SO, HOW DO YOU GO FROM DATA TO DECISIONS?

1. USE NUMBERS AND PLOTS TO DESCRIBE THE DATA

2. DRAW INFERENCES FROM THE DATA

3. ORGANIZE DATA USING ANALYTICAL TOOLS

4. QUANTIFY RELATIONSHIPS BETWEEN VARIABLES

5. VISUALLY COMMUNICATE WHAT YOU'VE LEARNT

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OFTEN, A GOOD DECK CAN BE THE DIFFERENCE BETWEEN

"WOW, THAT WAS AN AMAZING JOB"

AND

"EH.. WHAT WAS IT THAT YOU DID FOR THE LAST 3 WEEKS?"

5. VISUALLY COMMUNICATE WHAT YOU'VE LEARNT

A GOOD DECK DOCUMENTS YOUR FINDINGS
IN AN EXTREMELY EFFECTIVE WAY

A WELL PLANNED GRAPH

CAN BE MORE EFFECTIVE THAN A
100 TABLES AND SLIDES

5. VISUALLY COMMUNICATE WHAT YOU'VE LEARNT A WELL PLANNED GRAPH CAN BE USED TO TELL A STORY

THIS IS A GRAPH "THAT MADE A NATION CRY"

THIS WIDTH OF THE LINE SHOWS THE SIZE OF NAPOLEON'S ARMY

FROM LEFT TO RIGHT, THE RED PORTION SHOWS THE SIZE AS THE ARMY ADVANCED TO MOSCOW

FROM RIGHT TO LEFT, THE GREY PORTION SHOWS THE SIZE AS THE ARMY RETREATED FROM MOSCOW

THIS POIGNANT EXAMPLE IS ONE OF THE FIRST WELL-KNOWN DATA VISUALIZATIONS THAT "TELL A STORY" WITH DATA

"TELL A STORY" WITH DATA

THERE ARE MANY STANDARD WAYS TO VISUALIZE DATA

USING THEM TO TELL A STORY IS MORE AN ART THAN A SCIENCE

"TELL A STORY" WITH DATA

USING THEM TO TELL A STORY IS MORE AN ART THAN A SCIENCE

THE ARTISTRY COMES WITH EXPERIENCE

THE MECHANICS ARE EASY THOUGH AND IMPORTANT TO KNOW

R HAS BUILT-IN FUNCTIONALITY FOR LOTS OF DATA VISUALIZATIONS

HISTOGRAMS

BOXPLOTS

Q-Q PLOTS

SCATTER PLOTS

LINE CHARTS

BAR

HEAT MAPS

PIE CHARTS

HISTOGRAMS

BOXPLOTS

HEAT MAPS

Q-Q PLOTS

SCATTER PLOTS

PIE CHARTS

BAR

LINE CHARTS

R HAS MANY PACKAGES THAT HELP US GO BEYOND THESE BASIC VISUALIZATIONS

AND ENHANCE THEM IN MANY WAYS

R HAS MANY PACKAGES THAT HELP US GO BEYOND THESE BASIC VISUALIZATIONS

RCOLORBREWER CONTROL COLOR PALETTES

GGPLOT2 COMPLEX 2D GRAPHS

EXAMPLE 1: PLOT() FUNCTION

EXAMPLE 1: PLOT() FUNCTION

```
x <- 1:10
y <- rnorm(10)
```

LET'S PLOT X VS Y IN 2 DIFFERENT WAYS

EXAMPLE 1: PLOT() FUNCTION

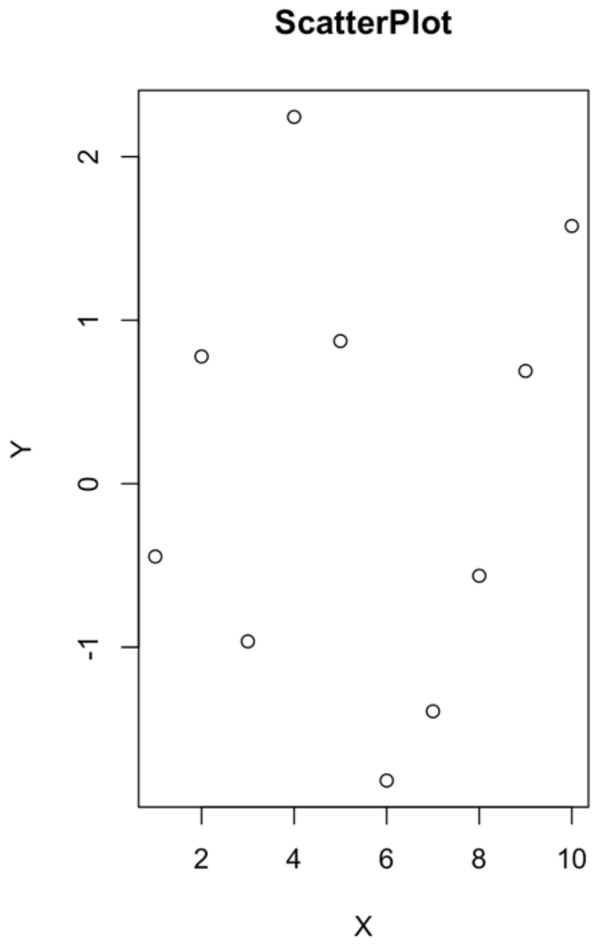
```
x <- 1:10
y <- rnorm(10)
par(mfrow=c(1,2))
```

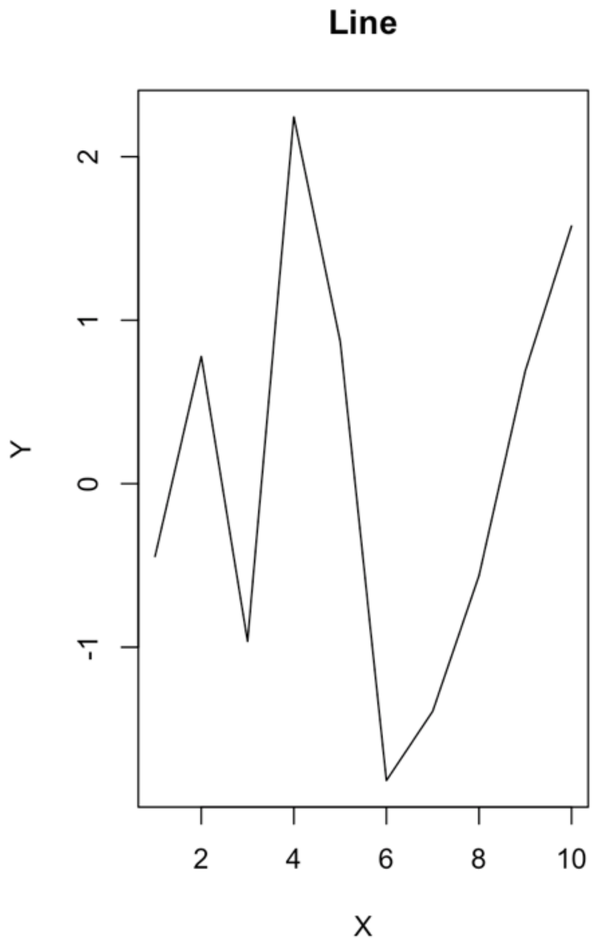
THIS SET'S UP A DISPLAY FOR MULTIPLE PLOTS

THE PLOTS WILL BE ARRANGED IN 1 ROW AND 2 COLUMNS

EXAMPLE 1: PLOT() FUNCTION

```
plot(x,y,type="p",main="ScatterPlot",xlab="X",ylab="Y")
plot(x,y,type="l",main="ScatterPlot",xlab="X",ylab="Y")
```



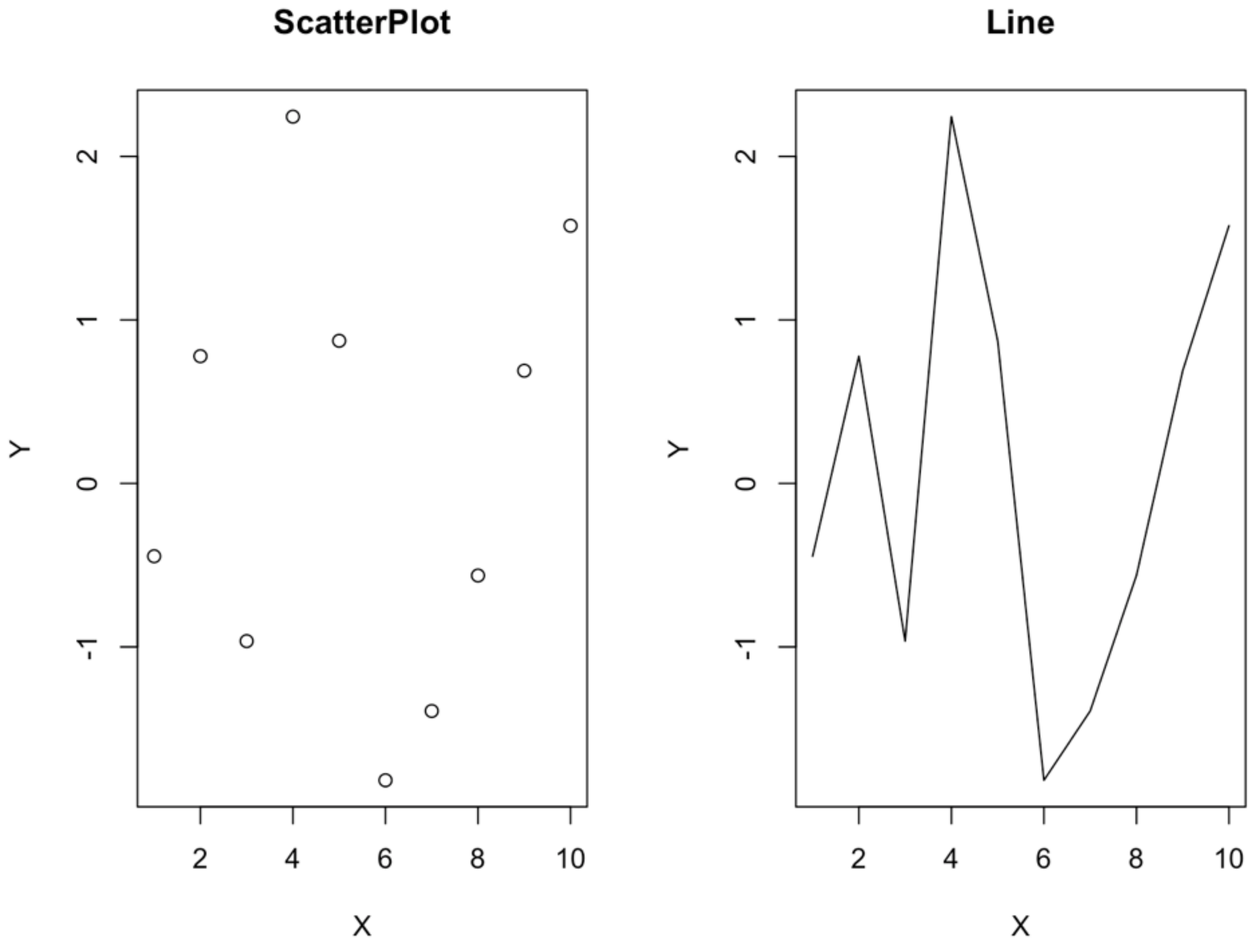


THE PLOT() FUNCTION IS THE MOST BASIC OF ALL VISUALIZATION FUNCTIONS

EXAMPLE 1: PLOT() FUNCTION

```
plot(x,y,type="p",main="ScatterPlot",xlab="X",ylab="Y")
plot(x,y,type="l",main="Line",xlab="X",ylab="Y")
```

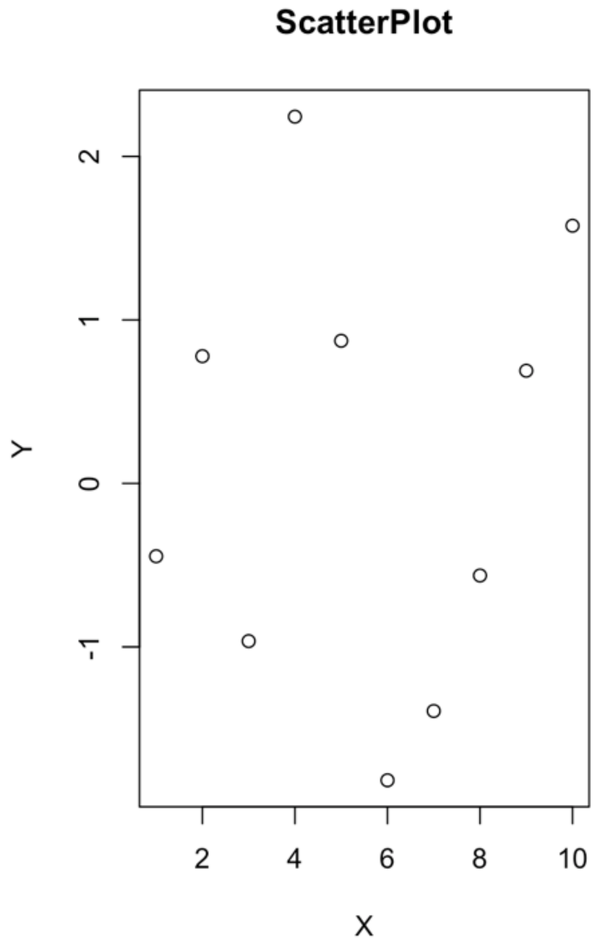
X AND Y VARIABLES

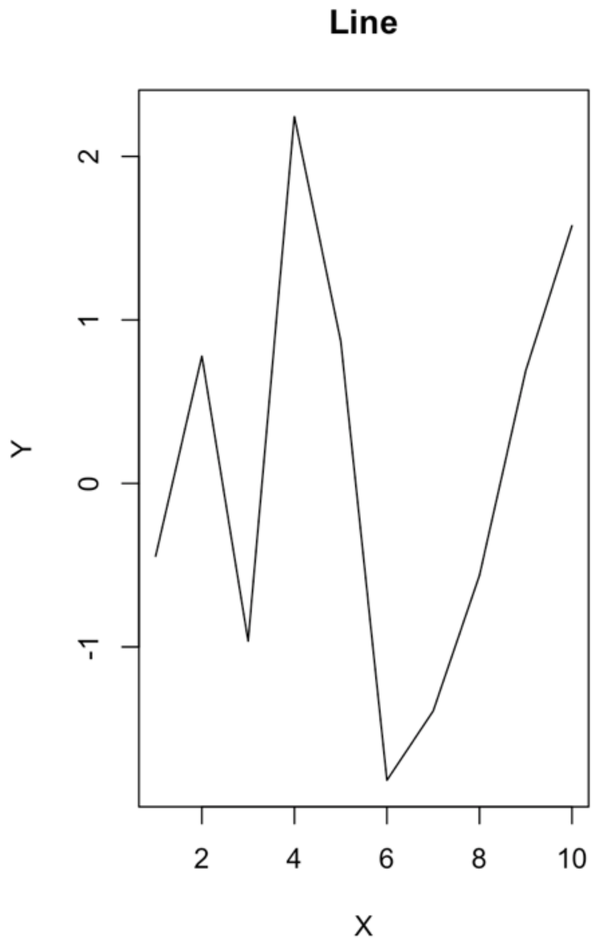


EXAMPLE 1: PLOT() FUNCTION

```
plot(x,y,type="p",main="ScatterPlot",xlab="X",ylab="Y")
plot(x,y,type="l",main="Line",xlab="X",ylab="Y")
```

THE TYPE OF PLOT,
P = POINT
L=LINE

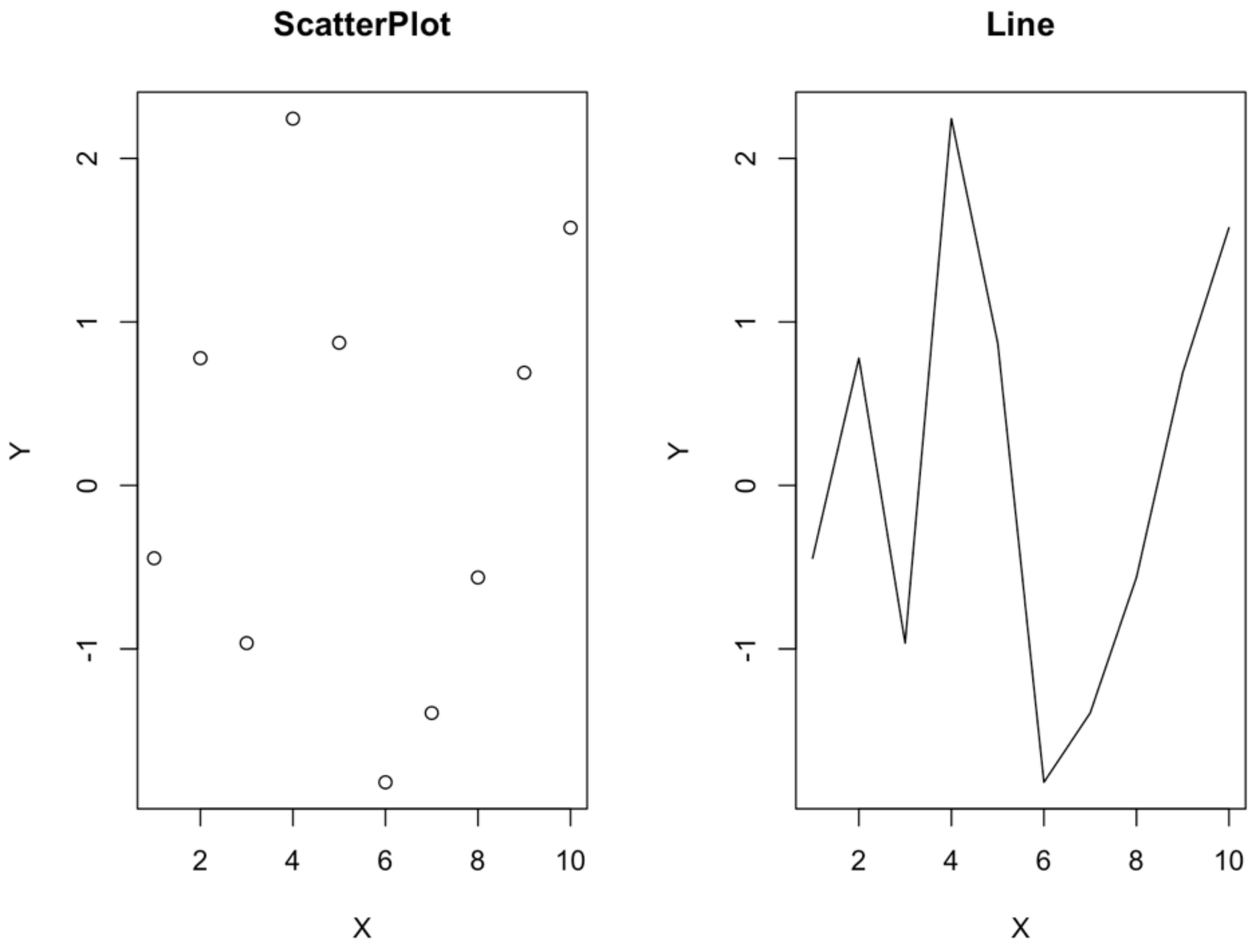




EXAMPLE 1: PLOT() FUNCTION

```
plot(x,y,type="p",main="ScatterPlot",xlab="X",ylab="Y")
plot(x,y,type="l",main="Line",xlab="X",ylab="Y")
```

