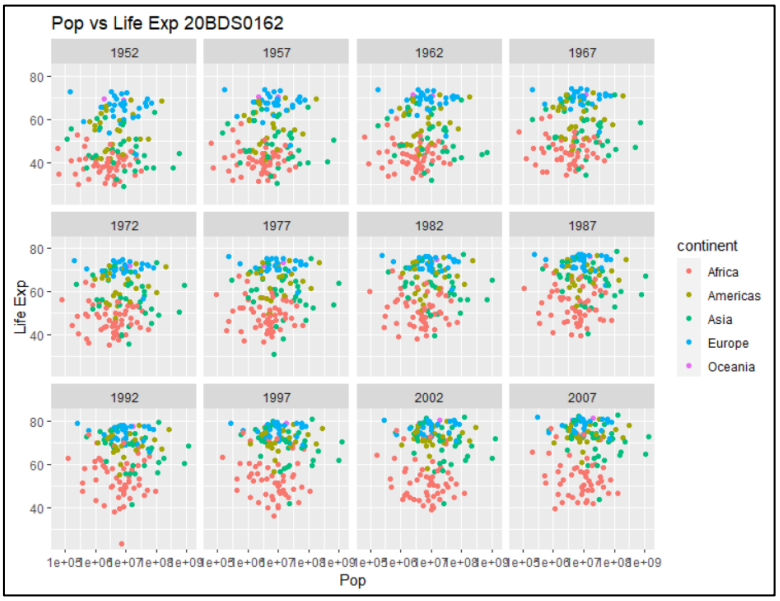
```
geom_col() + xlab("Year") + ylab("Median GDP Per Capita")+
ggtitle("Year vs Median GDP Per Capita 20BDS0162")
```

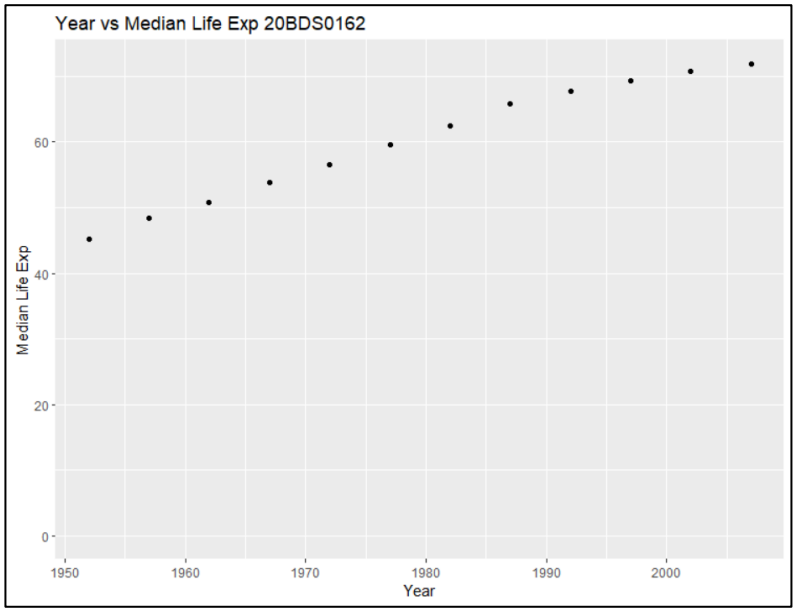
Output:

