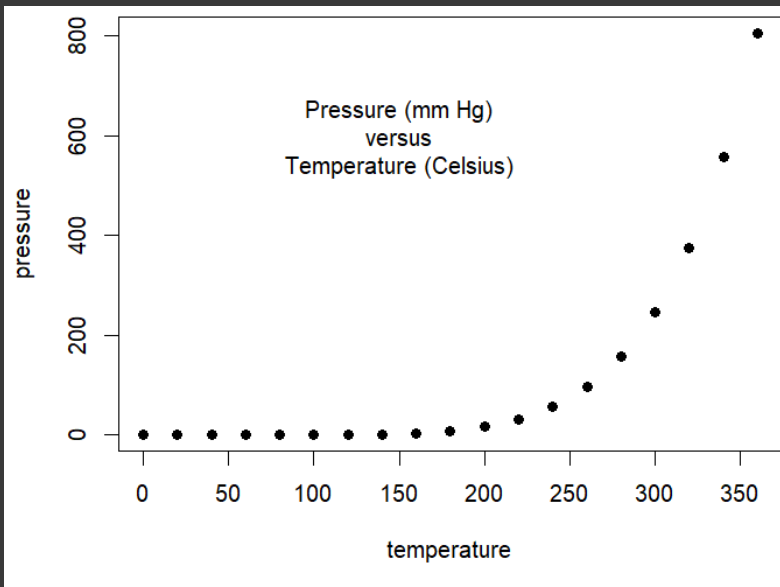


Paul Murrell's R examples

```
## Start plotting from basics
# Note the order
plot(pressure, pch=16) # Can you change pch?
text(150, 600,
     "Pressure (mm Hg)\nversus\nTemperature (Celsius)")
```

Question: Can you change the pch? **Yes you can change it, and it will change the shapes and fill of the plots in the graph**

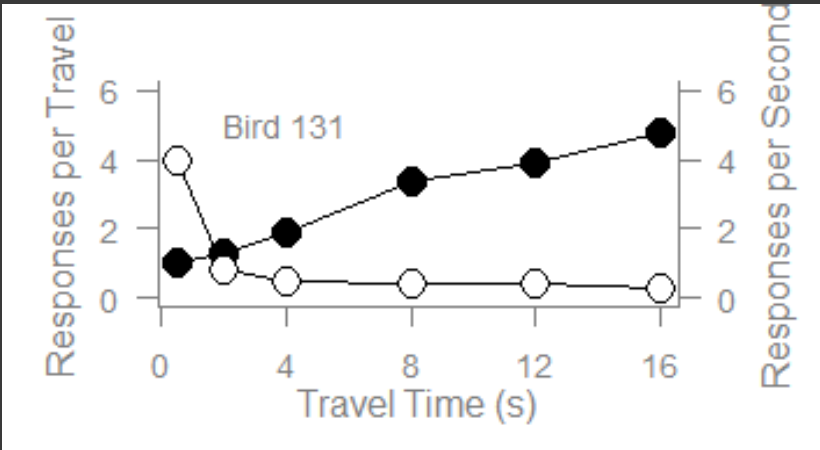


```
# Examples of standard high-level plots
# In each case, extra output is also added using low-level
# plotting functions.
#
# Setting the parameter (3 rows by 2 cols)
par(mfrow=c(3, 2))
# Scatterplot
# Note the incremental additions
x <- c(0.5, 2, 4, 8, 12, 16)
y1 <- c(1, 1.3, 1.9, 3.4, 3.9, 4.8)
y2 <- c(4, .8, .5, .45, .4, .3)
# Setting label orientation, margins c(bottom, left, top, right) & text size
par(las=1, mar=c(4, 4, 2, 4), cex=.7)
plot.new()
plot.window(range(x), c(0, 6))
lines(x, y1)
lines(x, y2)
points(x, y1, pch=16, cex=2) # Try different cex value?
points(x, y2, pch=21, bg="white", cex=2) # Different background color
par(col="gray50", fg="gray50", col.axis="gray50")
```

```

axis(1, at=seq(0, 16, 4)) # What is the first number standing for?
axis(2, at=seq(0, 6, 2))
axis(4, at=seq(0, 6, 2))
box(bty="u")
mtext("Travel Time (s)", side=1, line=2, cex=0.8)
mtext("Responses per Travel", side=2, line=2, las=0, cex=0.8)
mtext("Responses per Second", side=4, line=2, las=0, cex=0.8)
text(4, 5, "Bird 131")
par(mar=c(5.1, 4.1, 4.1, 2.1), col="black", fg="black", col.axis="black")