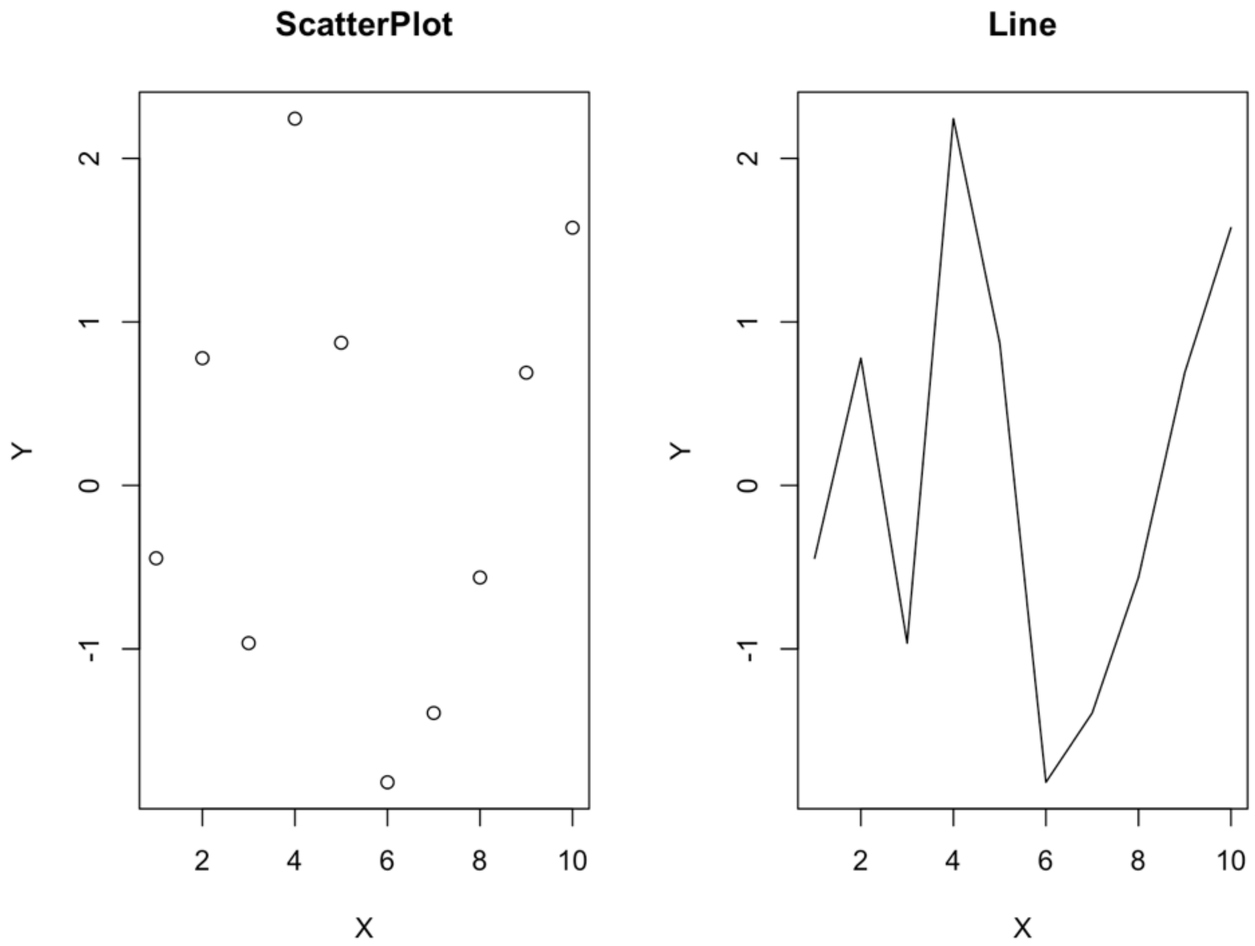
THE TITLE OF THE PLOT



EXAMPLE 1: PLOT() FUNCTION

```
plot(x,y,type="p",main="ScatterPlot",xlab="X",ylab="Y")
plot(x,y,type="l",main="Line",xlab="X",ylab="Y")
```

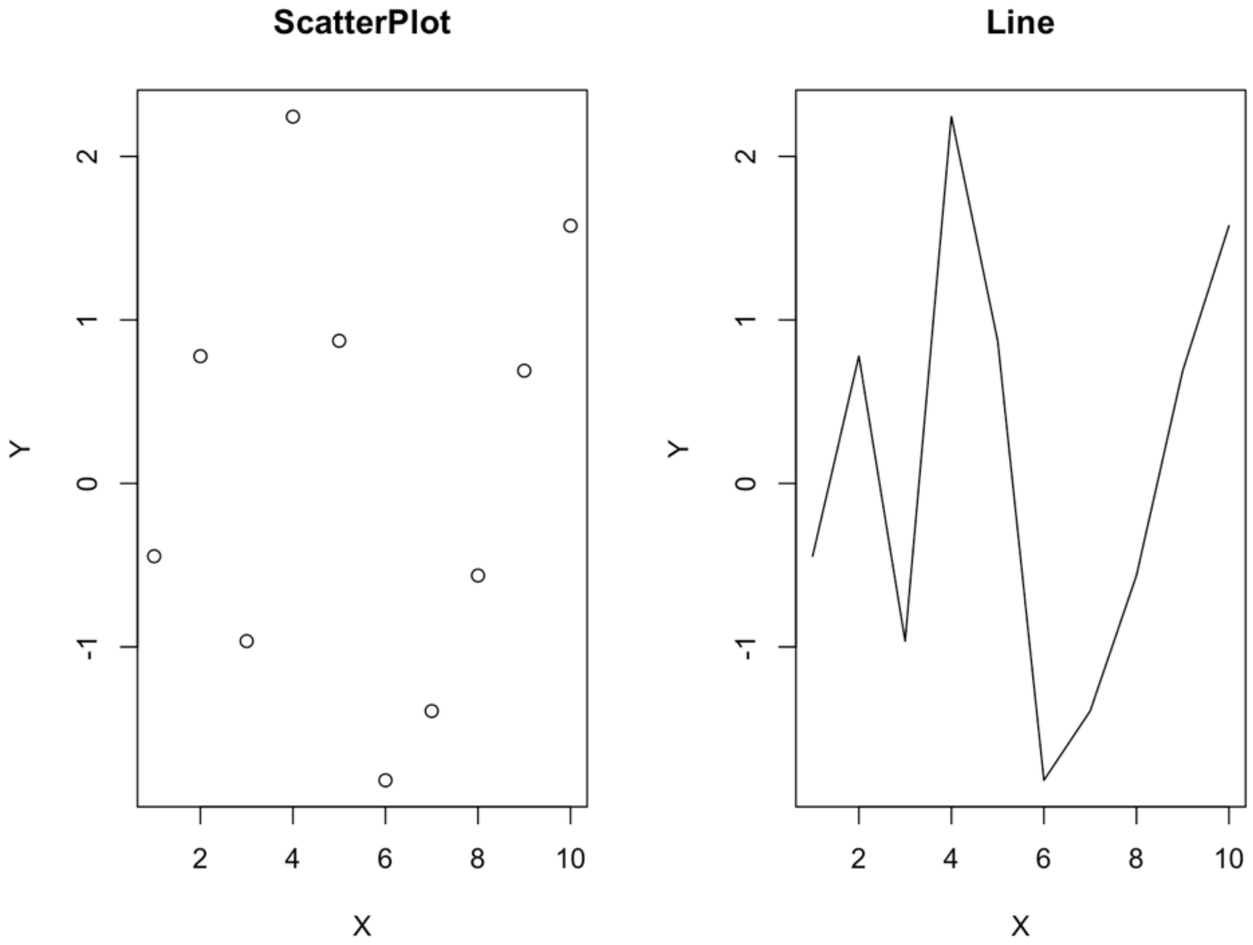
THE X AXIS LABEL OF THE PLOT



EXAMPLE 1: PLOT() FUNCTION

```
plot(x,y,type="p",main="ScatterPlot",xlab="X",ylab="Y")
plot(x,y,type="l",main="Line",xlab="X",ylab="Y")
```

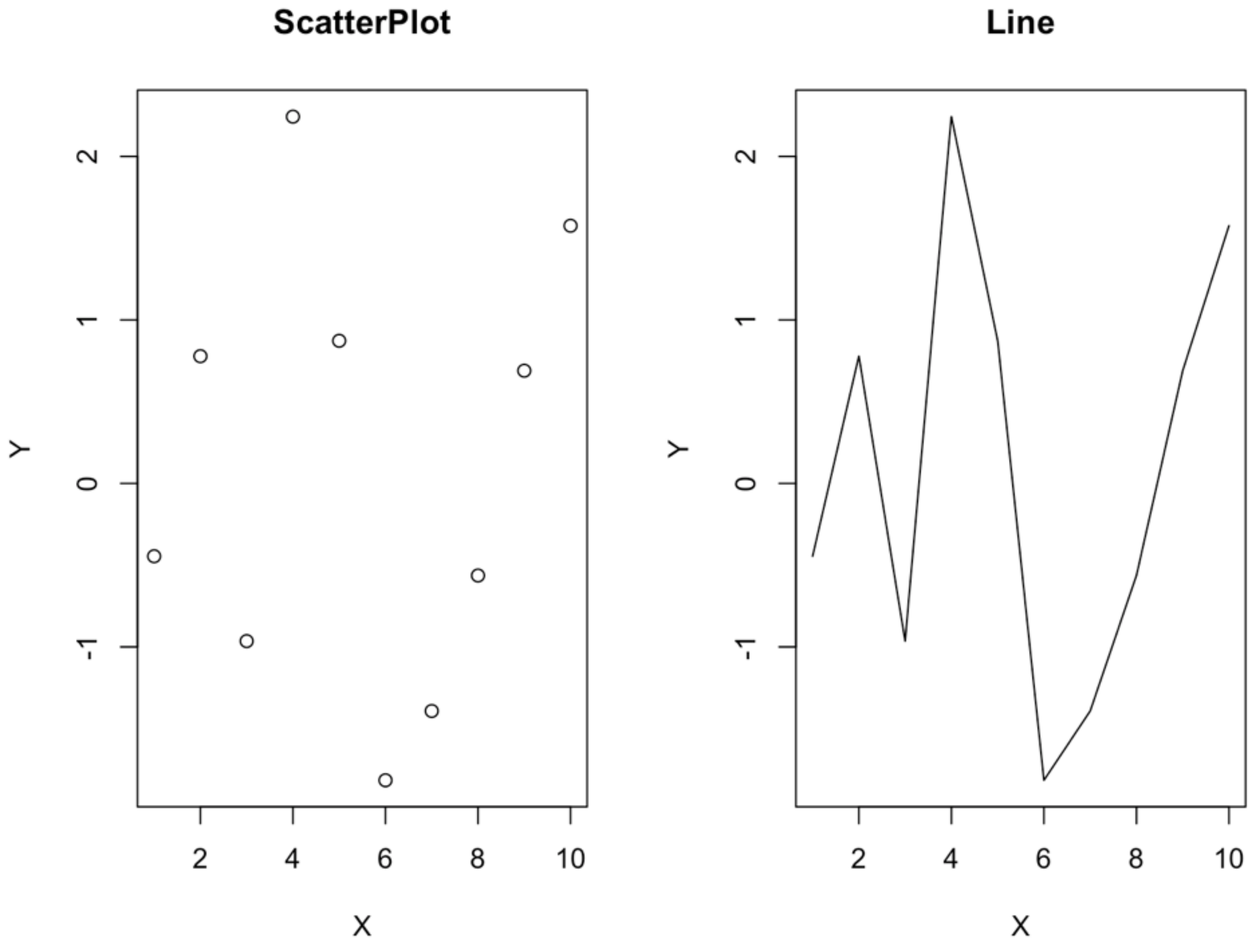
THE Y AXIS LABEL OF THE PLOT



EXAMPLE 1: PLOT() FUNCTION

```
plot(x,y,type="p",main="ScatterPlot",xlab="X",ylab="Y")
plot(x,y,type="l",main="Line",xlab="X",ylab="Y")
```

THESE OPTIONS ARE THE SAME FOR OTHER FUNCTIONS LIKE HIST() ETC



EXAMPLE 2: CONTROLLING COLOR PALETTES

EXAMPLE 2: CONTROLLING COLOR PALETTES

WE'VE SEEN HOW TO DRAW A HISTOGRAM BEFORE

HERE IS SOME DATA

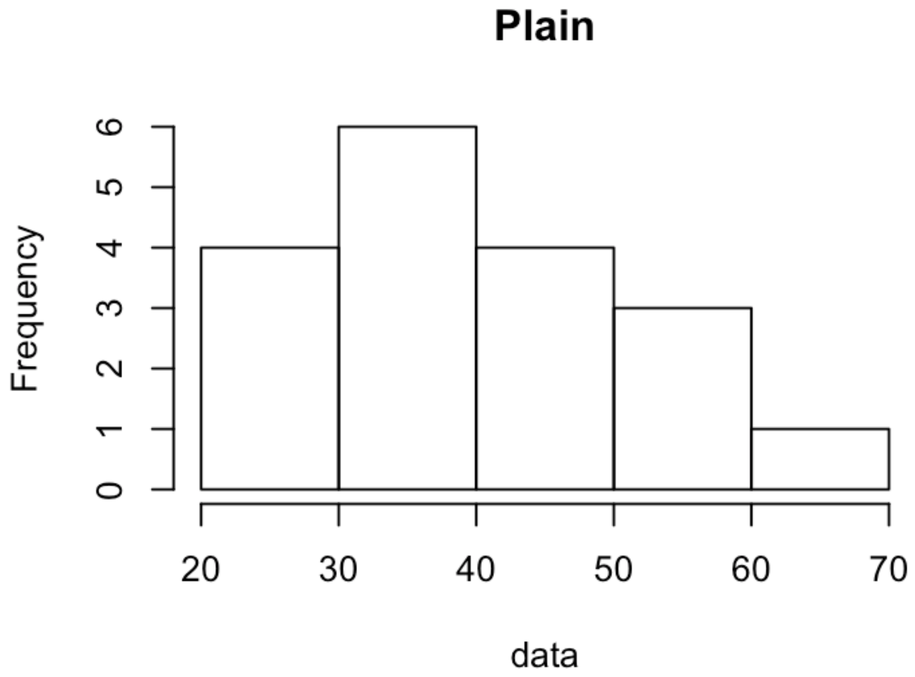
```
data <- c(40, 30, 20, 45, 60, 35, 40, 50, 55, 53, 22, 27, 48, 62, 33, 35, 40 ,4
```

```
bins <- seq(20,70,by=10)
```

THESE ARE THE INTERVALS FOR THE HISTOGRAM

EXAMPLE 2: CONTROLLING COLOR PALETTES

```
par(mfrow=c(2,2))
hist(data,breaks = bins,main="Plain")
```



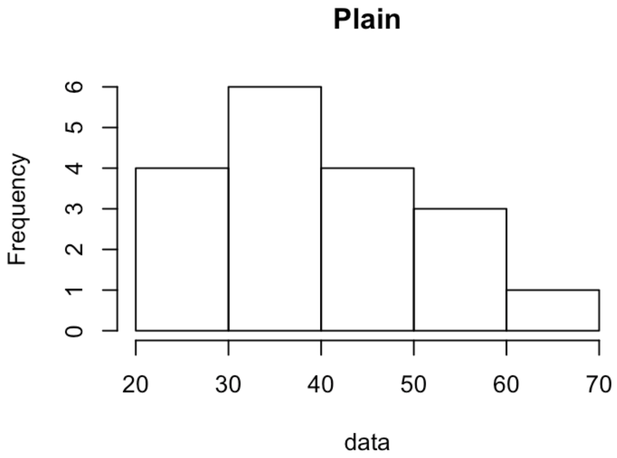
HIST() FUNCTION WILL DRAW A HISTOGRAM FOR THIS DATA USING THE SPECIFIED INTERVALS