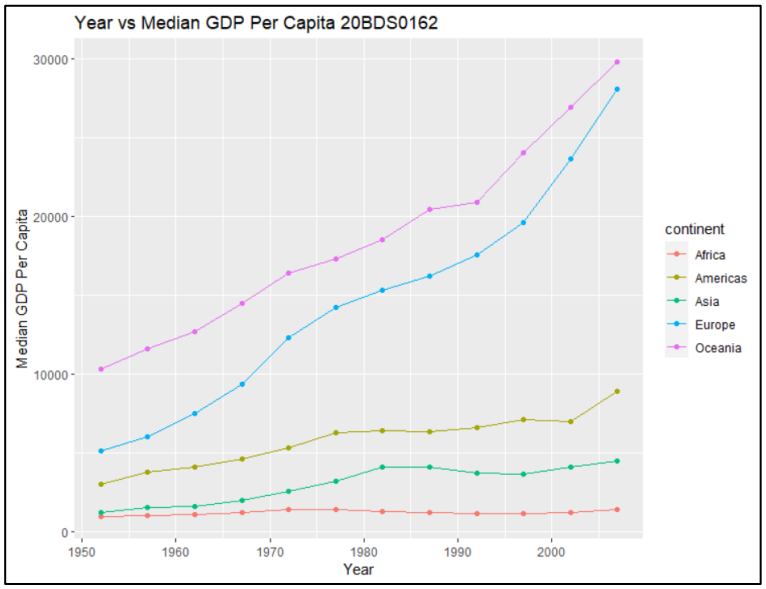


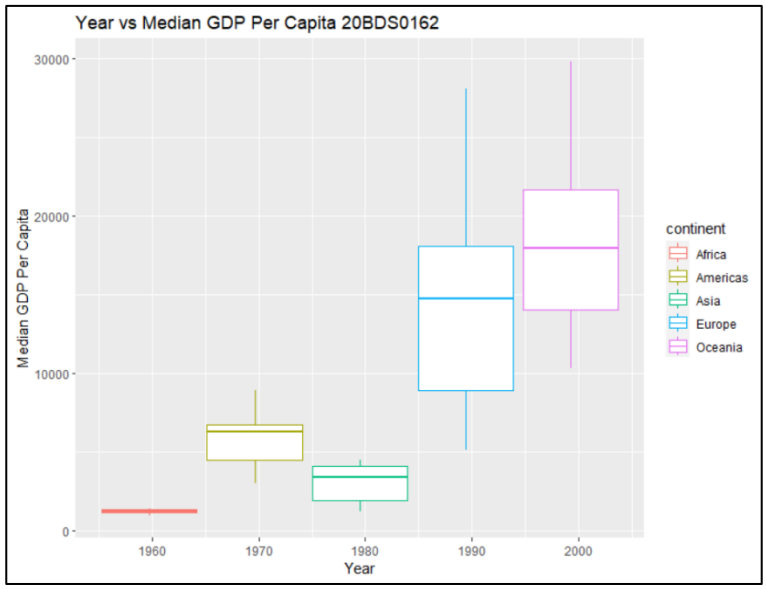


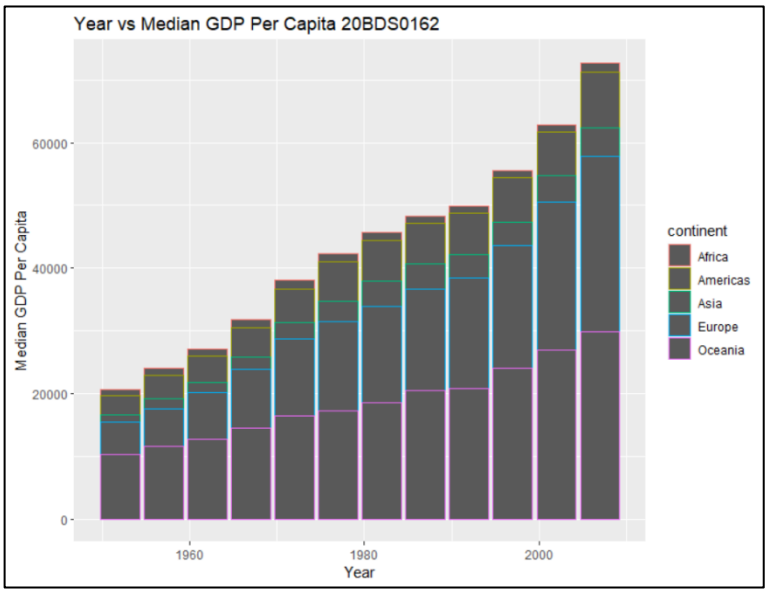

Pop vs Life Exp 20BDS0162
Africa
Americas
Asia
Europe
Oceania
Life Exp
Pop
continent
Africa
Americas
Asia
Europe
Oceania