```



QUESTIONS:

Try different CEX value? The CEX parameter in points() controls the size of the plotting symbols. Changing CEX, affects how large or small the symbols appear on the plot.

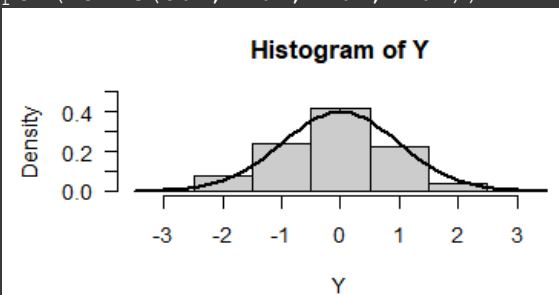
What is the first number standing for? In the axis() function, the first argument represents the side of the plot where the axis is to be drawn. For example:

- 1 stands for the bottom side
- 2 stands for the left side
- 3 stands for the top side
- 4 stands for the right side

```

# Histogram
# Random data
Y <- rnorm(50)
# Make sure no Y exceed [-3.5, 3.5]
Y[Y < -3.5 | Y > 3.5] <- NA # Selection/set range
x <- seq(-3.5, 3.5, .1)
dn <- dnorm(x)
par(mar=c(4.5, 4.1, 3.1, 0))
hist(Y, breaks=seq(-3.5, 3.5), ylim=c(0, 0.5),
      col="gray80", freq=FALSE)
lines(x, dnorm(x), lwd=2)
par(mar=c(5.1, 4.1, 4.1, 2.1))

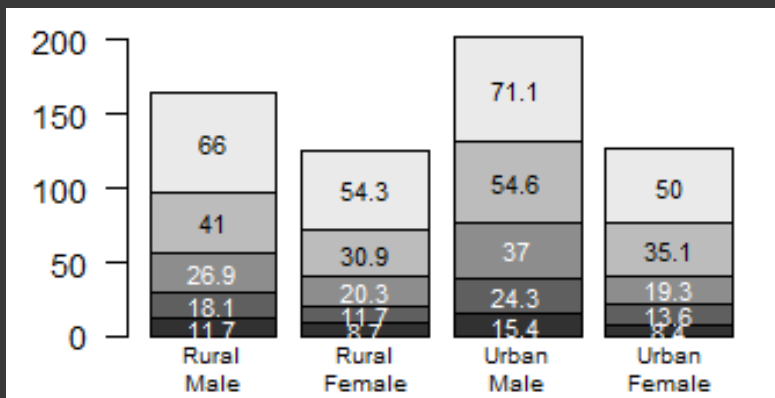
```



```

# Barplot
par(mar=c(2, 3.1, 2, 2.1))
midpts <- barplot(VADeaths,
                  col=gray(0.1 + seq(1, 9, 2)/11),
                  names=rep("", 4))
mtext(sub(" ", "\n", colnames(VADeaths)),
      at=midpts, side=1, line=0.5, cex=0.5)