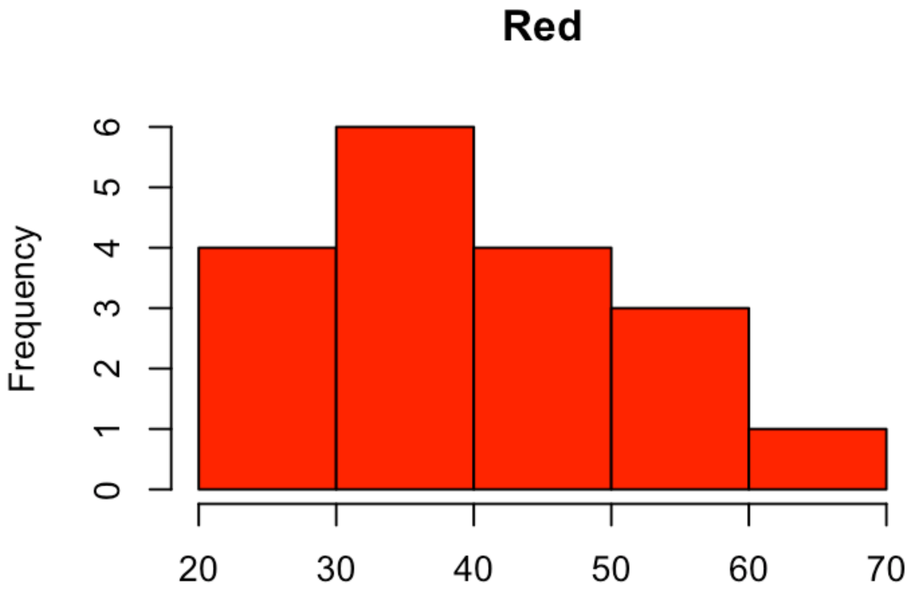
WE CAN ADD COLORS TO THIS HISTOGRAM USING COL OPTION

EXAMPLE 2: CONTROLLING COLOR PALETTES

```
par(mfrow=c(2,2))
hist(data,breaks = bins,main="Plain")
```

```
hist(data,breaks = bins,col=I("Red"),main="Red")
```





EXAMPLE 2: CONTROLLING COLOR PALETTES

```
par(mfrow=c(2,2))
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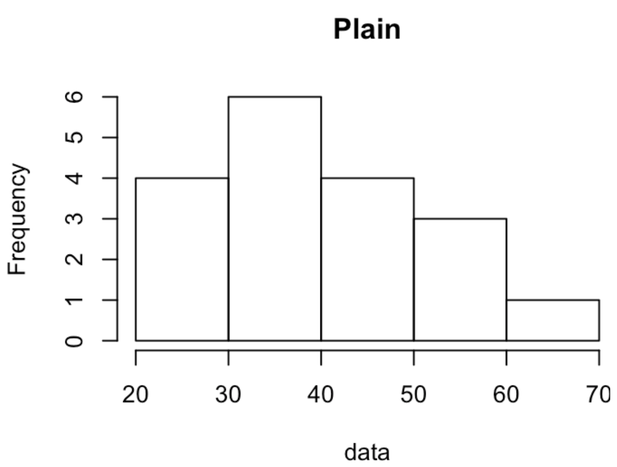
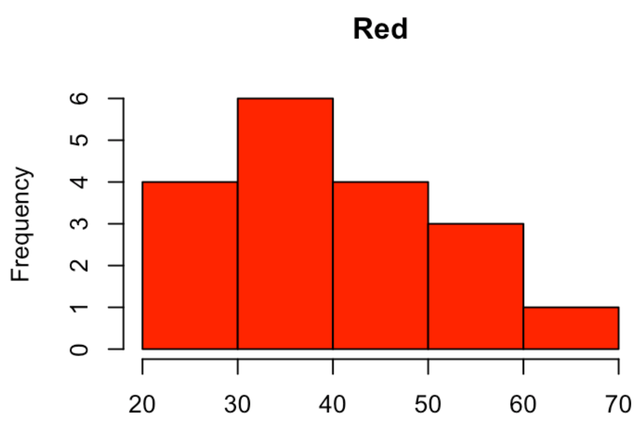
```

```
hist(data,breaks = bins,col=I("Red"),main="Red")
```

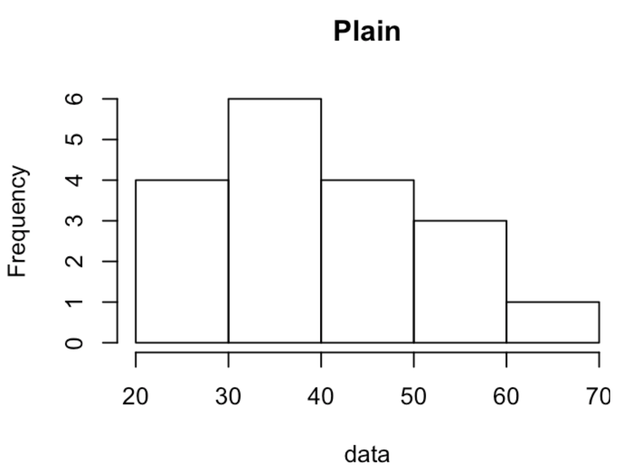


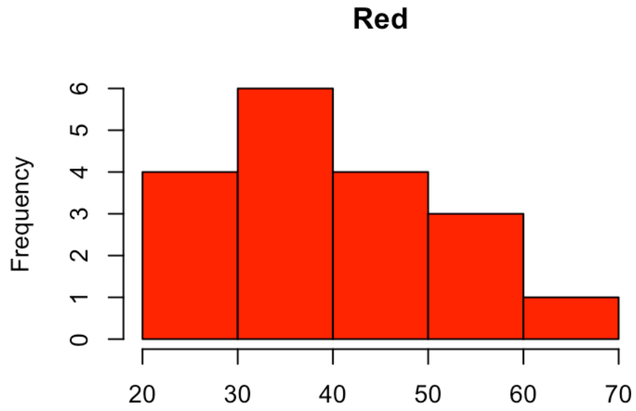


I() CAN BE USED TO ACCESS BUILT-IN COLORS

EXAMPLE 2: CONTROLLING COLOR PALETTES

```
par(mfrow=c(2,2))
hist(data,breaks = bins,main="Plain")
hist(data,breaks = bins,col=I("Red"),main="Red")
```

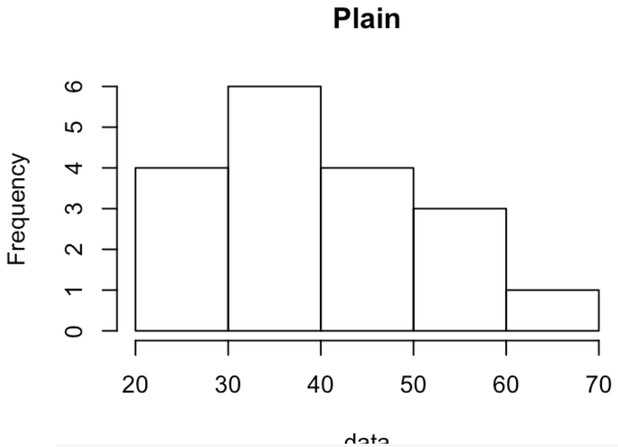


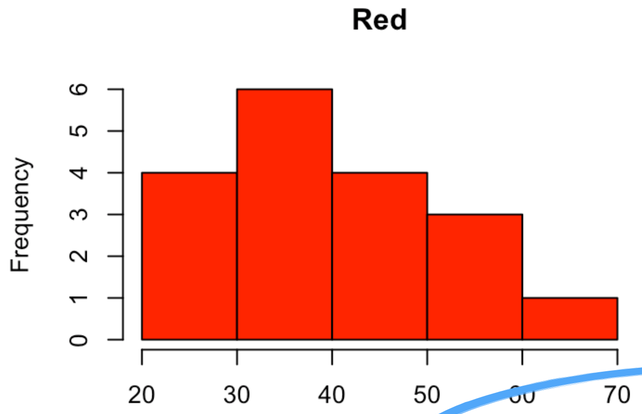



```
library(RColorBrewer)
```

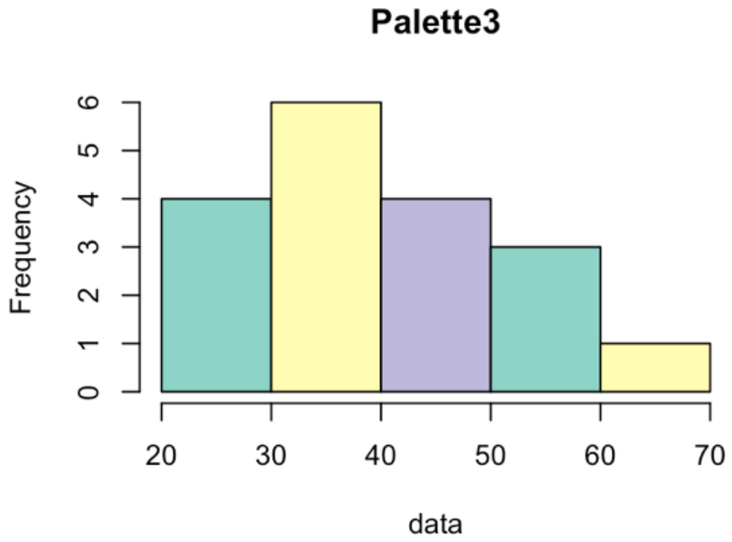
USE RCOLORBREWER PACKAGE TO ASSIGN A MULTICOLOR PALETTE, EACH BAR WILL HAVE A DIFFERENT COLOR

EXAMPLE 2: CONTROLLING COLOR PALETTES



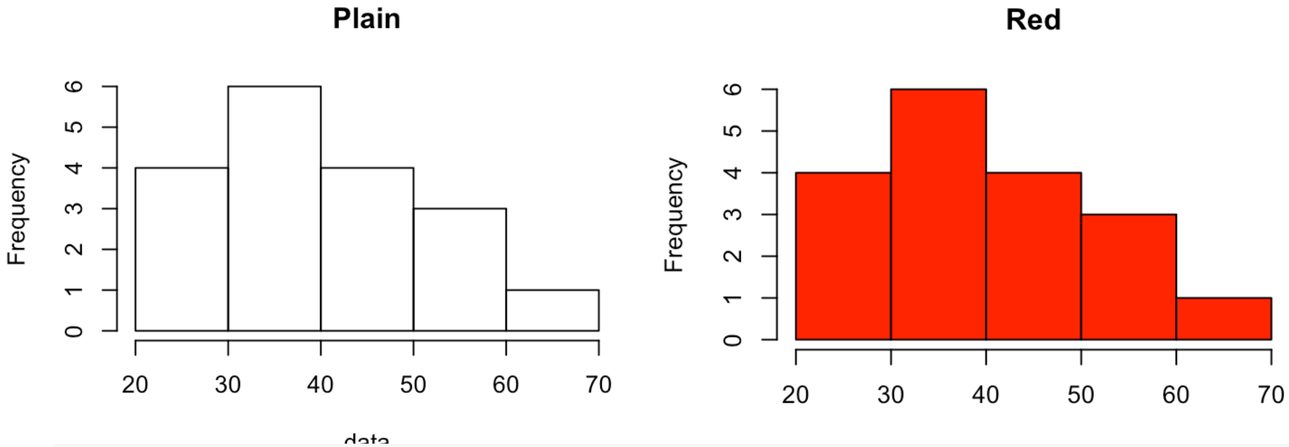



```
hist(data,breaks = bins,col=brewer.pal(3,"Set3"),main ="Palette3")
```

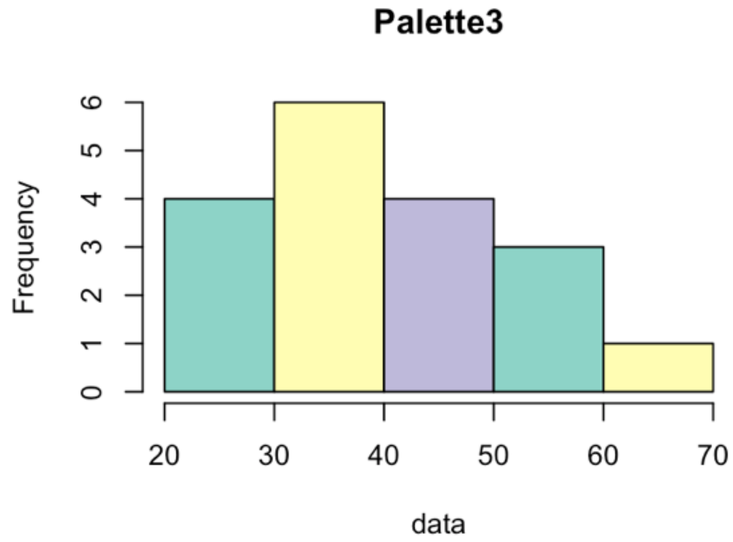


WE CAN SPECIFY THE PALETTE AND THE NUMBER OF COLORS TO PICK FROM THAT PALETTE

EXAMPLE 2: CONTROLLING COLOR PALETTES

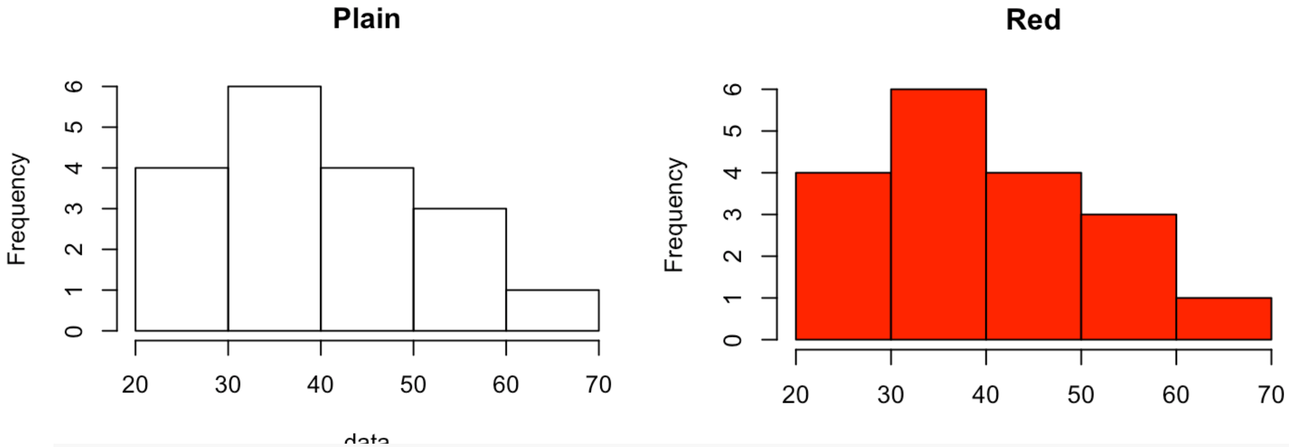



```
hist(data,breaks = bins,col=brewer.pal(3,"Set3"),main ="Palette3")
```

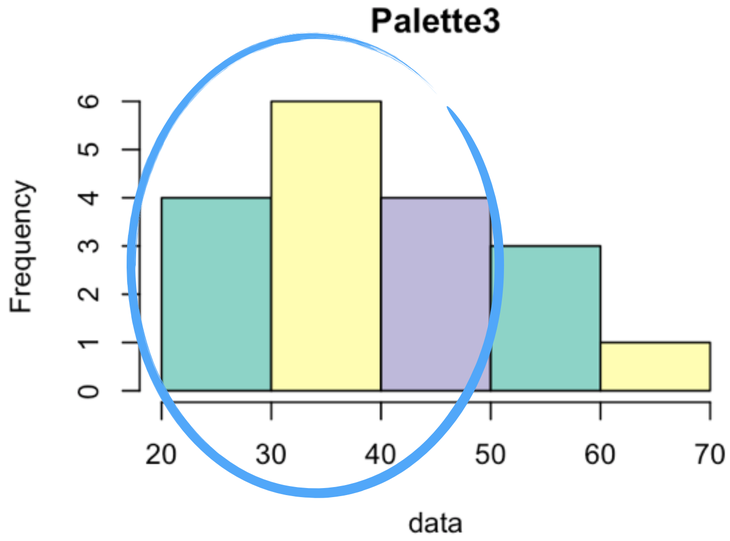


THIS IS ONE OF THE PALETTES

EXAMPLE 2: CONTROLLING COLOR PALETTES

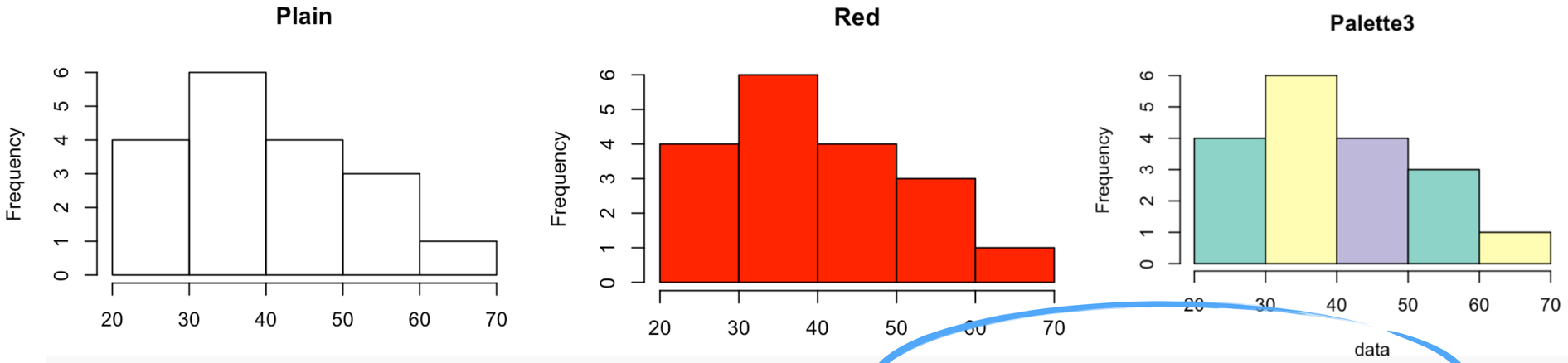



```
hist(data,breaks = bins,col=brewer.pal(3,"Set3"),main ="Palette3")
```