Pop vs Life Exp 20BDS0162
1952
1957
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
Life Exp
Pop
continent
Africa
Americas
Asia
Europe
Oceania


Year vs Median Life Exp 20BDS0162
Median Life Exp
Year







Result: We were able to successfully perform the statistical analysis of gapminder dataset using the in-built functions of the dplyr and tidyr libraries.

Q2. Using RColorBrewer visualize mpg data.

Aim: To visualize the mpg data in R using the RColorBrewer library

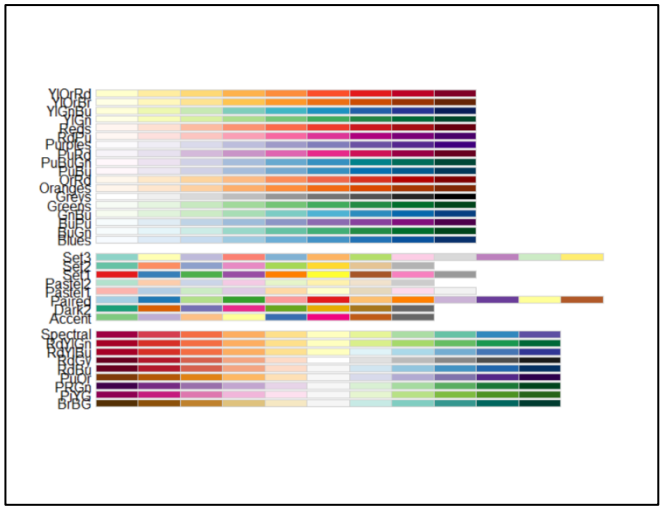
Code:

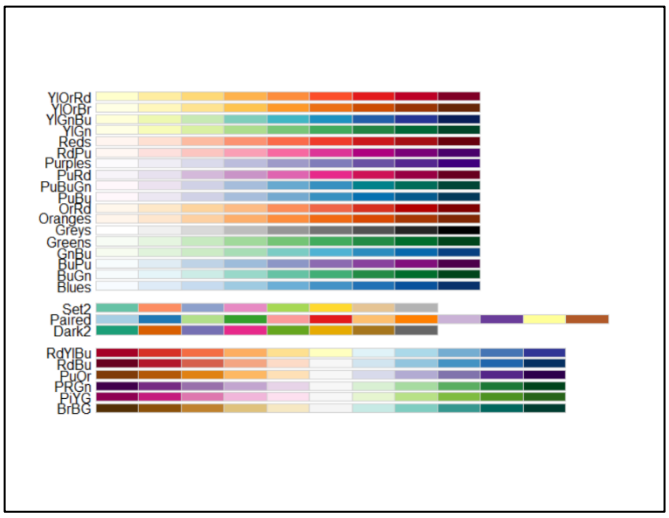
```
#Q2

#Color Visualization using RColorBrewer


library(RColorBrewer)

library(viridis)

library(ggplot2)

library(gridExtra)


str(mpg)

factor(mpg$cyl)


display.brewer.all()

display.brewer.all(colorblindFriendly=T)



#mpg dataset

View(mpg)


#1.Density Plot

ggplot(data = mpg,aes(x = cty))+geom_density(aes(fill = factor(cyl))) + ggtitle("Density Plot
20BDS0162")


#2.Transparency

ggplot(data = mpg,aes(x = cty))+geom_density(aes(fill = factor(cyl),alpha=0.7)) + ggtitle("Density Plot
(Transparency) 20BDS0162")


#3.Labels

ggplot(data = mpg,aes(x = cty))+geom_density(aes(fill = factor(cyl),alpha=0.7))+labs(title = "Density
Plot 20BDS0162",x = "City Mileage",fill = "#Cylinder")
```