text(rep(midpts, each=5), apply(VADeaths, 2, cumsum) - VADeaths/2,
     VADeaths,
     col=rep(c("white", "black"), times=3:2),
     cex=0.8)
par(mar=c(5.1, 4.1, 4.1, 2.1))

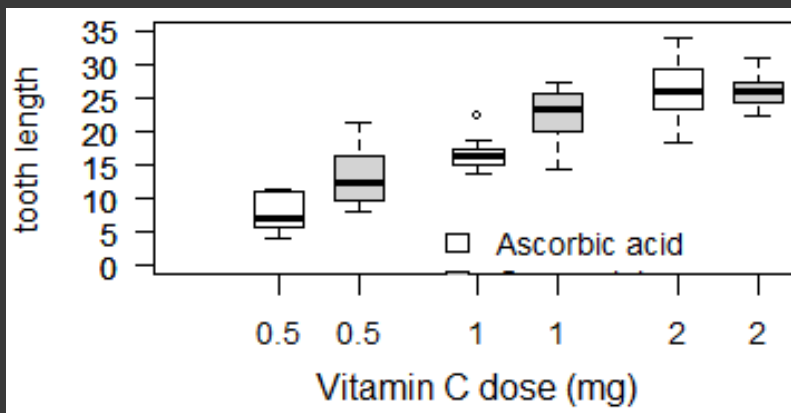
```



```

# Boxplot
par(mar=c(3, 4.1, 2, 0))
boxplot(len ~ dose, data = ToothGrowth,
        boxwex = 0.25, at = 1:3 - 0.2,
        subset= supp == "VC", col="white",
        xlab="",
        ylab="tooth length", ylim=c(0,35))
mtext("Vitamin C dose (mg)", side=1, line=2.5, cex=0.8)
boxplot(len ~ dose, data = ToothGrowth, add = TRUE,
        boxwex = 0.25, at = 1:3 + 0.2,
        subset= supp == "OJ")
legend(1.5, 9, c("Ascorbic acid", "Orange juice"),
      fill = c("white", "gray"),
      bty="n")
par(mar=c(5.1, 4.1, 4.1, 2.1))

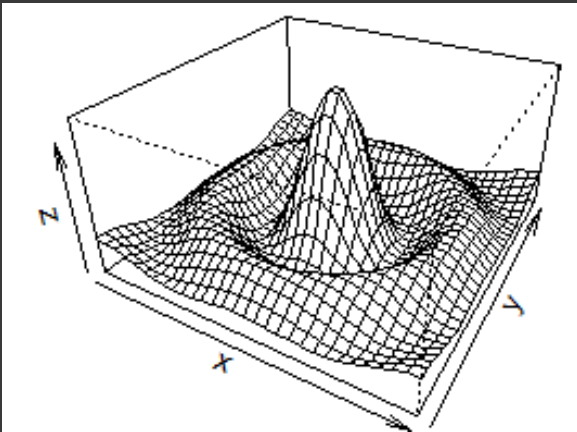
```



```

# Persp
x <- seq(-10, 10, length= 30)
y <- x
f <- function(x,y) { r <- sqrt(x^2+y^2); 10 * sin(r)/r }
z <- outer(x, y, f)
z[is.na(z)] <- 1
# 0.5 to include z axis label
par(mar=c(0, 0.5, 0, 0), lwd=0.5)
persp(x, y, z, theta = 30, phi = 30,
      expand = 0.5)
par(mar=c(5.1, 4.1, 4.1, 2.1), lwd=1)

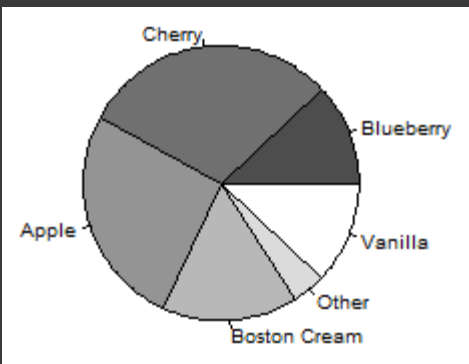
```