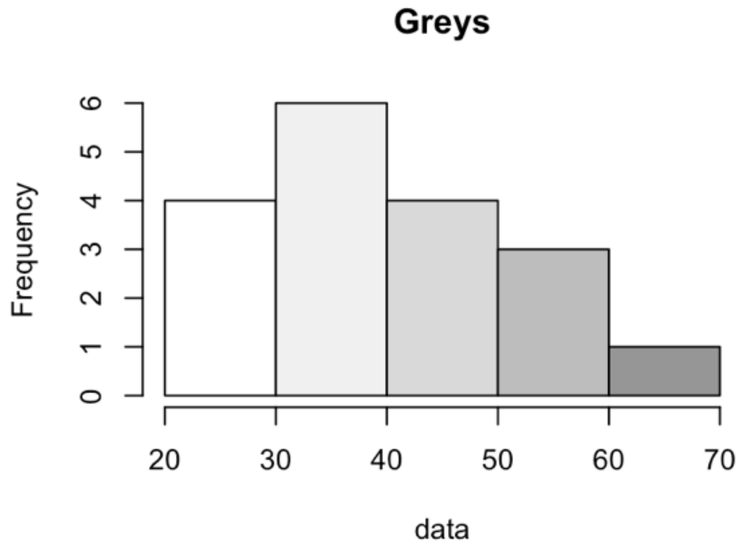


WE ARE USING 3 COLORS FROM THE PALETTE

EXAMPLE 2: CONTROLLING COLOR PALETTES

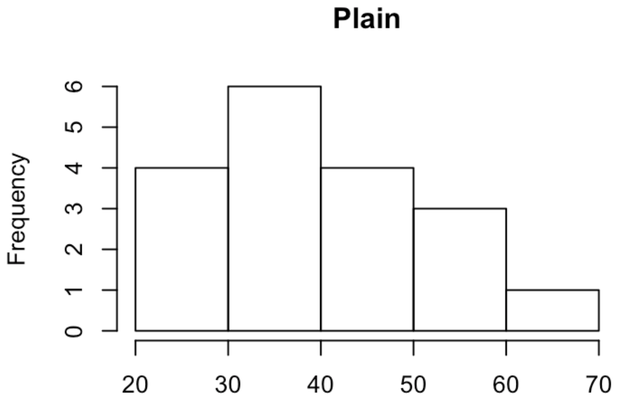


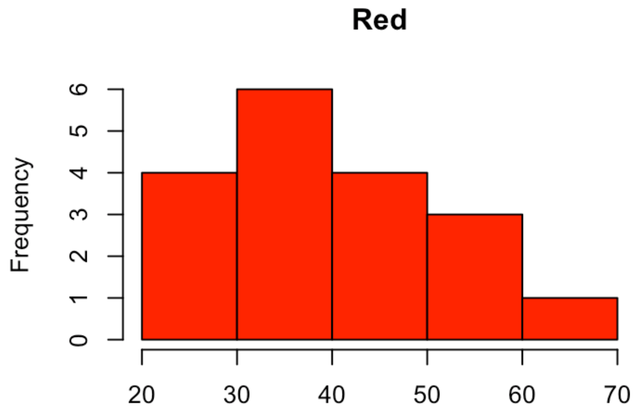

```
hist(data,breaks = bins,col=brewer.pal(8,"Greys"),main = "Greys")
```

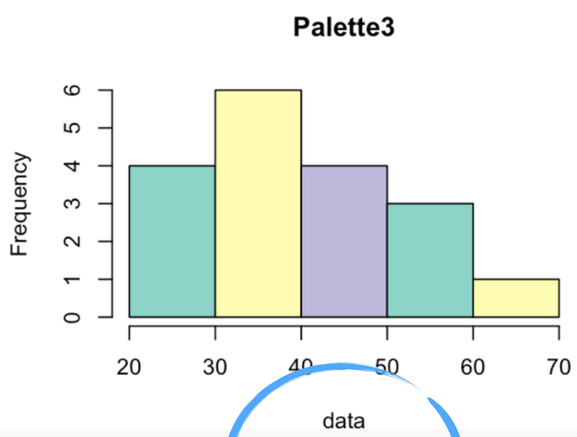


WE CAN SPECIFY THE PALETTE TO BE SHADES OF A SINGLE COLOR

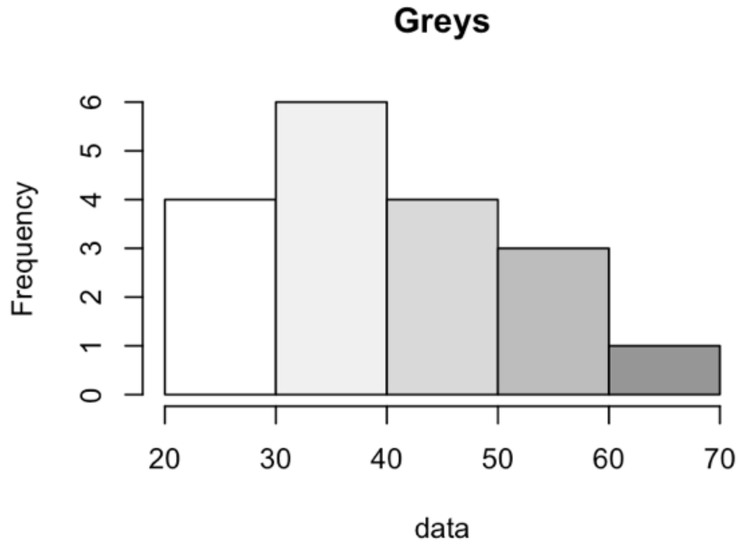
EXAMPLE 2: CONTROLLING COLOR PALETTES





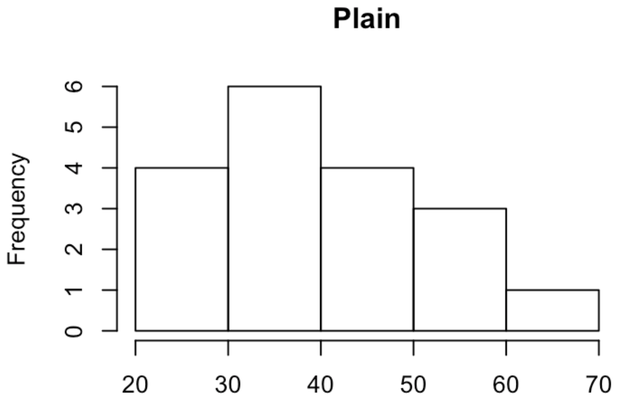


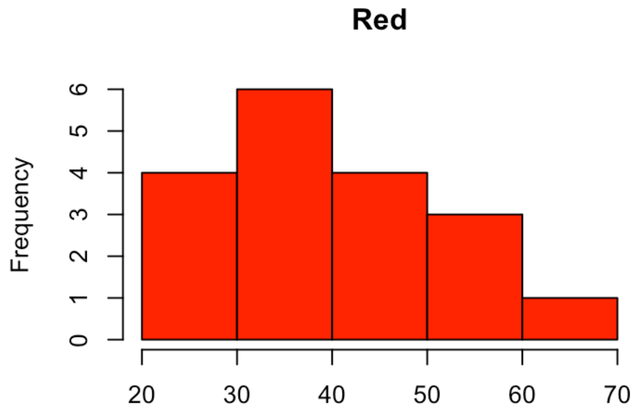

```
hist(data,breaks = bins,col=brewer.pal(8,"Greys"),main = "Greys")
```

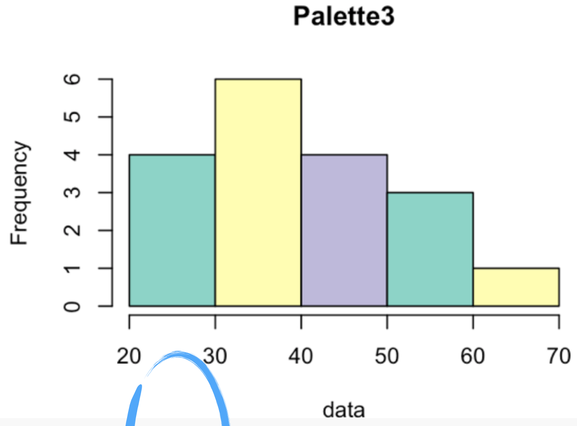


THE COLOR WHOSE SHADES ARE CHOSEN

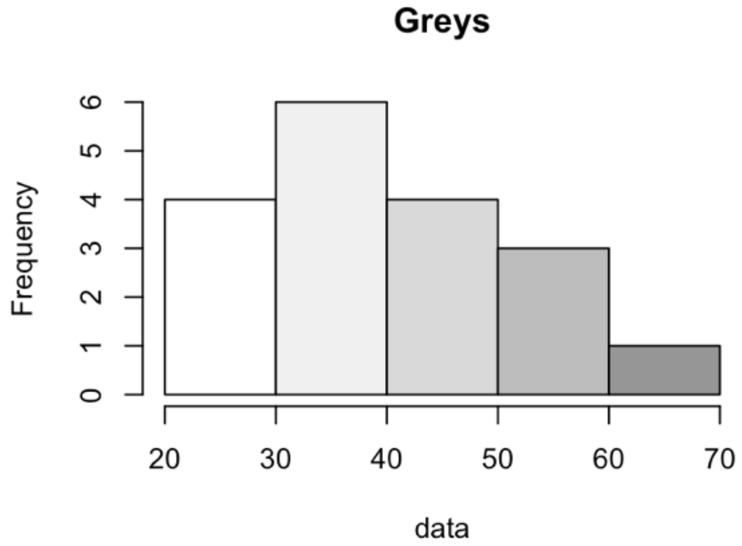
EXAMPLE 2: CONTROLLING COLOR PALETTES








```
hist(data,breaks = bins,col=brewer.pal(8,"Greys"),main = "Greys")
```



THE NUMBER OF DISTINCT SHADES

EXAMPLE 3: DRAWING A BARPLOT

EXAMPLE 3: DRAWING A BARPLOT

BARPLOTS ARE PRETTY SIMPLE :)

LET'S DRAW A BARPLOT TO REPRESENT SALES DATA

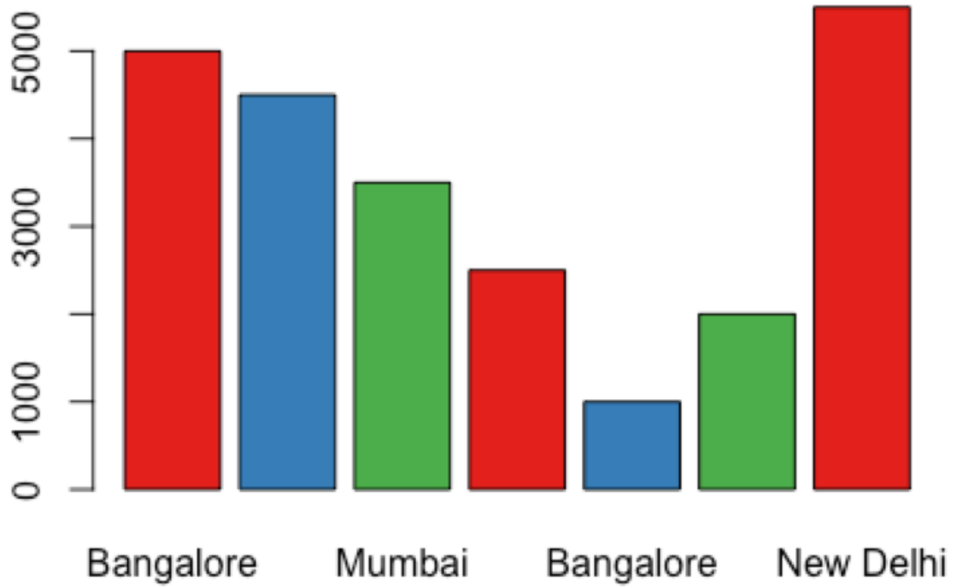
Bangalore	Clothing	INR 5000
New Delhi	Footwear	INR 4500
Mumbai	Cosmetics	INR 3500
Bangalore	Cosmetics	INR 2500
Bangalore	Footwear	INR 1000
Mumbai	Clothing	INR 2000
New Delhi	Clothing	INR 5500

EXAMPLE 3: DRAWING A BARPLOT

WE'VE PUT THIS DATA IN A DATA FRAME

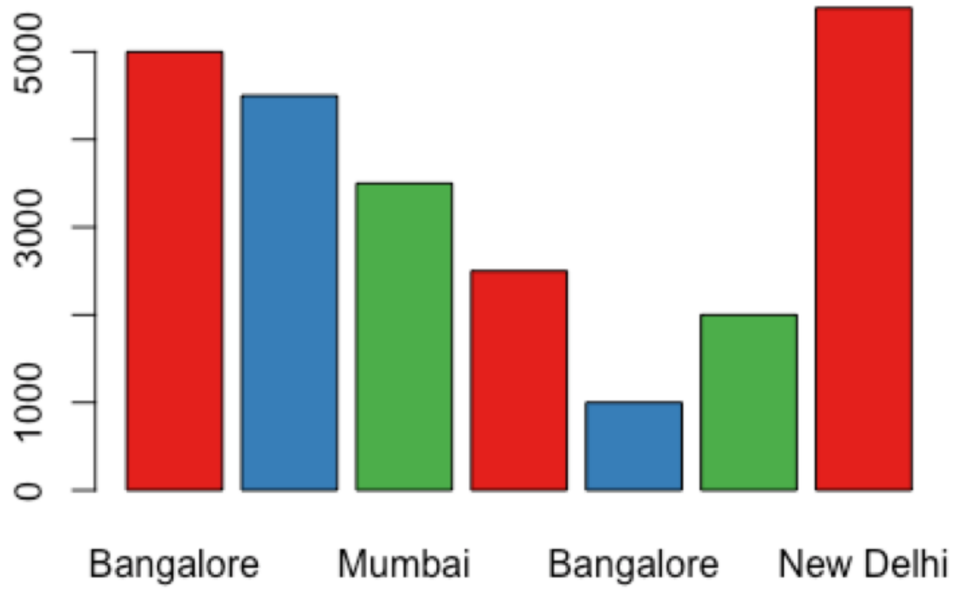
```
sales <-data.frame(city,category,saleAmount)
```

```
barplot(sales$saleAmount,names.arg = sales$city,col=brewer.pal(3,"Set1"))
```



EXAMPLE 3: DRAWING A BARPLOT

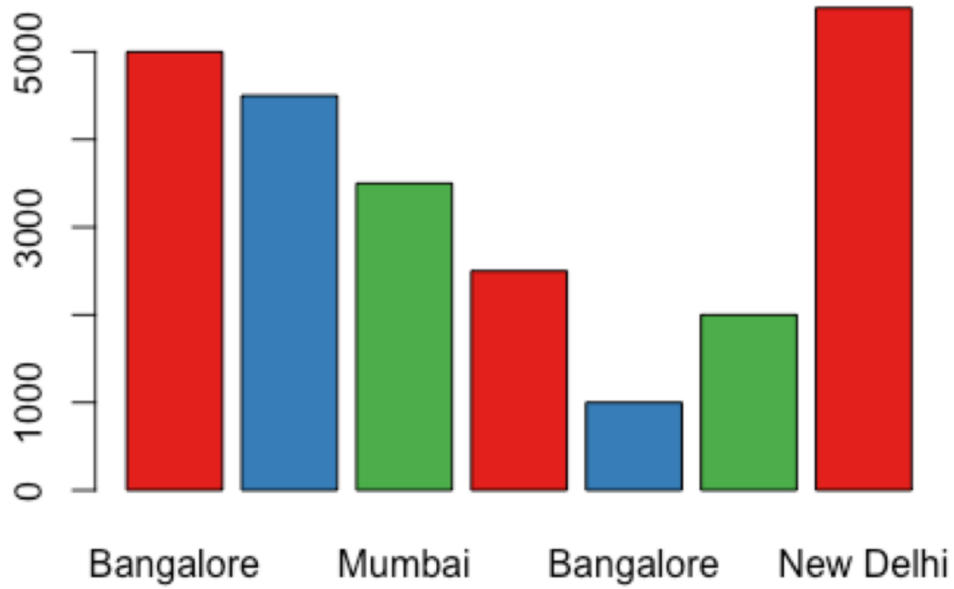
```
barplot(sales$saleAmount,names.arg = sales$city,col=brewer.pal(3,"Set1"))
```