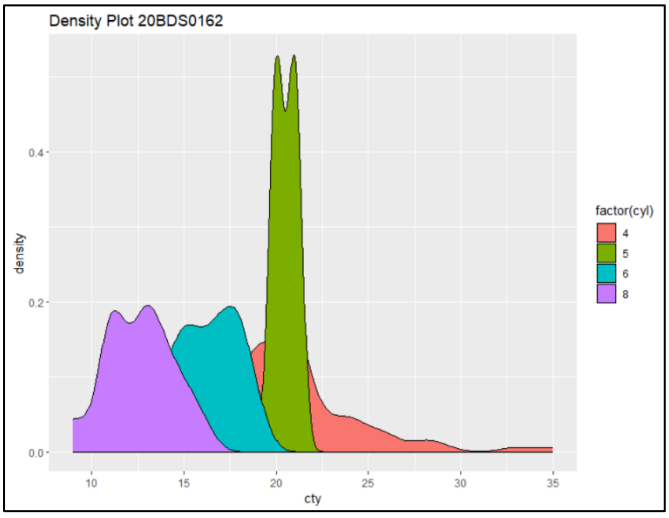
#4.Brewer

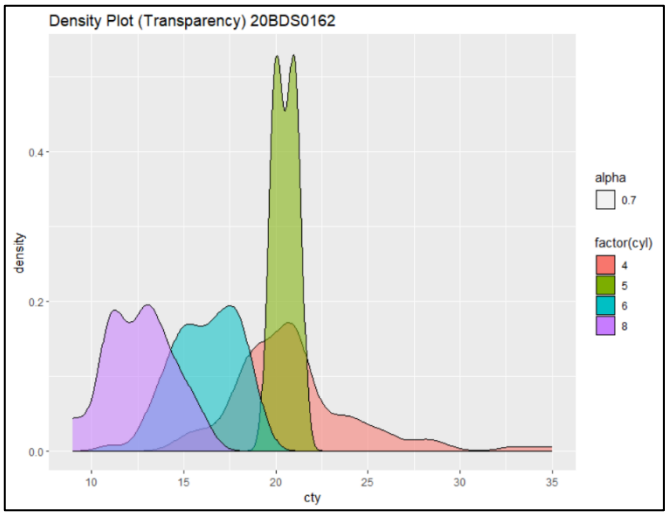
```
p1<-ggplot(data = mpg,aes(x = cty))+geom_density(aes(fill = factor(cyl),alpha=0.7))+labs(title = "D1 20BDS0162",x = "City Mileage",fill = "#Cylinder")+scale_fill_brewer(palette = "YlOrRd")

p2<-ggplot(data = mpg,aes(x = cty))+geom_density(aes(fill = factor(cyl),alpha=0.7))+labs(title = "D2 20BDS0162",x = "City Mileage",fill = "#Cylinder")+scale_fill_brewer(palette = "Set2")

p3<-ggplot(data = mpg,aes(x = cty))+geom_density(aes(fill = factor(cyl),alpha=0.7))+labs(title = "D3 20BDS0162",x = "City Mileage",fill = "#Cylinder")+scale_fill_brewer(palette = "BrBG")

p4<-ggplot(data = mpg,aes(x = cty))+geom_density(aes(fill = factor(cyl),alpha=0.7))+labs(title = "D4 20BDS0162",x = "City Mileage",fill = "#Cylinder")+scale_fill_brewer(palette = "Spectral")


grid.arrange(p1,p2,p3,p4,nrow = 2,top = "Grid Graphs 20BDS0162")
```