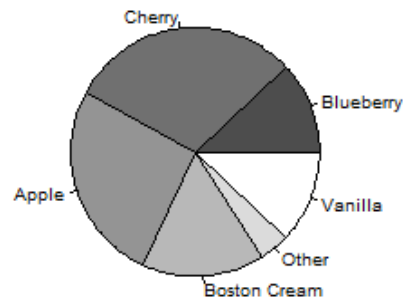
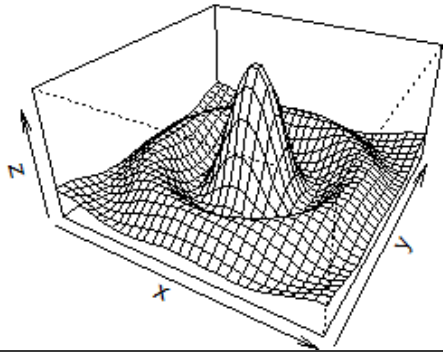
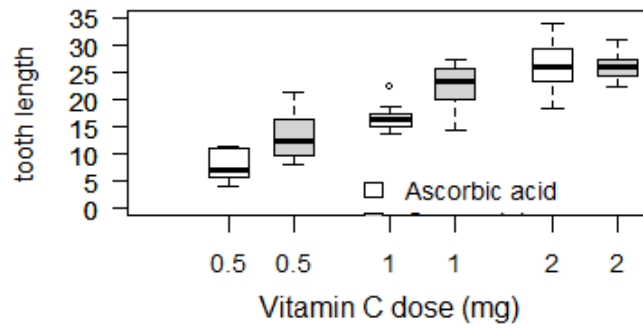
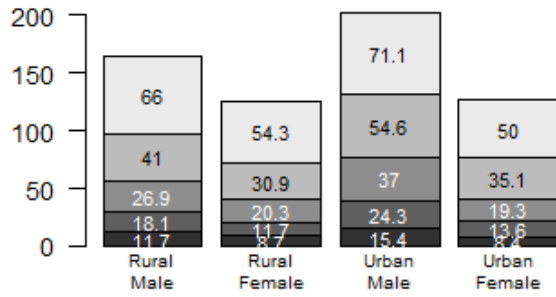
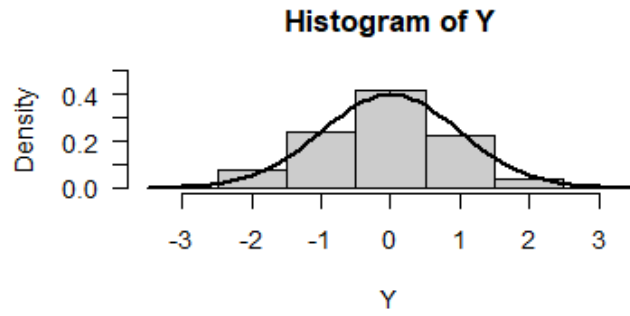
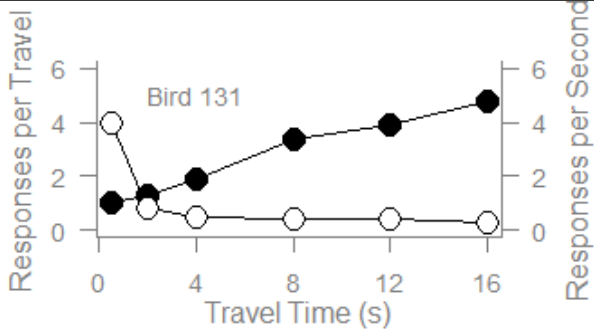


```

# Piechart
par(mar=c(0, 2, 1, 2), xpd=FALSE, cex=0.5)
pie.sales <- c(0.12, 0.3, 0.26, 0.16, 0.04, 0.12)
names(pie.sales) <- c("Blueberry", "Cherry",
                    "Apple", "Boston Cream", "Other", "Vanilla")
pie(pie.sales, col = gray(seq(0.3,1.0,length=6)))