THE HEIGHTS OF THE BARS

EXAMPLE 3: DRAWING A BARPLOT

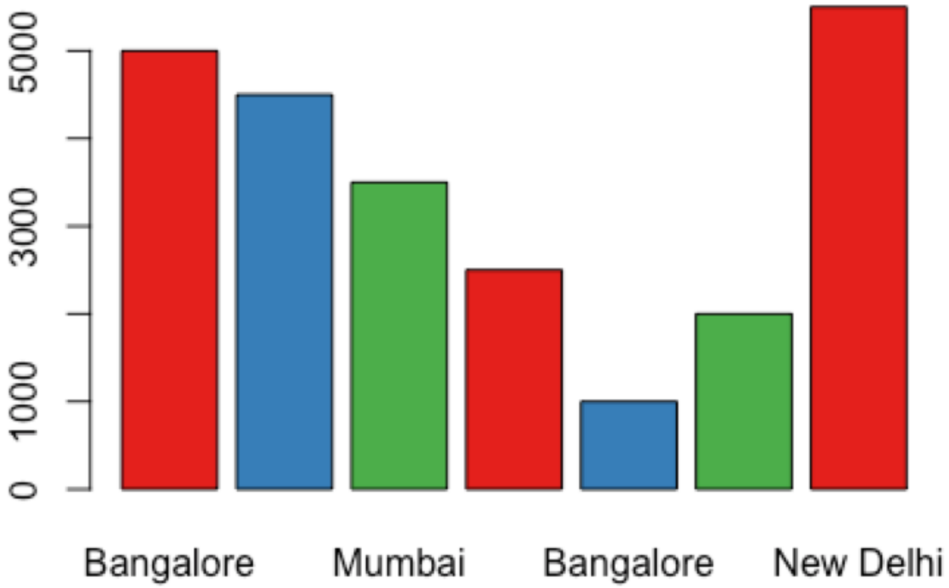
```
barplot(sales$saleAmount,names.arg = sales$city,col=brewer.pal(3,"Set1"))
```



THE NAMES OF THE BARS

EXAMPLE 3: DRAWING A BARPLOT

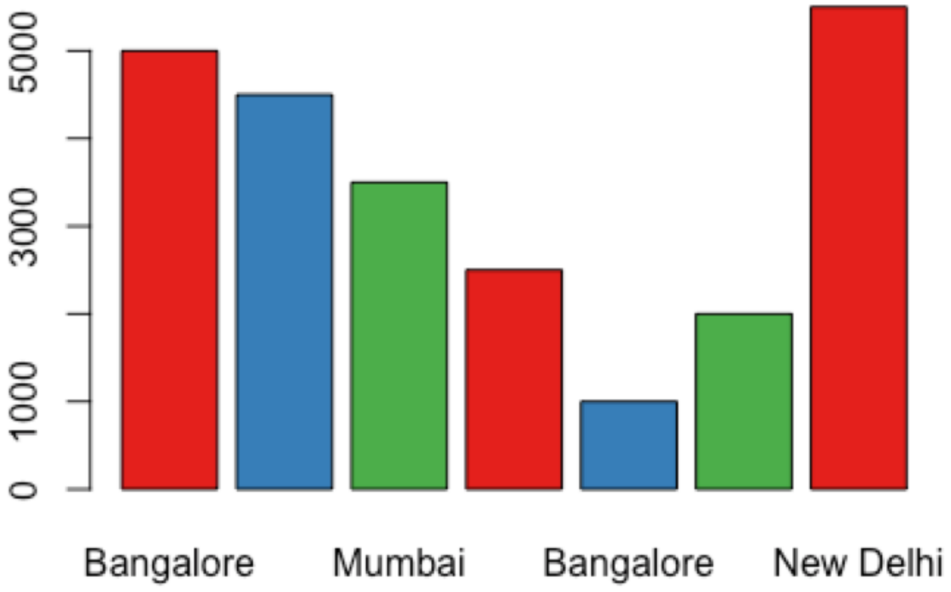
```
barplot(sales$saleAmount,names.arg = sales$city,col=brewer.pal(3,"Set1"))
```



THE COLOR PALETTE TO USE

EXAMPLE 3: DRAWING A BARPLOT

```
barplot(sales$saleAmount,names.arg = sales$city,col=brewer.pal(3,"Set1"))
```



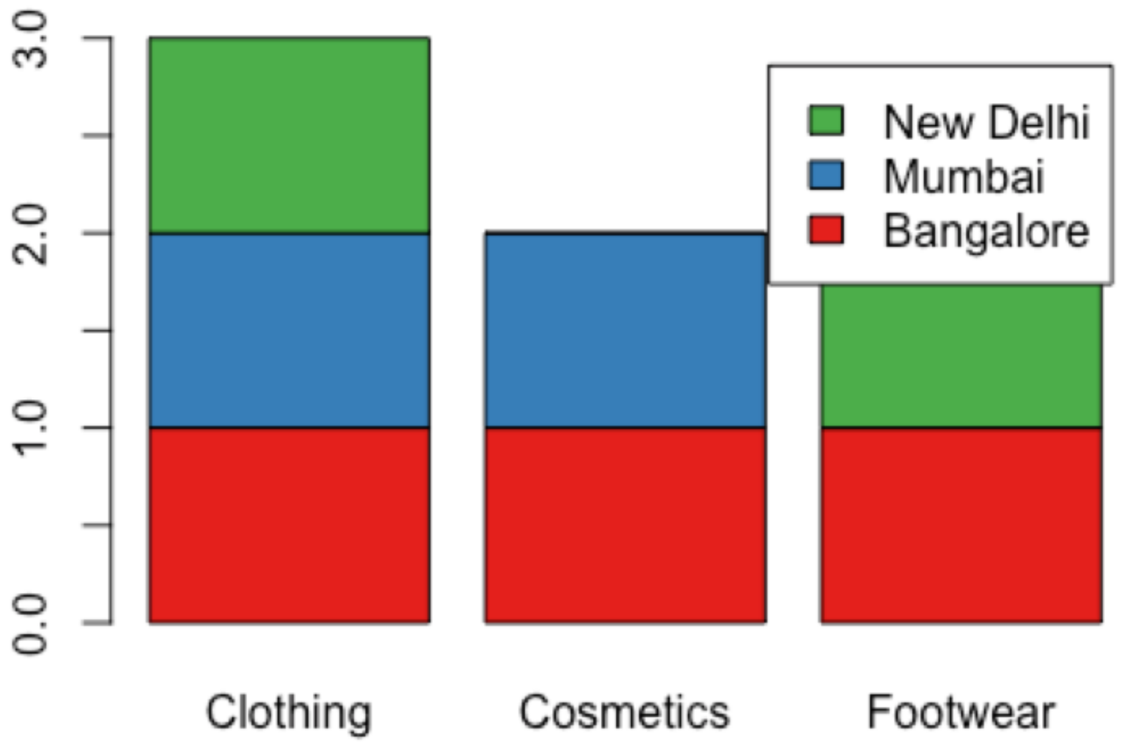
ONE COOL THING YOU CAN DO WITH BARPLOTS, IS PLOT STACKED BARS

THESE ARE USEFUL TO VISUALIZE 2-DIMENSIONAL DATA

EXAMPLE 3: DRAWING A BARPLOT

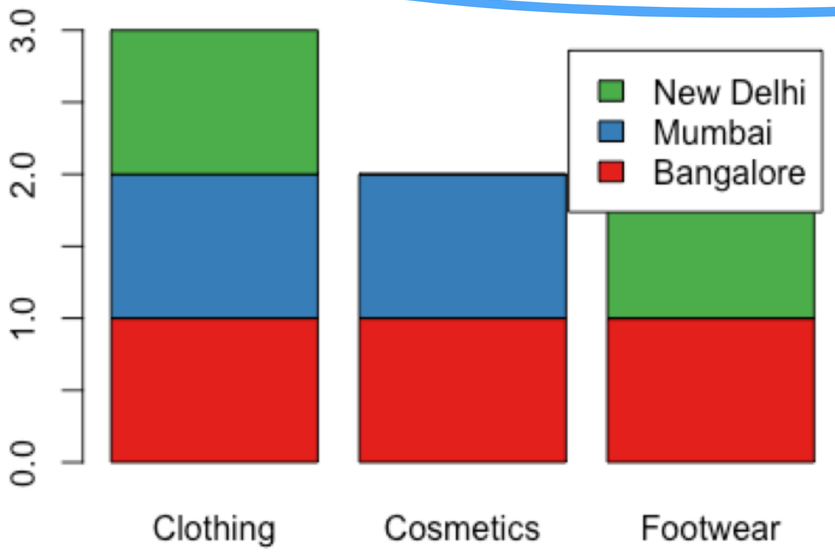
LET'S STACK THE SALES PER CITY BY CATEGORY

```
barplot(table(sales$city,sales$category),col=brewer.pal(3,"Set1"),legend.text=TRUE)
```



EXAMPLE 3: DRAWING A BARPLOT

```
barplot(table(sales$city,sales$category),col=brewer.pal(3,"Set1"),legend.text=TRUE)
```



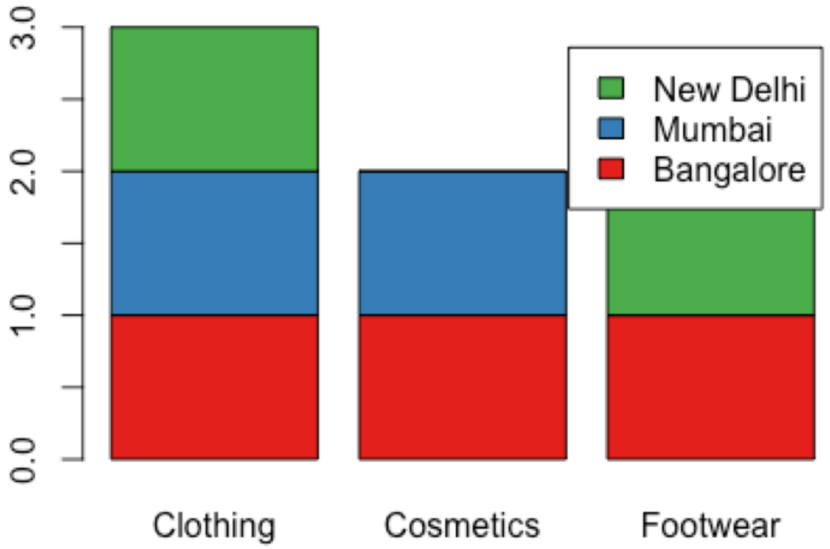
THE HEIGHTS OF THE BARS AS A MATRIX

ROWS ARE CITIES
COLUMNS ARE CATEGORIES

VALUES ARE COUNTS

EXAMPLE 3: DRAWING A BARPLOT

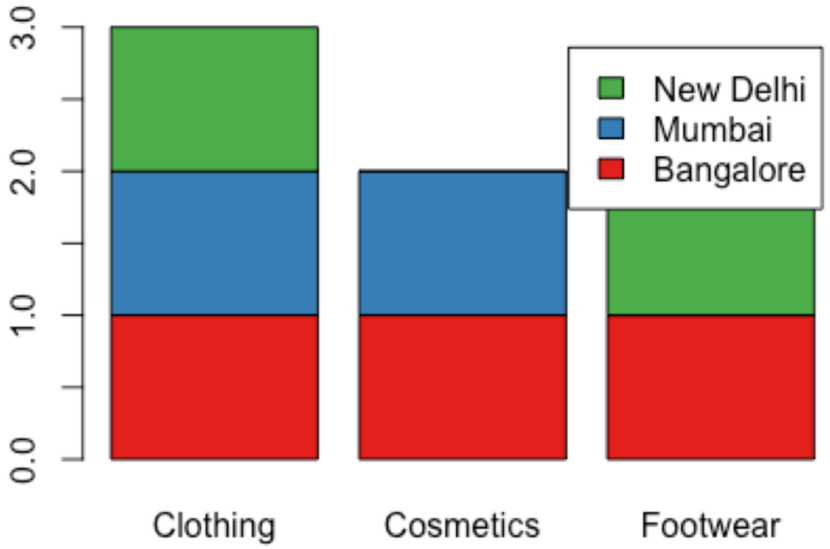
```
barplot(table(sales$city,sales$category),col=brewer.pal(3,"Set1"),legend.text=TRUE)
```



THE COLOR PALETTE TO BE USED

EXAMPLE 3: DRAWING A BARPLOT

```
barplot(table(sales$city,sales$category),col=brewer.pal(3,"Set1"),legend.text=TRUE)
```



WE NEED A LEGEND TO DISTINGUISH THE CITIES

EXAMPLE 4: DRAWING A HEATMAP

EXAMPLE 4: DRAWING A HEATMAP

HEAT MAPS ARE PRETTY USEFUL TO VISUALIZE 2 DIMENSIONAL DATA

LET'S SAY WE HAVE 2 VARIABLES - HAIR COLOR AND EYE COLOR

EXAMPLE 4: DRAWING A HEATMAP

HAIR COLOR AND EYE COLOR

WHAT COMBINATIONS OF HAIR COLOR AND EYE COLOR ARE VERY COMMON AND WHICH ARE UNCOMMON?

EXAMPLE 4: DRAWING A HEATMAP

TO DRAW A HEAT MAP IN R, YOU NEED TO PUT YOUR DATA IN A MATRIX

THE VARIABLES ARE REPRESENTED BY THE ROW NAMES AND COLUMN NAMES

THE VALUES IN THE MATRIX REPRESENT THE INTENSITY OF COLOR

EXAMPLE 4: DRAWING A HEATMAP

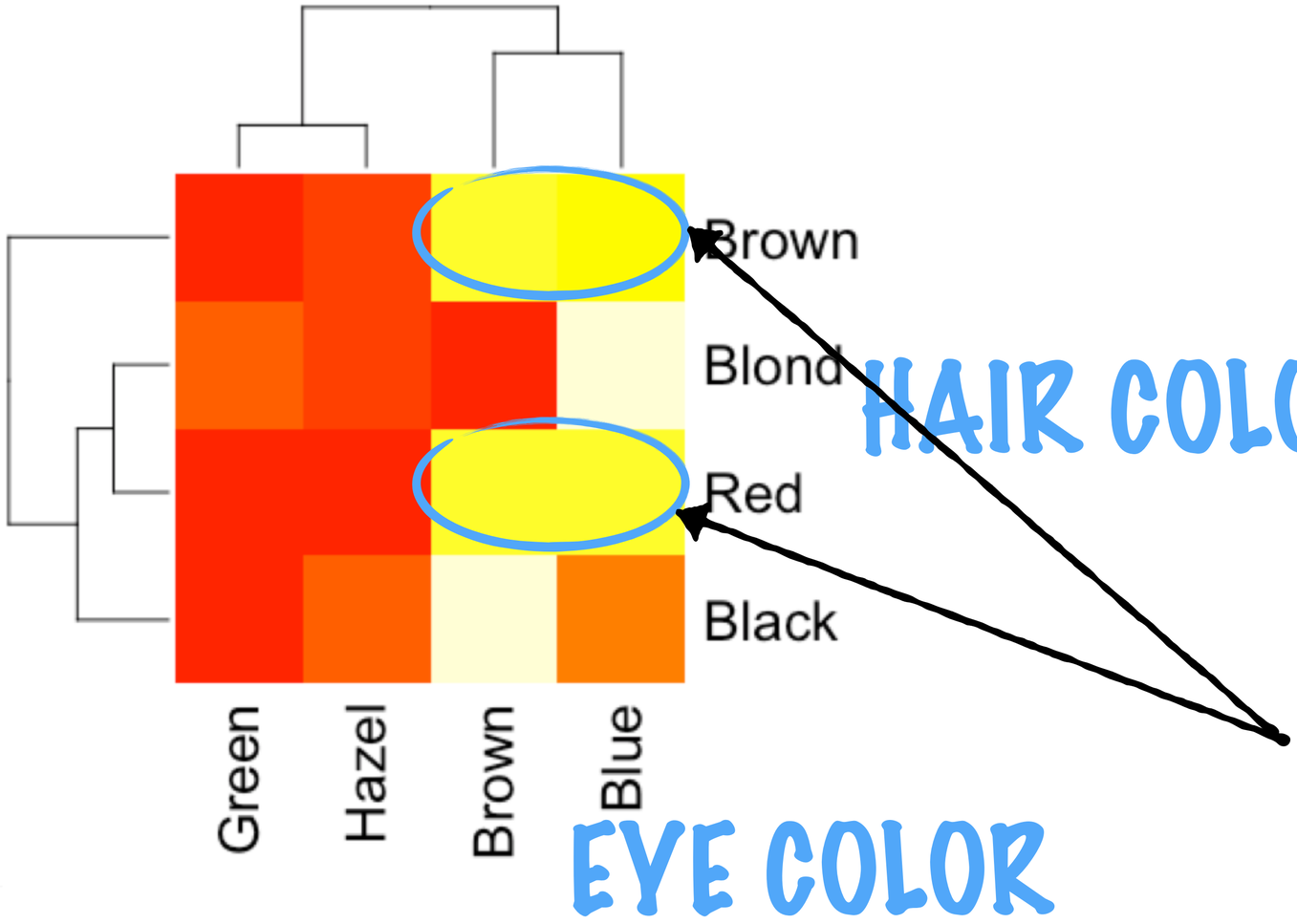
```
data(HairEyeColor)
```

INVOKE A BUILT-IN DATASET IN R WITH HAIR AND EYE COLOR OF SOME STUDENTS

THIS IS ANARRAY WITH 3 DIMENSIONS (HAIR COLOR, EYE COLOR AND GENDER)