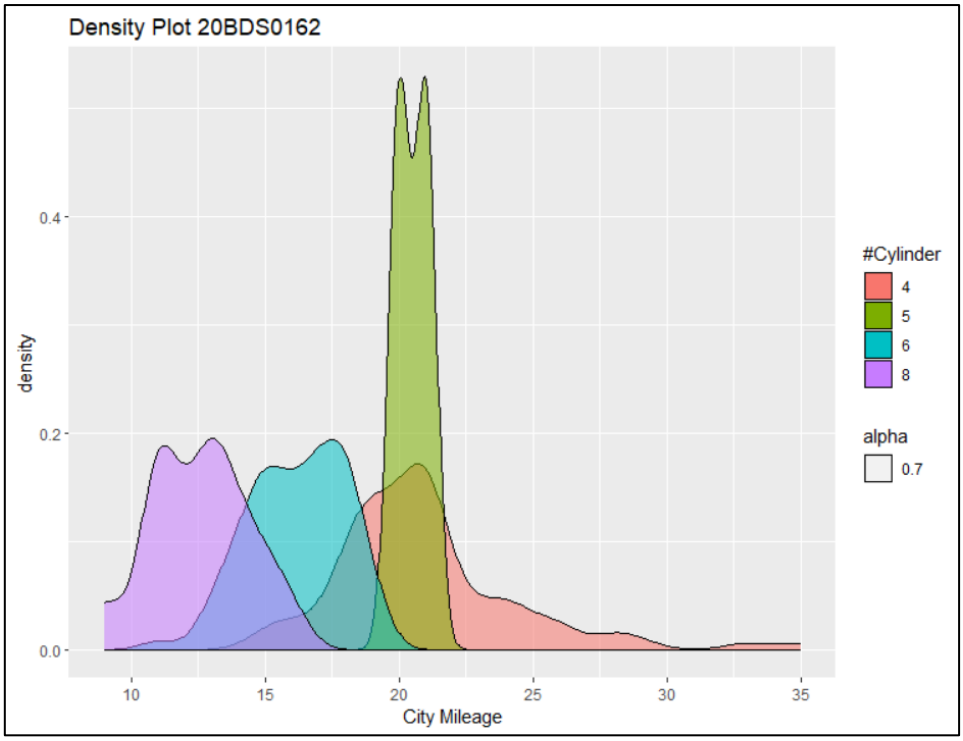
Output:

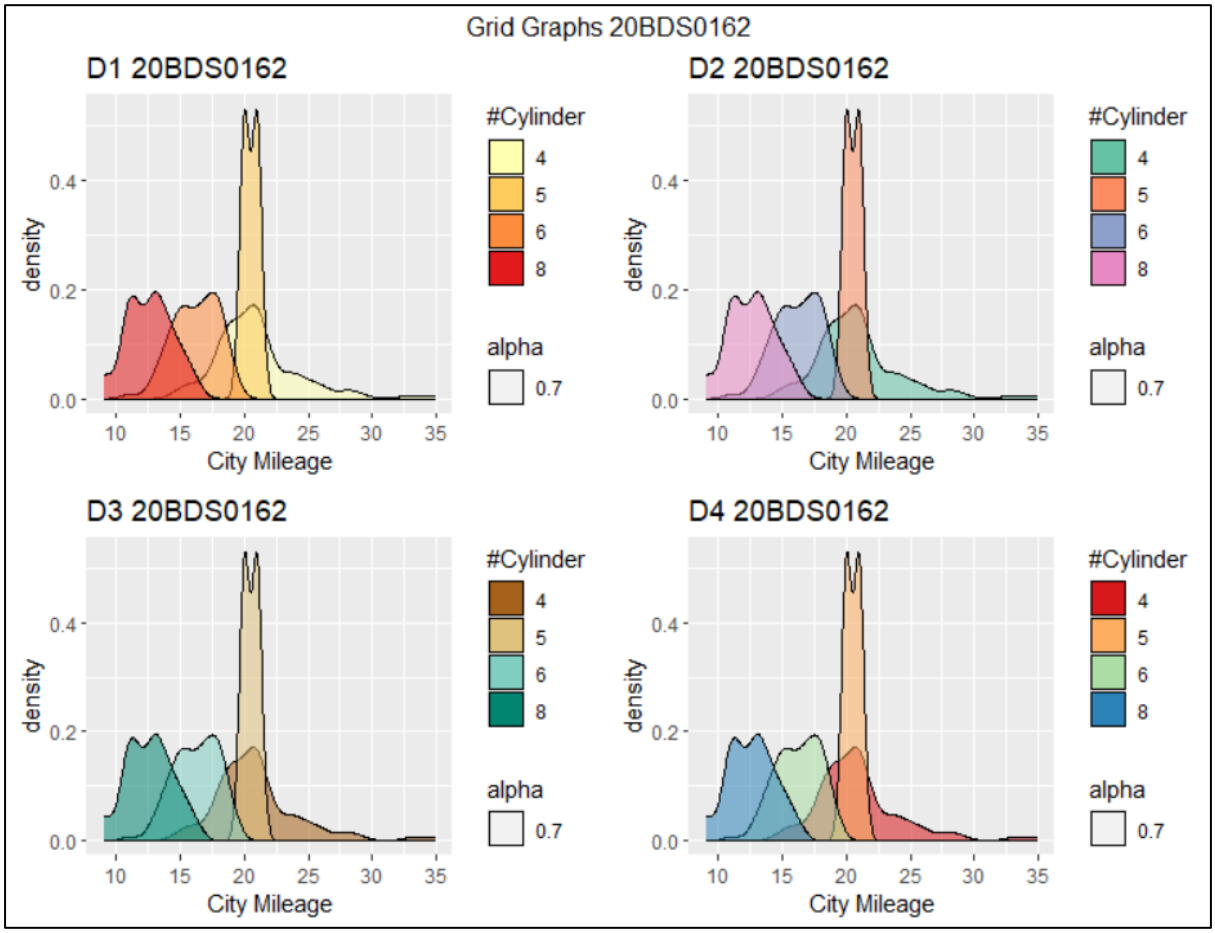












Result: We were able to visualize the mpg dataset using the RColorBrewer and plotted various density plots and also shown graphs in a 2x2 grid using the library gridExtra.

Q3. Load USArrests in-built dataset and correlate in the maps with anyone fields. Display the maps using colormapping.

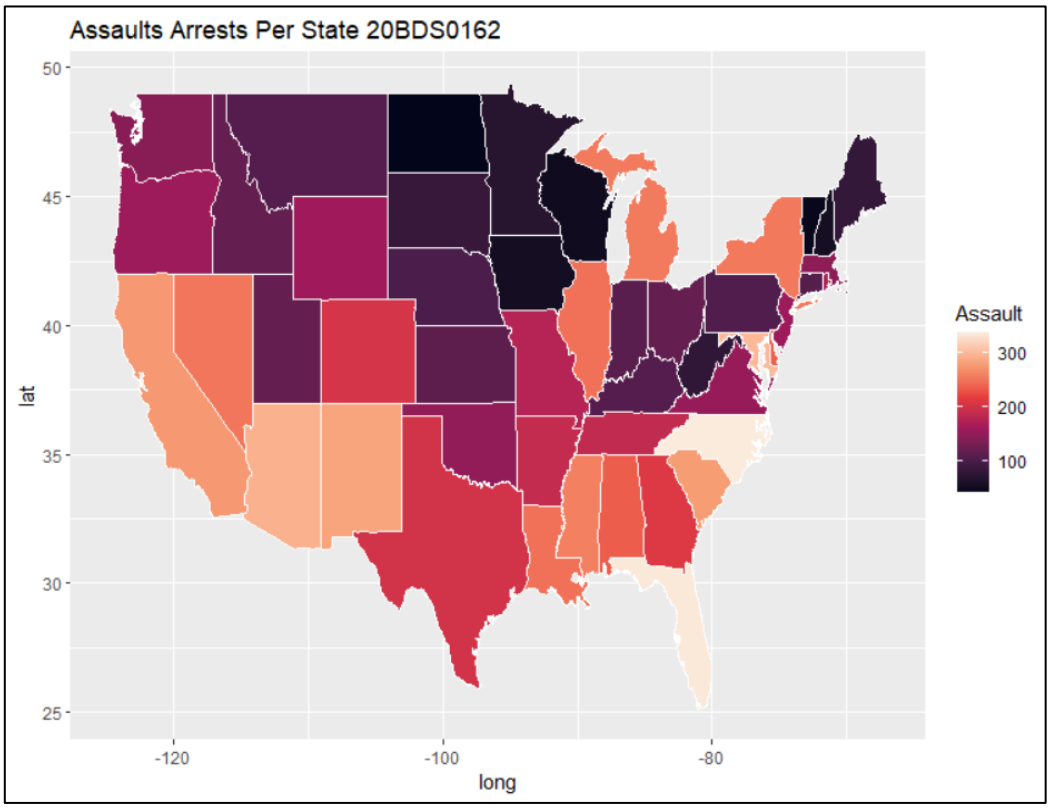
Aim: To use the USArrests dataset in R and correlate in the maps with anyone field and use color mapping to display the maps.