```





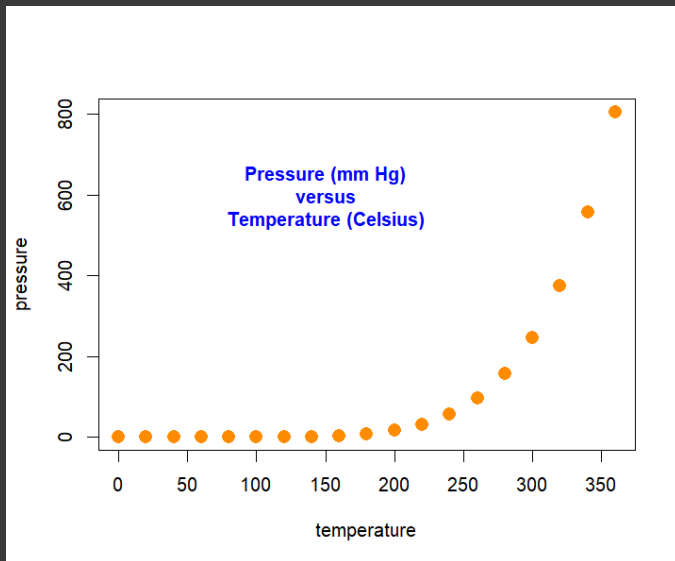
(continues on next page)

Exercise: Can you generate these charts individually?

First I will plot these charts individually and with different color schemes.

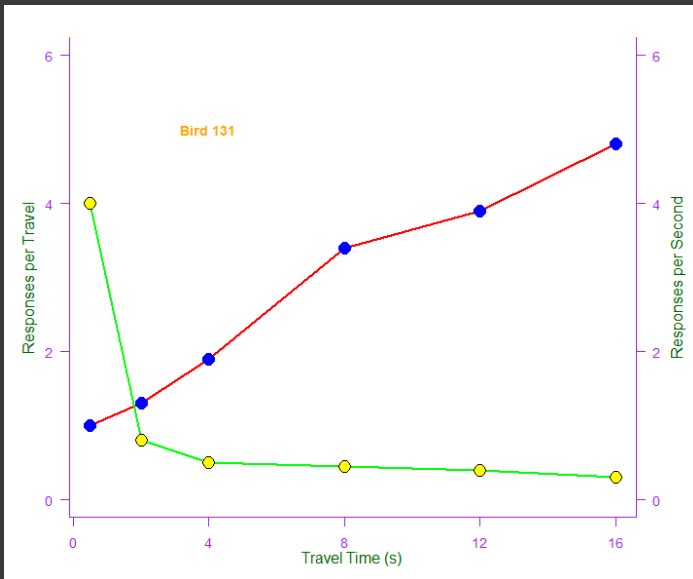
INITIAL PLOT OF PRESSURE VS. TEMPERATURE

```
plot(pressure, pch=16, col="darkorange", cex=1.5)
text(150, 600,
     "Pressure (mm Hg)\nversus\nTemperature (Celsius)", col="blue", font=2)
```



SCATTERPLOT

```
x <- c(0.5, 2, 4, 8, 12, 16)
y1 <- c(1, 1.3, 1.9, 3.4, 3.9, 4.8)
y2 <- c(4, .8, .5, .45, .4, .3)
par(las=1, mar=c(4, 4, 2, 4), cex=.7)
plot.new()
plot.window(range(x), c(0, 6))
lines(x, y1, col="red", lwd=2) # Bright red line for y1
lines(x, y2, col="green", lwd=2) # Bright green line for y2
points(x, y1, pch=16, col="blue", cex=2) # Blue points for y1
points(x, y2, pch=21, bg="yellow", cex=2) # Yellow-filled points for y2
par(col="purple", fg="purple", col.axis="purple") # Purple axis colors
axis(1, at=seq(0, 16, 4))
axis(2, at=seq(0, 6, 2))
axis(4, at=seq(0, 6, 2))
box(bty="u", col="purple")
mtext("Travel Time (s)", side=1, line=2, cex=0.8, col="darkgreen")
mtext("Responses per Travel", side=2, line=2, las=0, cex=0.8, col="darkgreen")
mtext("Responses per Second", side=4, line=2, las=0, cex=0.8, col="darkgreen")
text(4, 5, "Bird 131", col="orange", font=2)
dev.new() # Create a new plot window
```