EXAMPLE 4: DRAWING A HEATMAP

```
heatmap(HairEyeColor[,,1])
```



LET'S LOOK AT A HEAT MAP FOR HAIR VS EYE COLOR FOR MALES

HAIR COLOR

MAX INTENSITY

EYE COLOR

EXAMPLE 5: A SCATTERPLOT MATRIX

EXAMPLE 5: A SCATTERPLOT MATRIX

SCATTERPLOTS ARE VERY USEFUL TO UNDERSTAND RELATIONSHIPS BETWEEN VARIABLES

EXAMPLE 5: A SCATTERPLOT MATRIX

WHEN YOU HAVE LOTS OF VARIABLES, YOU CAN USE A SCATTERPLOT MATRIX TO VISUALLY EXPLORE THEIR RELATIONSHIPS

EXAMPLE 5: A SCATTERPLOT MATRIX

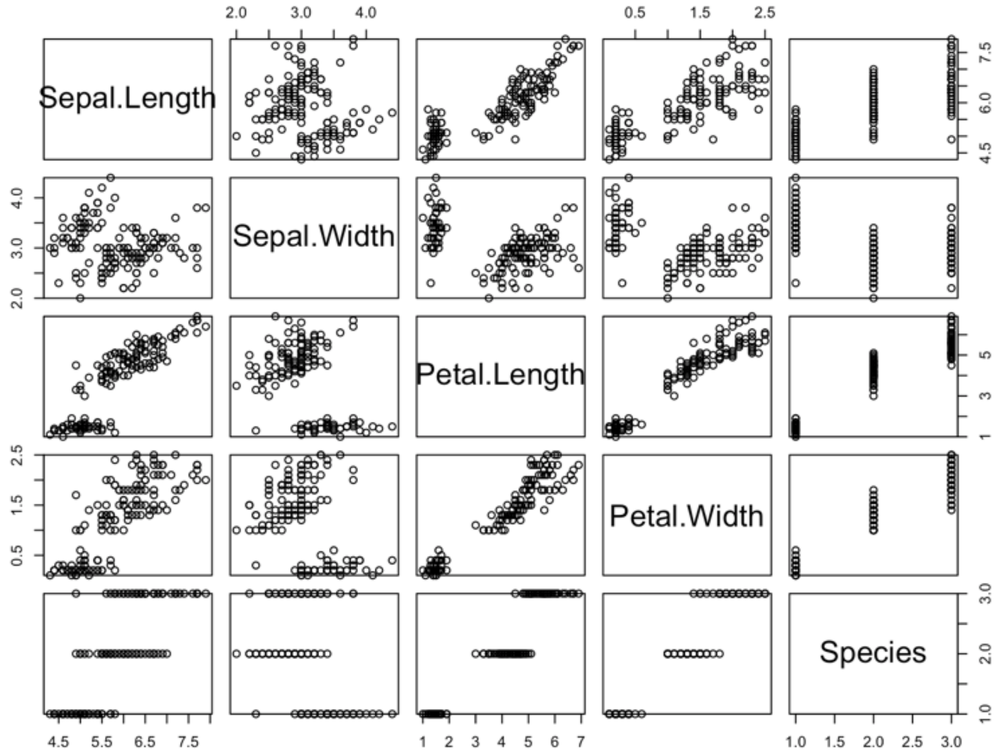
WHEN YOU USE PLOT() FUNCTION ON A DATA FRAME, IT WILL TREAT EACH COLUMN AS A VARIABLE AND PLOT A SCATTERPLOT MATRIX

EXAMPLE 5: A SCATTERPLOT MATRIX

IRIS IS A VERY FAMOUS DATASET WITH SOME MEASUREMENTS FROM DIFFERENT SPECIES OF IRIS FLOWERS

EXAMPLE 5: A SCATTERPLOT MATRIX

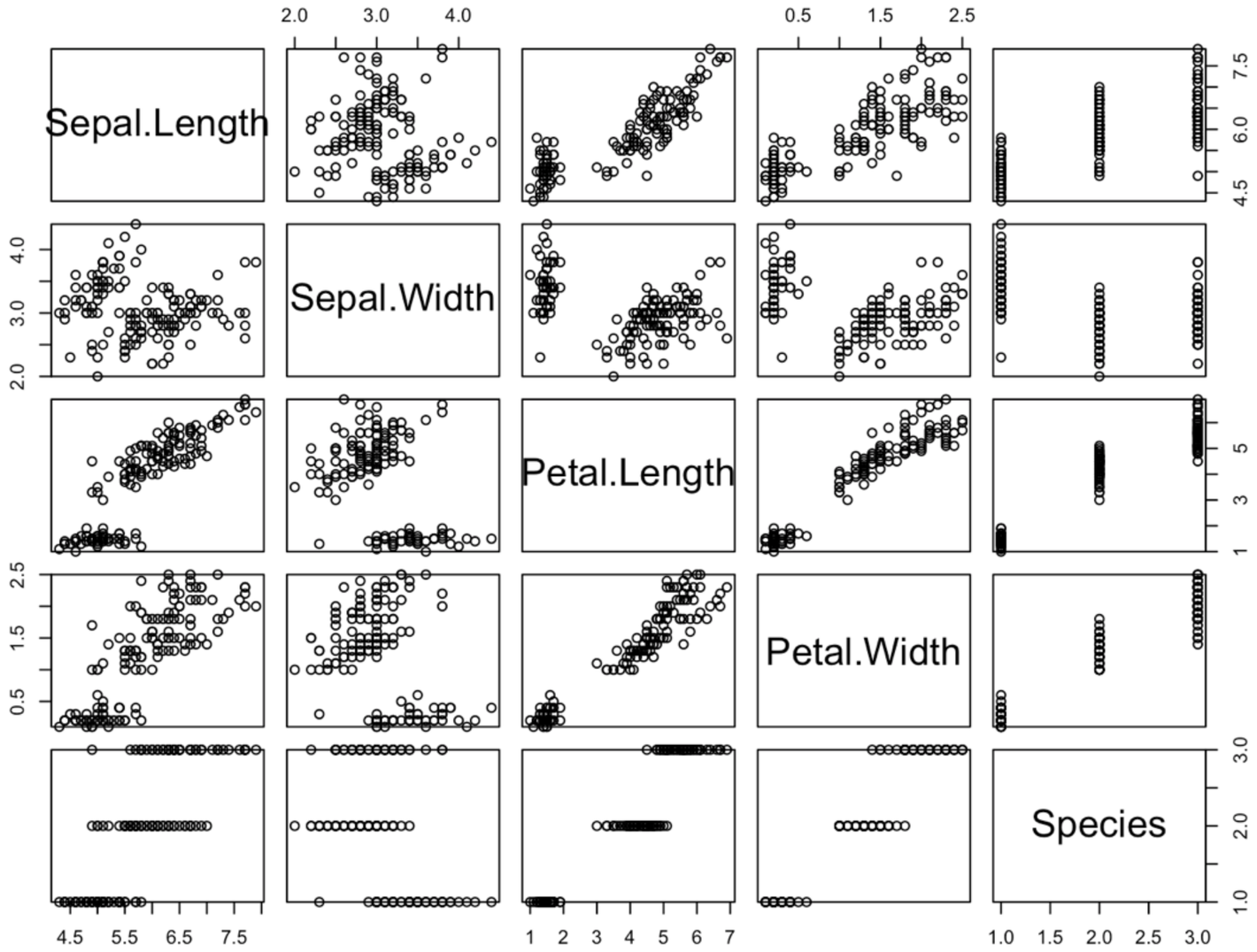
YOU CAN ACCESS THE IRIS DATASET IN R AS A DATA FRAME




```
is)
```

EXAMPLE 5: A SCATTERPLOT MATRIX

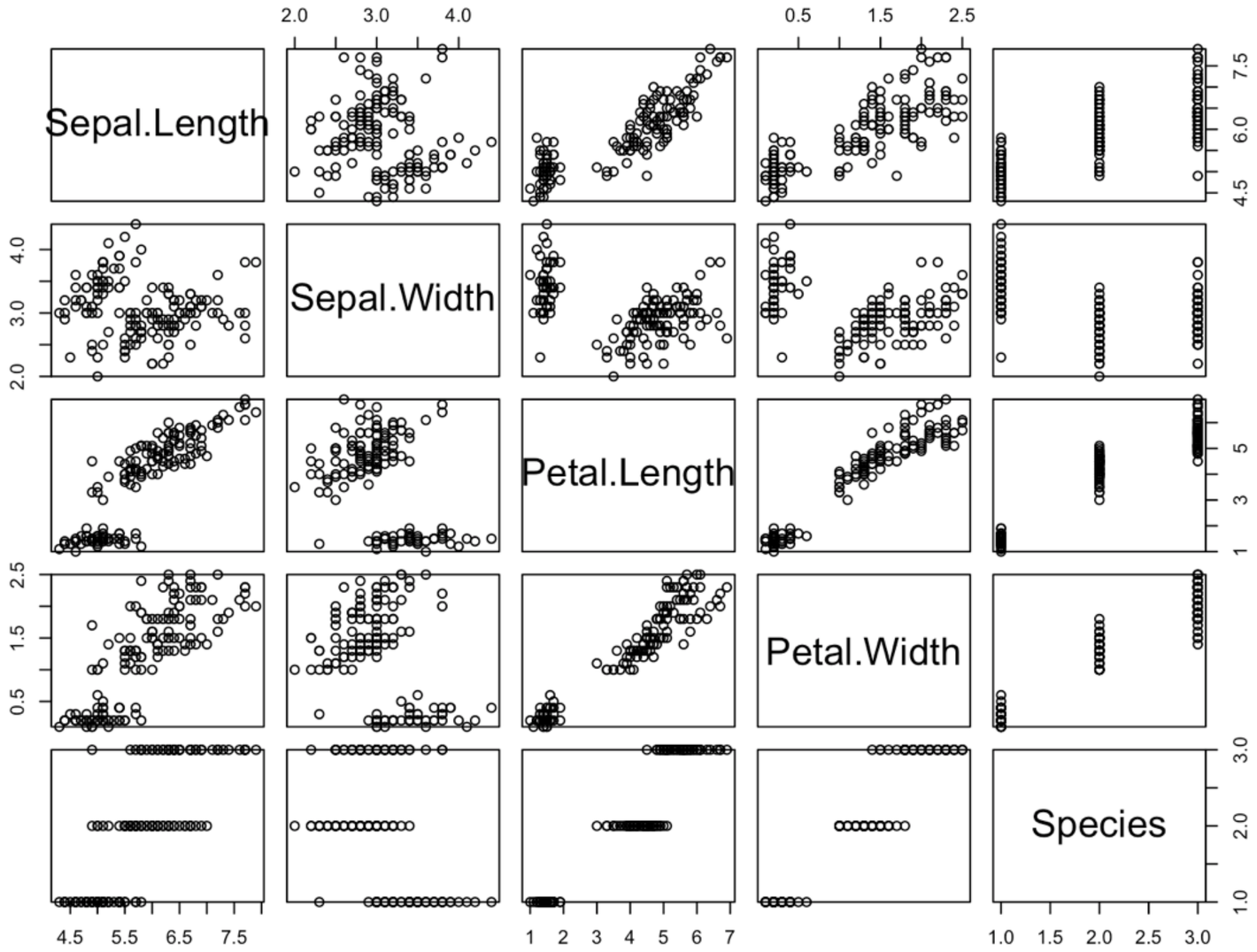
```
plot(iris)
```



LET'S PARSE THIS GRAPH

EXAMPLE 5: A SCATTERPLOT MATRIX

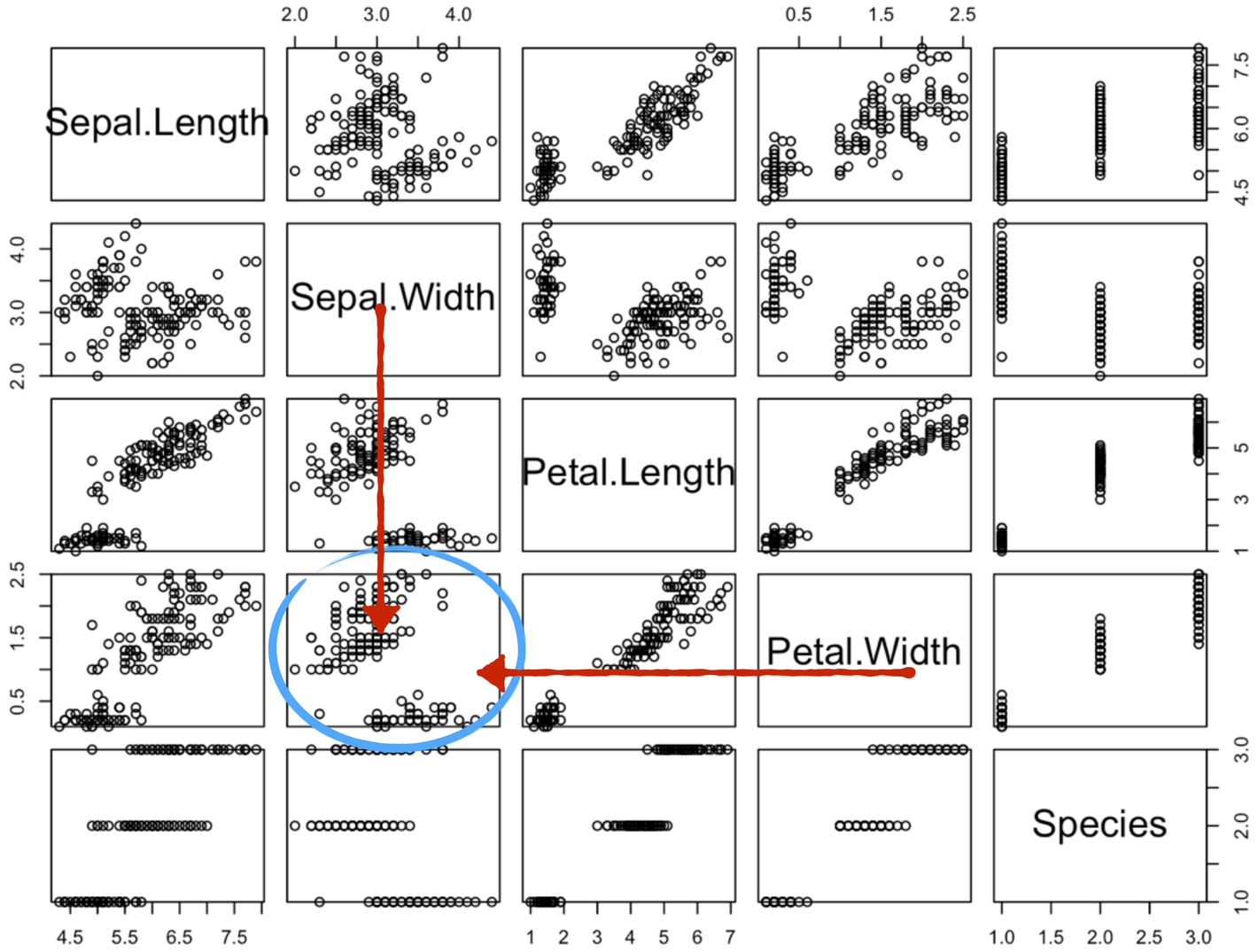
```
plot(iris)
```



EACH GRAPH IN THIS MATRIX IS A SCATTER PLOT FOR 2 VARIABLES

EXAMPLE 5: A SCATTERPLOT MATRIX

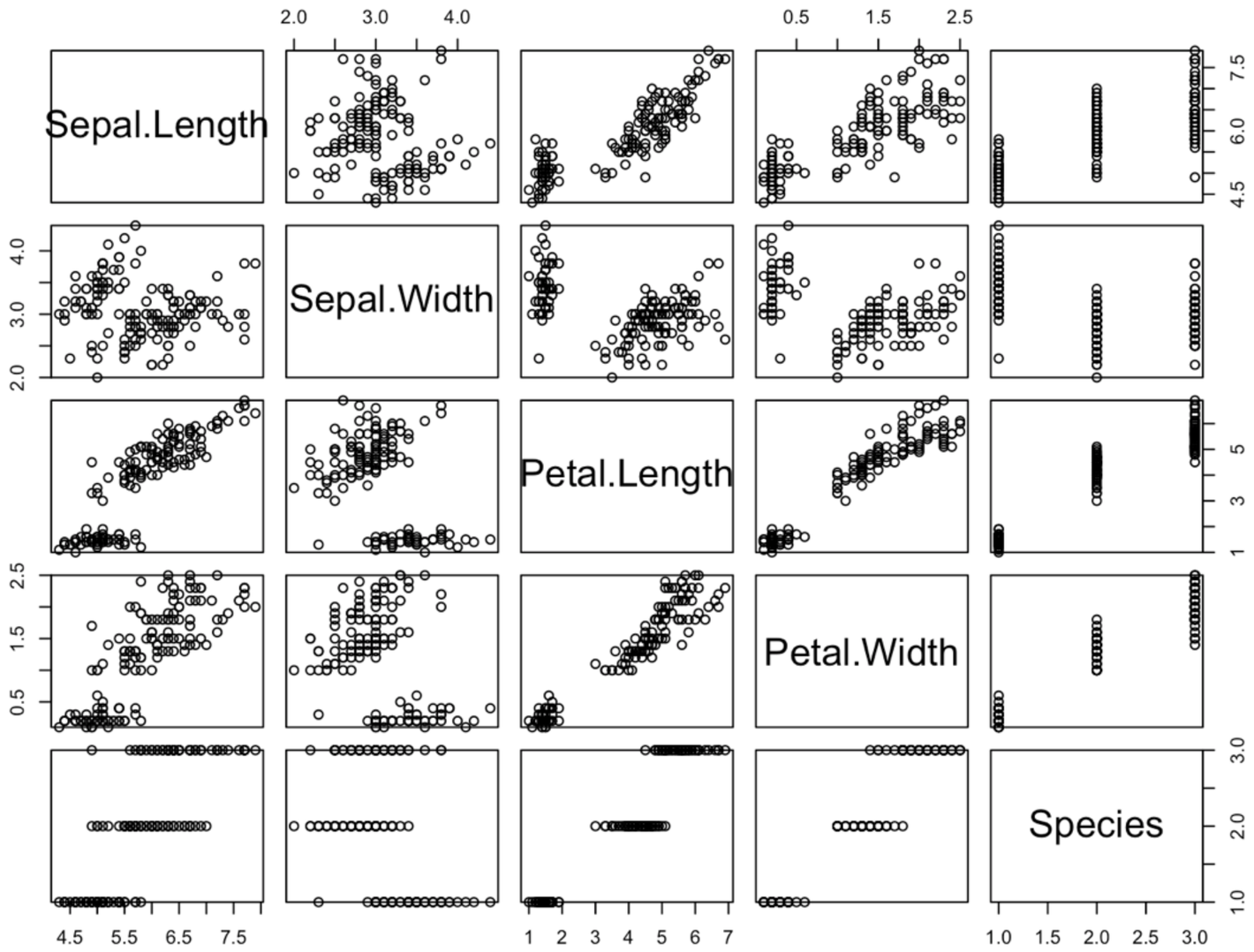
```
plot(iris)
```



THIS IS A SCATTER PLOT OF PETAL.WIDTH(Y) VS SEPAL.WIDTH(X)

EXAMPLE 5: A SCATTERPLOT MATRIX

```
plot(iris)
```



WE ARE ABLE TO SEE ALL THE RELATIONSHIPS BETWEEN ALL PAIRS OF VARIABLES AT ONCE!