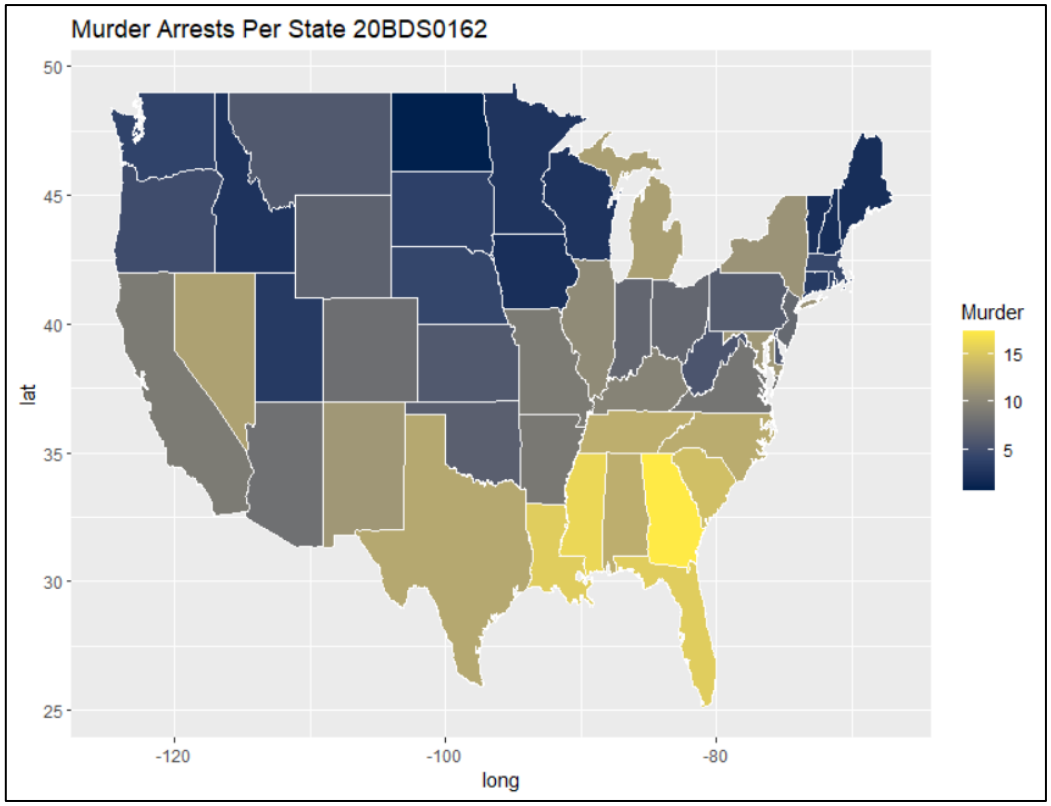
Code:

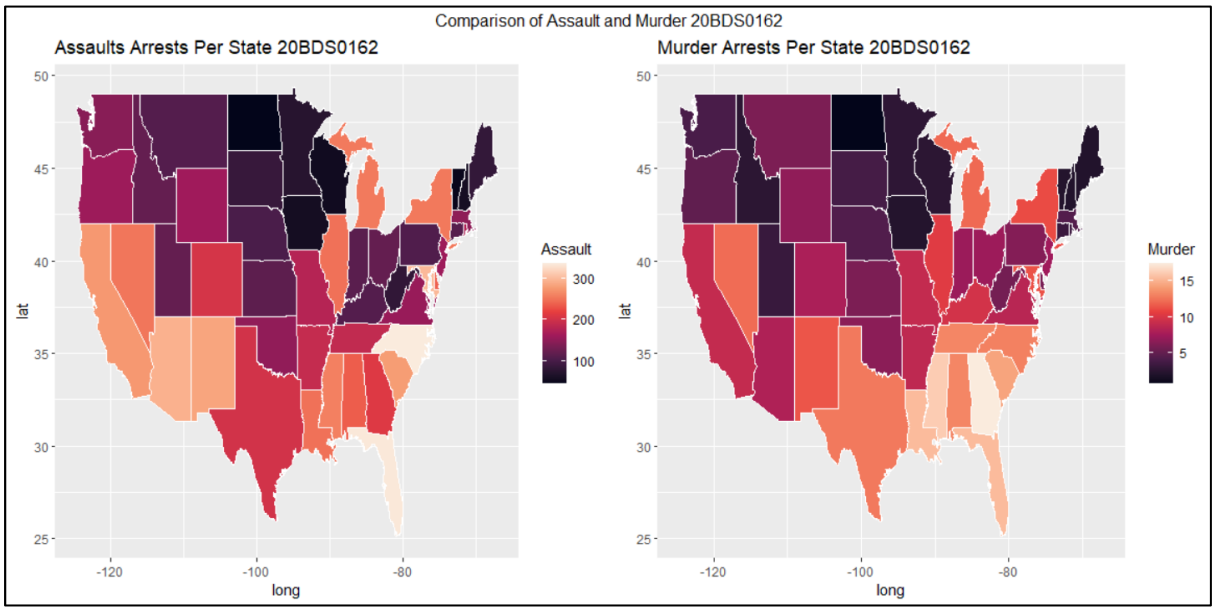
```
#Q4

#Colorful map using Viridis

library(maps)

library(ggmap)

library(viridis)

library(dplyr)


View(USArrests)


arrests = USArrests


arrests$region <- tolower(rownames(USArrests))

View(arrests)


#Retrieve the states map

states_map <- map_data("state")

View(states_map)

arrests_map<-left_join(x=states_map,

                       y=arrests,

                       by ='region')

View(arrests_map)


#Create the map

#1.Assault

p1<-ggplot(arrests_map,aes(x=long,y=lat,group=group))+

  geom_polygon(aes(fill=Assault),color='white')+

  labs(title="Assaults Arrests Per State 20BDS0162")+
```

```
  scale_fill_viridis_c(option='F',direction=1)

#2.Murder
p2<-ggplot(arrests_map,aes(x=long,y=lat,group=group))+
  geom_polygon(aes(fill=Murder),color='white')+
  labs(title="Murder Arrests Per State 20BDS0162")+
  scale_fill_viridis_c(option='F',direction=1)

grid.arrange(p1,p2,nrow = 1,top = "Comparison of Assault and Murder 20BDS0162")
```

Output:







Result: We were able to compare Murder and Assaults Per State of the USArrests dataset in R and correlate in the maps and used color mapping to display the maps.