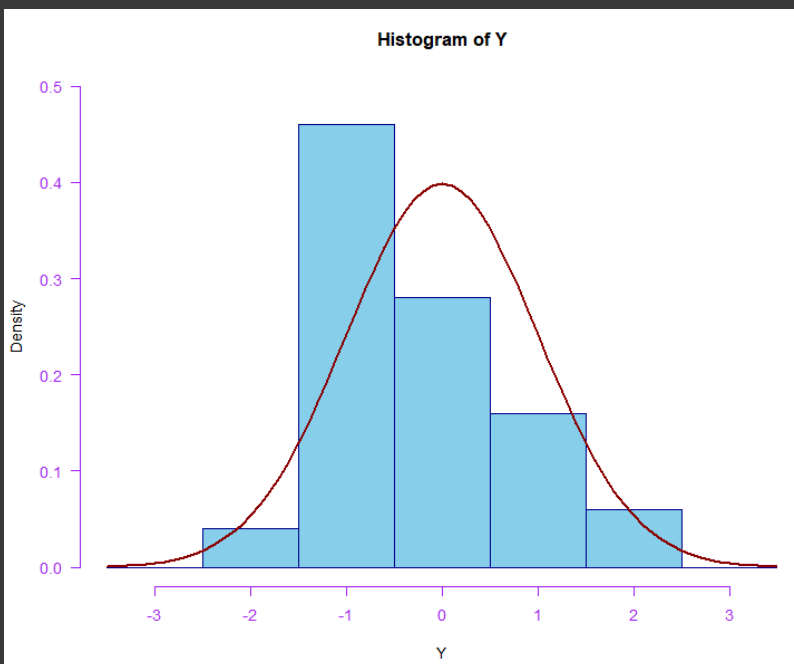


Histogram

```

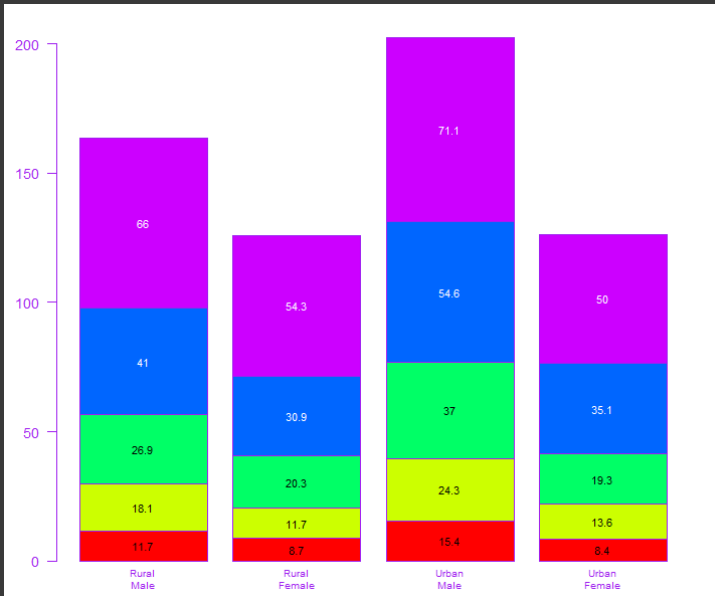
Y <- rnorm(50)
Y[Y < -3.5 | Y > 3.5] <- NA
x <- seq(-3.5, 3.5, .1)
dn <- dnorm(x)
par(mar=c(4.5, 4.1, 3.1, 0))
hist(Y, breaks=seq(-3.5, 3.5), ylim=c(0, 0.5),
     col="skyblue", freq=FALSE, border="darkblue") # Sky blue bars, dark blue border
lines(x, dnorm(x), lwd=2, col="darkred") # Dark red line for the normal distribution
dev.new() # Create a new plot window