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

GGPLOT2 IS A PACKAGE FOR DATA VISUALIZATION IN R

IT CAN BE USED TO BUILD COMPLEX 2D GRAPHICS

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

WE HAVE SOME DATA OF STOCK MOVEMENTS FOR LAST 5 YEARS

LET'S PLOT ALL THE STOCK MOVEMENTS USING GGPLOT2

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

WE HAVE FILES WITH STOCK MOVEMENTS OF GOOGLE, NASDAQ, EXXON MOBIL AND S&P 500

```
googFile <- '/Users/swethakolalapudi/Desktop/Regression/goog.csv'
nasdaqFile <-'/Users/swethakolalapudi/Desktop/Regression/nasdaq.csv'
xomFile <- '/Users/swethakolalapudi/Desktop/Regression/xom.csv'
snpFile <-'/Users/swethakolalapudi/Desktop/Regression/snp.csv'
```

LET'S READ THESE INTO DATA FRAMES

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
goog <-read.table(googFile,header = TRUE, sep =",")[,c("Date","Adj.Close")]
goog["Series"] <- "Goog"
```

WE'LL READ ONLY 2 COLUMNS, THE DATE AND ADJUSTED CLOSING PRICE

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
goog <-read.table(googFile,header = TRUE, sep =",")[,c("Date","Adj.Close")]
goog["Series"] <- "Goog"
```

WE ADD AN ADDITIONAL COLUMN TO THE DATA FRAME TO SPECIFY THE SECURITY NAME

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
goog <-read.table(googFile,header = TRUE, sep =",")[,c("Date","Adj.Close")]
goog["Series"] <- "Goog"

nasdaq <-read.table(nasdaqFile,header = TRUE, sep =",")[,c("Date","Adj.Close
nasdaq["Series"] <- "Nasdaq"

xom <-read.table(xomFile,header = TRUE, sep =",")[,c("Date","Adj.Close")]
xom["Series"] <- "Exxon Mobil"

snp <-read.table(snpFile,header = TRUE, sep =",")[,c("Date","Adj.Close")]
snp["Series"] <- "S&P 500"
```

DO THIS FOR ALL THE FILES

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

AT THE END WE HAVE 4 DATA FRAMES

Date	Adj.Close	Series
2016-02-01	752.0000	Goog
2016-01-04	742.9500	Goog
2015-12-01	758.8800	Goog
2015-11-02	744.0000	Goog
2015-10-01	710.8100	Goog
2015-09-01	608.4200	Goog
2015-08-03	618.2500	Goog
2015-07-01	625.6100	Goog
2015-06-01	520.5100	Goog
2015-05-01	532.1100	Goog

GOOG

Date	Adj.Close	Series
2016-02-01	4620.37	Nasdaq
2016-01-04	4613.95	Nasdaq
2015-12-01	5007.41	Nasdaq
2015-11-02	5108.07	Nasdaq
2015-10-01	5053.75	Nasdaq
2015-09-01	4620.16	Nasdaq
2015-08-03	4776.51	Nasdaq
2015-07-01	5128.28	Nasdaq
2015-06-01	4986.87	Nasdaq
2015-05-01	5070.03	Nasdaq

NASDAQ

Date	Adj.Close	Series
2016-02-01	75.60381	Exxon Mobil
2016-01-04	77.14977	Exxon Mobil
2015-12-01	77.24887	Exxon Mobil
2015-11-02	80.82571	Exxon Mobil
2015-10-01	81.28717	Exxon Mobil
2015-09-01	73.04449	Exxon Mobil
2015-08-03	73.91886	Exxon Mobil
2015-07-01	77.09778	Exxon Mobil
2015-06-01	80.98138	Exxon Mobil
2015-05-01	82.92805	Exxon Mobil

XOM

Date	Adj.Close	Series
2016-02-01	1939.38	S&P 500
2016-01-04	1940.24	S&P 500
2015-12-01	2043.94	S&P 500
2015-11-02	2080.41	S&P 500
2015-10-01	2079.36	S&P 500
2015-09-01	1920.03	S&P 500
2015-08-03	1972.18	S&P 500
2015-07-01	2103.84	S&P 500
2015-06-01	2063.11	S&P 500
2015-05-01	2107.39	S&P 500

SNP

RBIND() CAN COMBINE THESE INTO A SINGLE DATA FRAME

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

RBIND() CAN COMBINE THESE INTO A SINGLE DATA FRAME

```
data <- rbind(goog,nasdaq,xom,snp)
data$Date <- as.Date(data$Date)
```

CONVERT THE DATE COLUMN TO DATE (FROM STRING)

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

WE ARE NOW READY TO PLOT THIS DATA

```
require(ggplot2)
```

GGPLOT2 IS A DATA VISUALIZATION PACKAGE

IT USES LAYERS TO PLOT THE DATA

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
require(ggplot2)
```

EACH LAYER IS ADDED ON TOP OF THE OTHER

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

THE FIRST LAYER IS AN EMPTY PLOT WHICH IS AWARE OF THE DATA FRAME IT WILL READ THE DATA FROM

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

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```

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EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

THE DATA TO BE USED FOR X-LABELS , Y-LABELS , ARE SPECIFIED USING A FUNCTION CALLED AES()

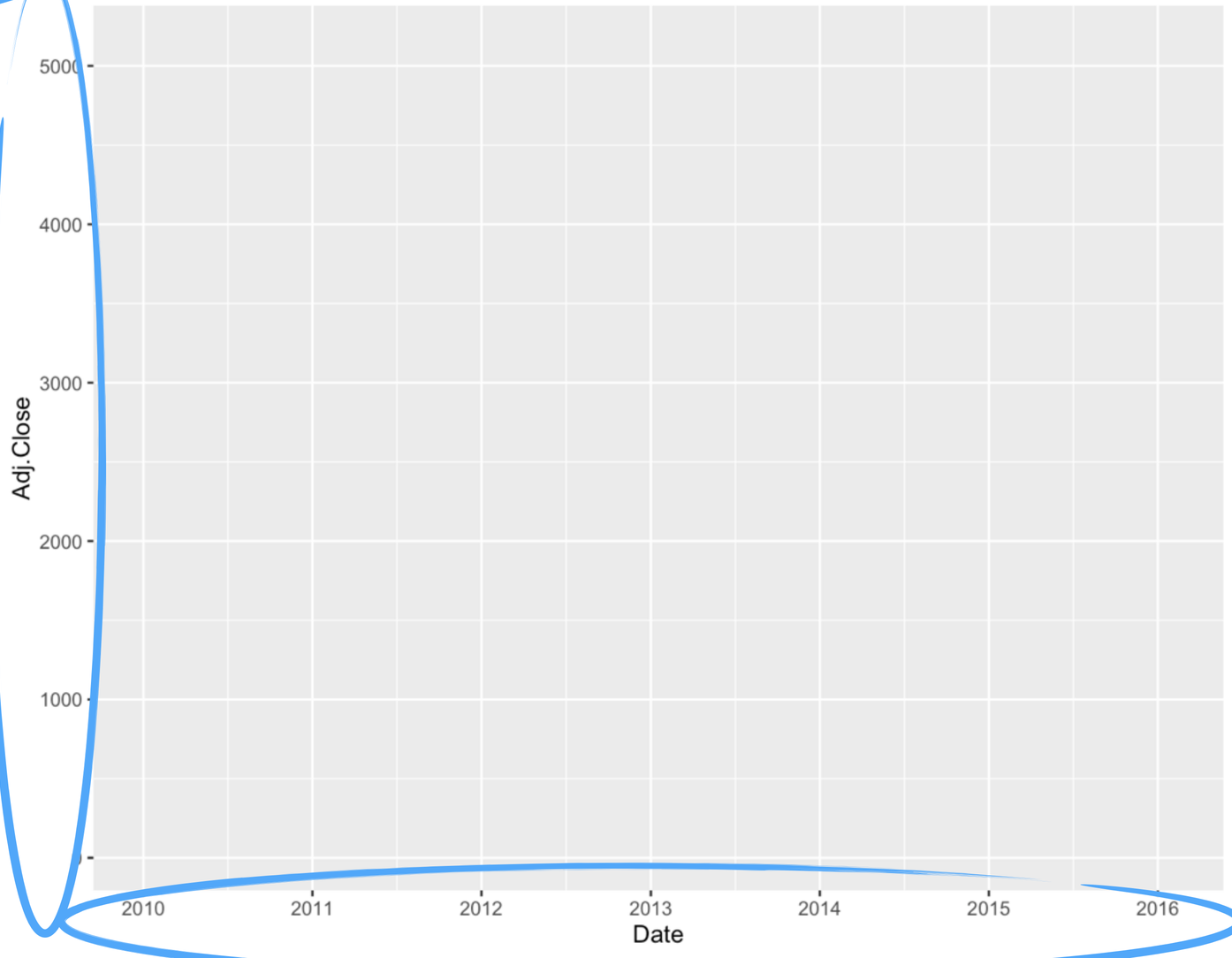
AES STANDS FOR AESTHETICS

IN EACH LAYER, YOU CAN SPECIFY THAT THE AESTHETICS NEED TO BE READ FROM SOME DATA FRAME COLUMN

EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

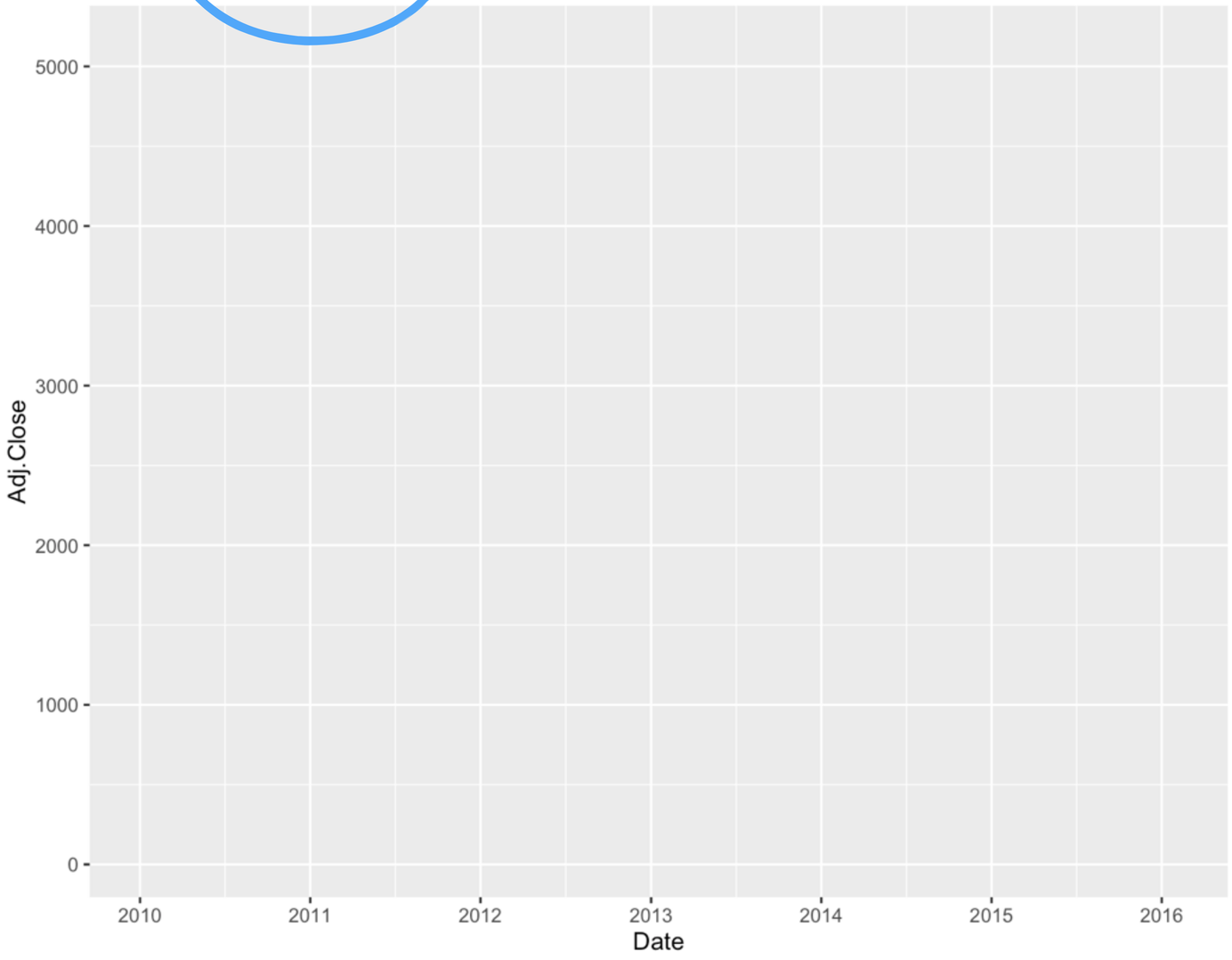
IF YOU JUST USE THIS , AN EMPTY PLOT WITH X AND Y-AXIS WILL SHOW UP



EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

NOW WE ADD A SECOND LAYER WITH THE LINES TO BE PLOTTED

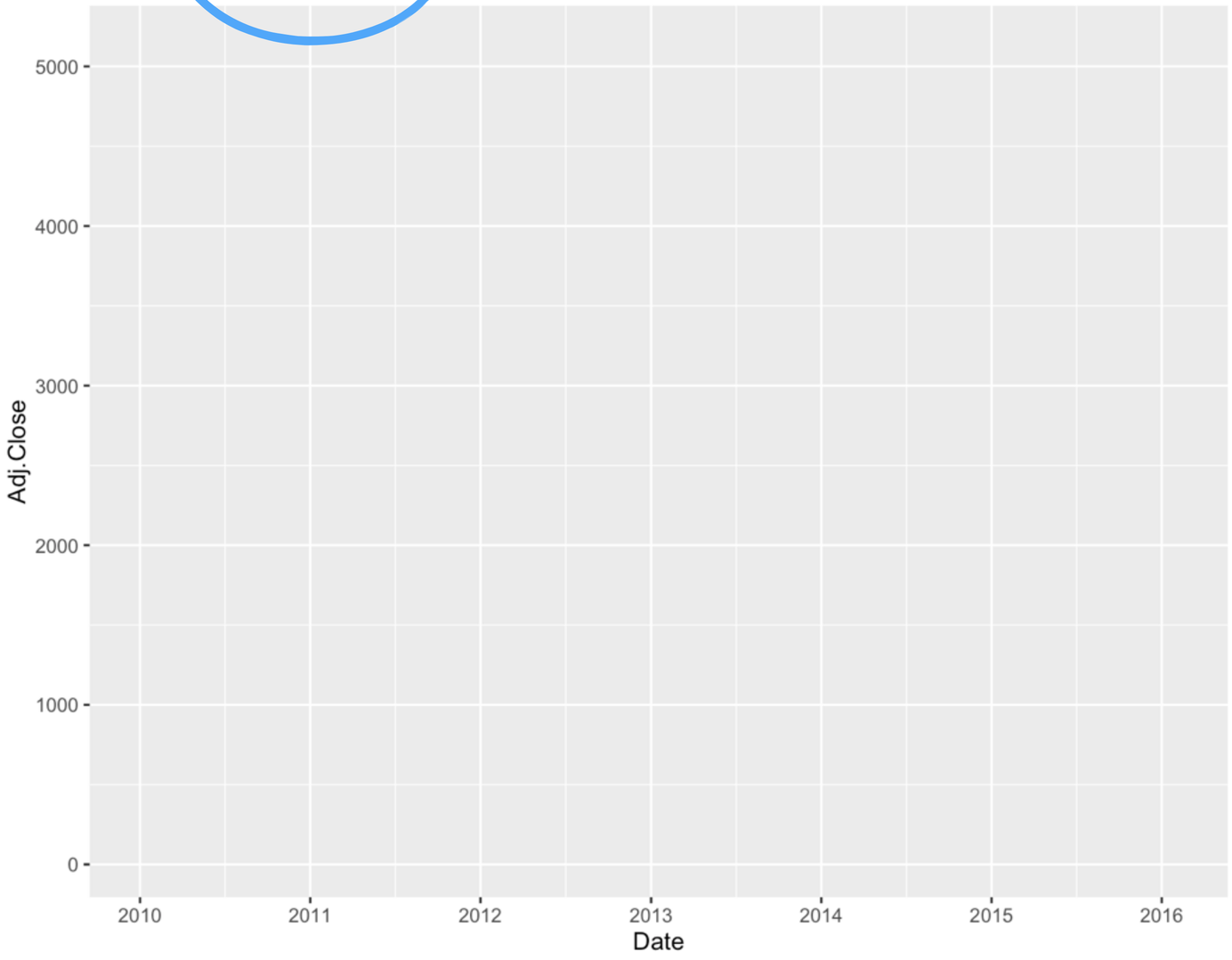


EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

GEOM_LINE()