```



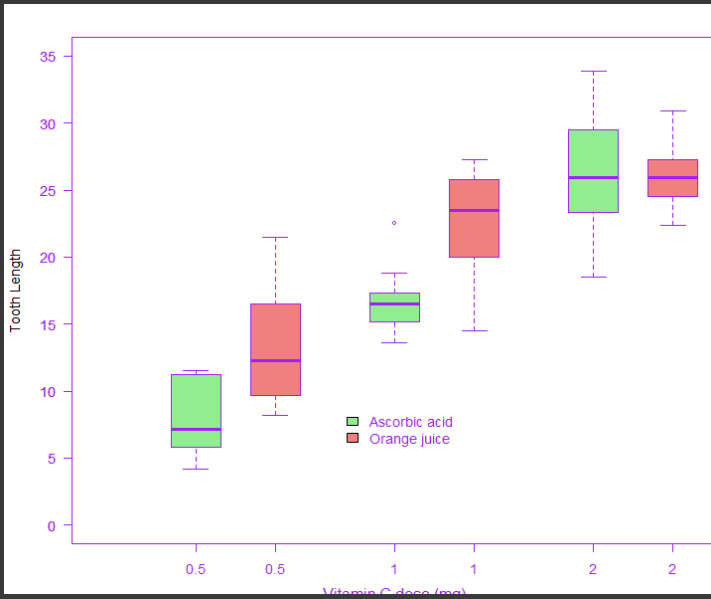
BAR PLOT

```
par(mar=c(2, 3.1, 2, 2.1))
midpts <- barplot(VADeaths,
                 col=rainbow(5), # Rainbow colors for the bars
                 names=rep("", 4))
mtext(sub(" ", "\n", colnames(VADeaths)),
      at=midpts, side=1, line=0.5, cex=0.5)
text(rep(midpts, each=5), apply(VADeaths, 2, cumsum) - VADeaths/2,
     VADeaths,
     col=rep(c("black", "white"), times=3:2),
     cex=0.8)
dev.new() # Create a new plot window
```



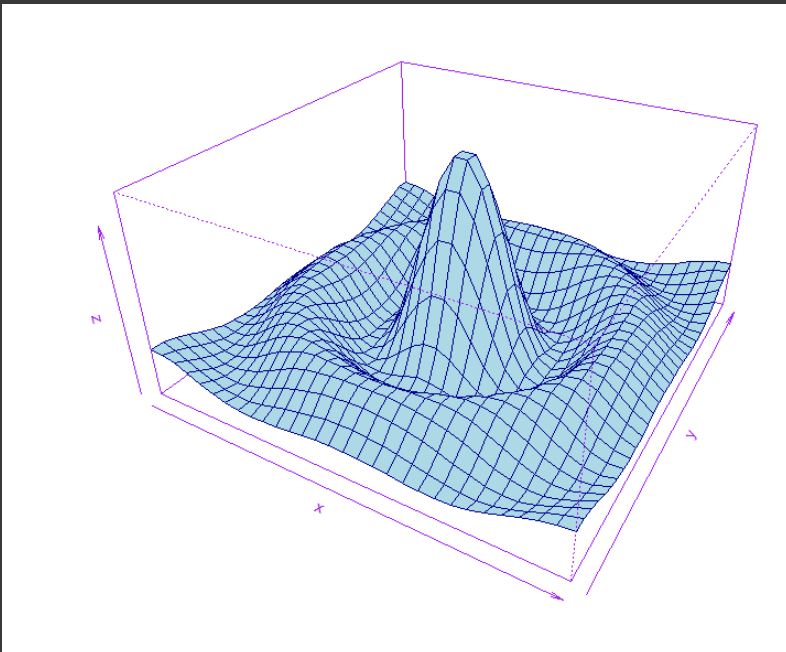
BOXPLOT

```
par(mar=c(3, 4.1, 2, 0))
boxplot(len ~ dose, data = ToothGrowth,
       boxwex = 0.25, at = 1:3 - 0.2,
       subset= supp == "VC", col="lightgreen",
       xlab="",
       ylab="Tooth Length", ylim=c(0,35))
mtext("Vitamin C dose (mg)", side=1, line=2.5, cex=0.8)
boxplot(len ~ dose, data = ToothGrowth, add = TRUE,
       boxwex = 0.25, at = 1:3 + 0.2,
       subset= supp == "OJ", col="lightcoral") # Light coral for OJ group
legend(1.5, 9, c("Ascorbic acid", "Orange juice"),
     fill = c("lightgreen", "lightcoral"),
     bty="n")
dev.new() # Create a new plot window
```