SPECIFIES THAT WE WANT A LINE GRAPH

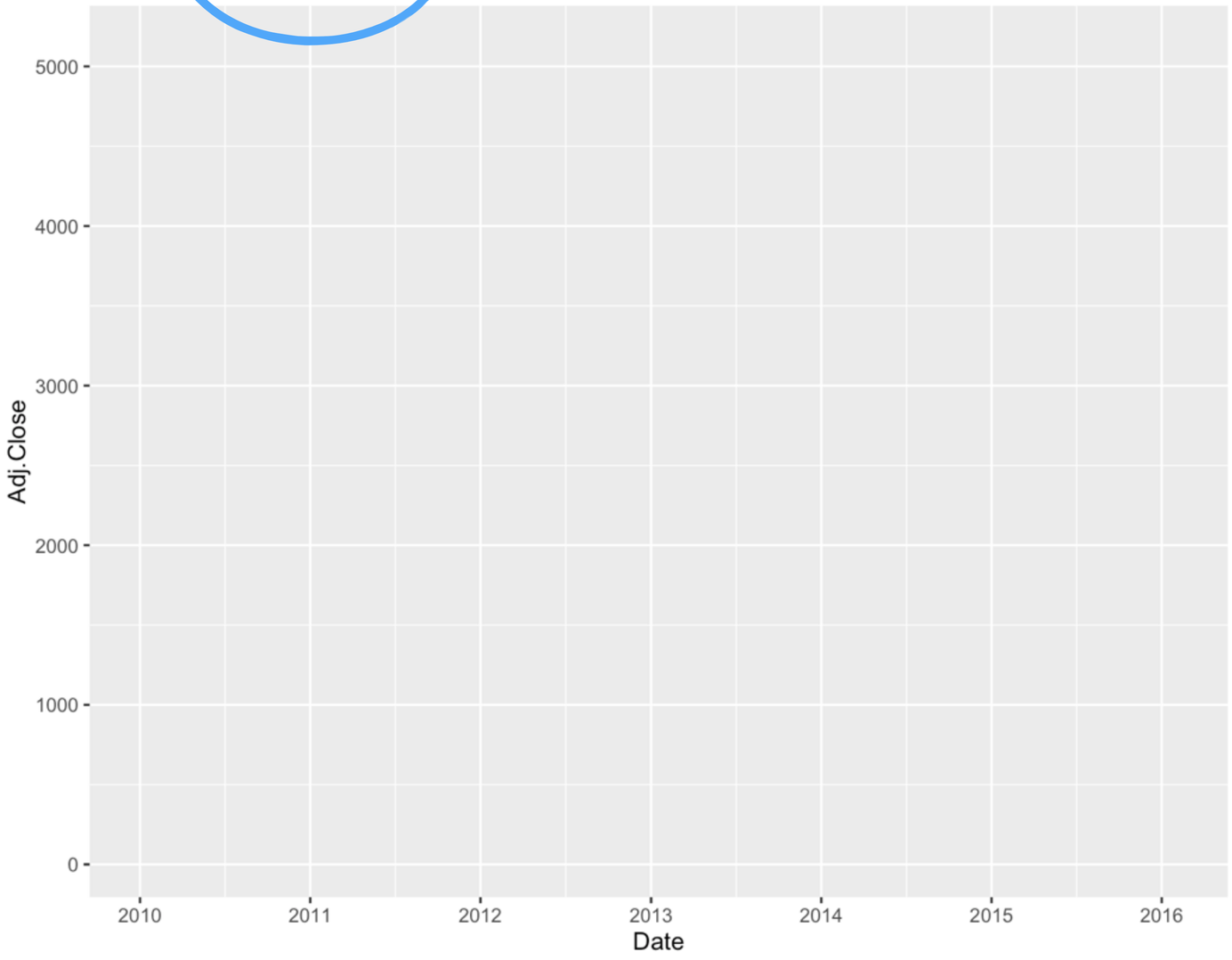


EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

THERE ARE DIFFERENT FUNCTIONS FOR DIFFERENT PLOTS

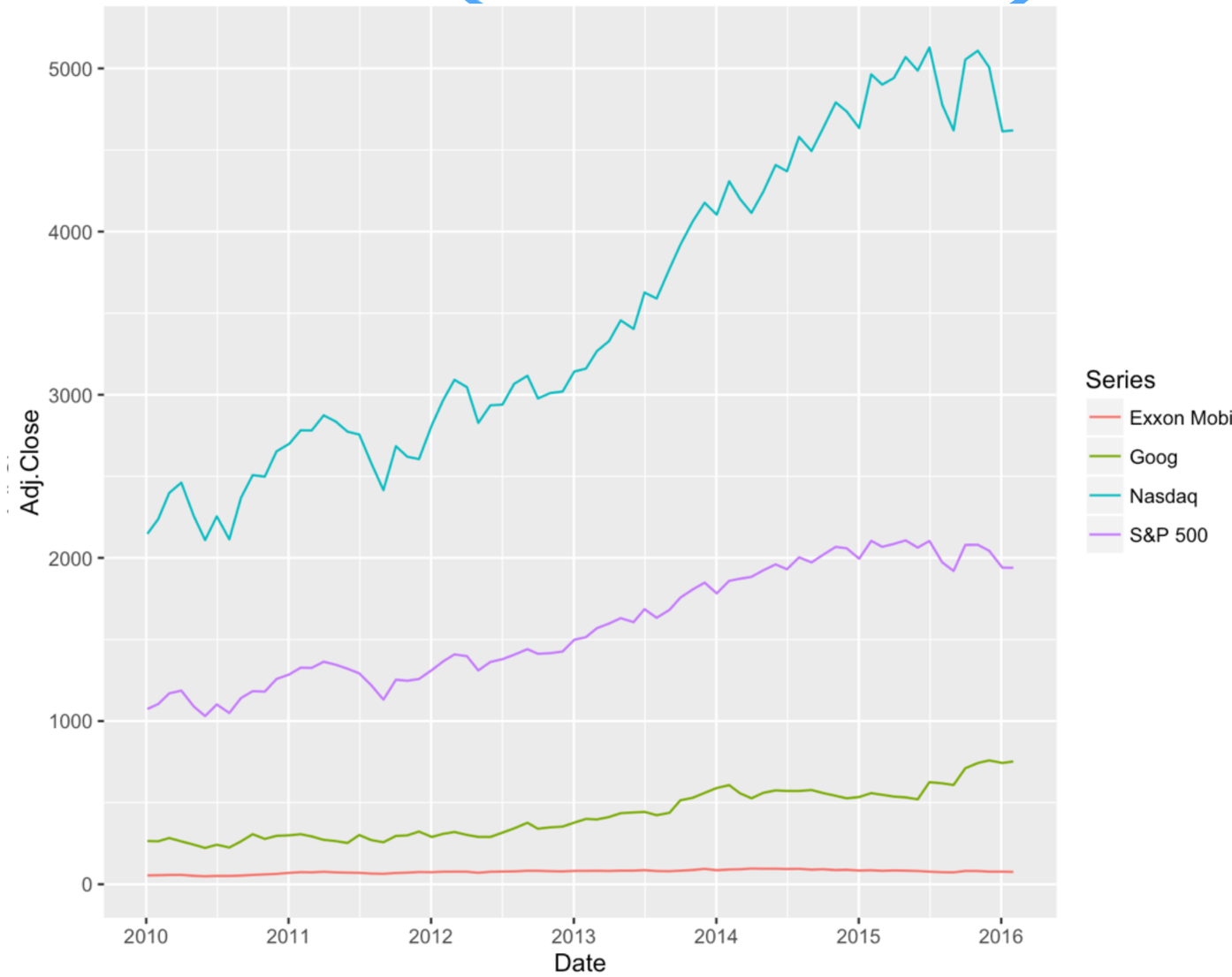
GEOM_HIST() ,
GEOM_AREA(),
GEOM_BAR() ETC



EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

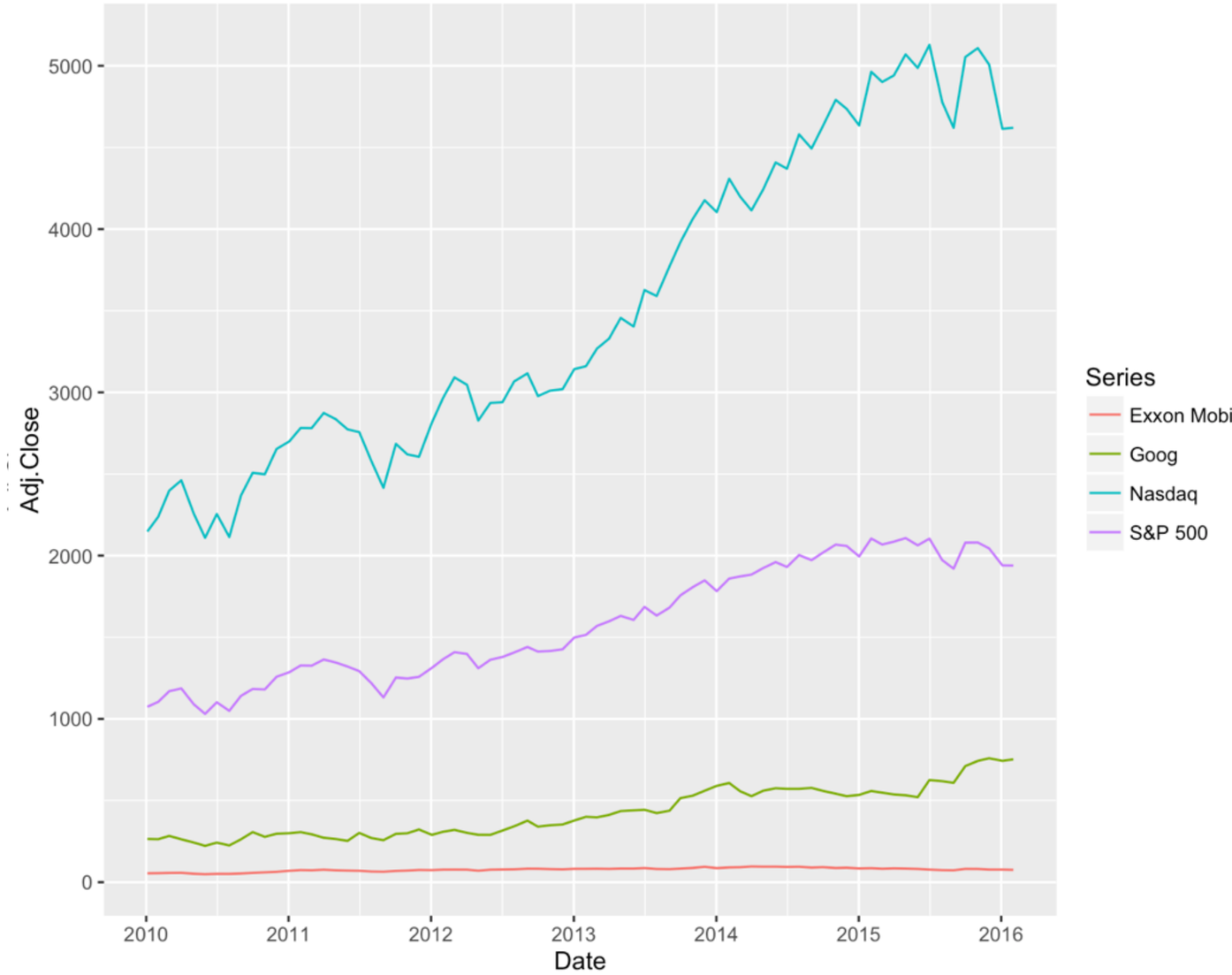
HERE WE SPECIFY ANOTHER AESTHETIC, THE LINE COLOR SHOULD BE BASED ON THE SERIES COLUMN OF THE DATA FRAME



EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

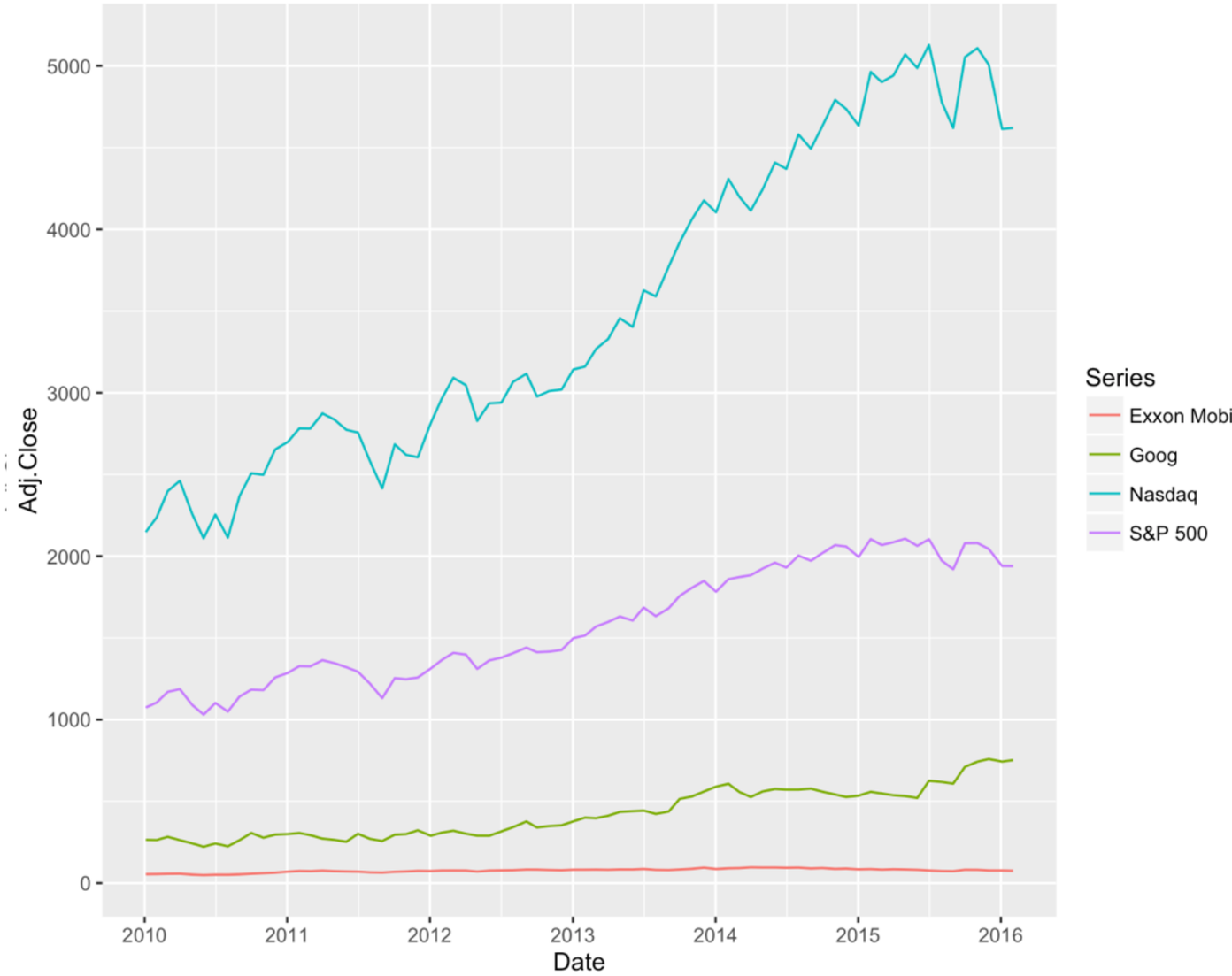
GGPLOT2 IS VERY POWERFUL AS IT GIVES YOU A LOT OF CONTROL OVER THE LAYERS



EXAMPLE 6: PLOT MULTIPLE LINES USING GGPLOT2

```
ggplot(data, aes(Date,Adj.Close)) + geom_line(aes(colour = Series))
```

YOU CAN DRAW A COMBINATION LINE - BAR CHART, LINE-AREA CHART OR ANY COMBINATION THAT YOU LIKE



SO, HOW DO YOU GO FROM DATA TO DECISIONS?

1. USE NUMBERS AND PLOTS TO DESCRIBE THE DATA

2. DRAW INFERENCES FROM THE DATA

3. ORGANIZE DATA USING ANALYTICAL TOOLS

4. QUANTIFY RELATIONSHIPS BETWEEN VARIABLES

5. VISUALLY COMMUNICATE WHAT YOU'VE LEARNT

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