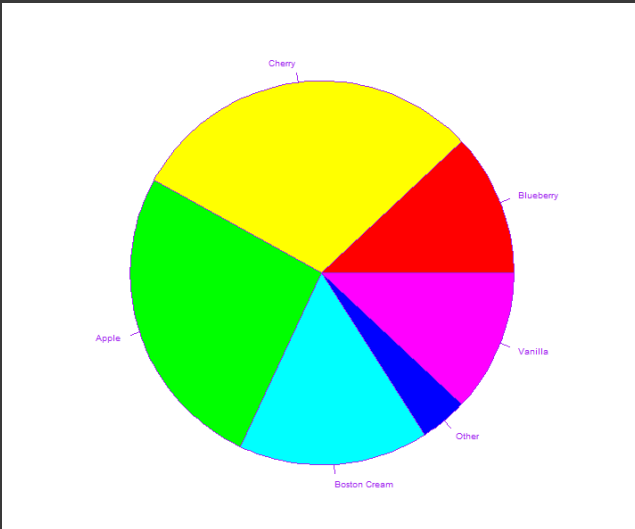
3D PERSPECTIVE PLOT

```
x <- seq(-10, 10, length=30)
y <- x
f <- function(x, y) { r <- sqrt(x^2 + y^2); 10 * sin(r)/r }
z <- outer(x, y, f)
z[is.na(z)] <- 1
persp(x, y, z, theta = 30, phi = 30,
      expand = 0.5, col="lightblue", border="darkblue") # Light blue surface, dark blue
borders
dev.new() # Create a new plot window
```



PIE CHART

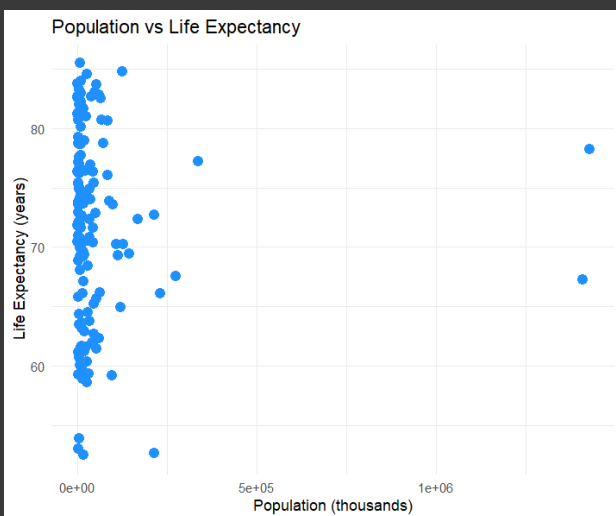
```
par(mar=c(0, 2, 1, 2), xpd=FALSE, cex=0.5)
pie.sales <- c(0.12, 0.3, 0.26, 0.16, 0.04, 0.12)
names(pie.sales) <- c("Blueberry", "Cherry",
                    "Apple", "Boston Cream", "Other", "Vanilla")
pie(pie.sales, col = rainbow(6)) # Use rainbow colors for the pie slices
```



#Try these functions using another dataset. Be sure to work on the layout and margins
Now I will plot these charts individually with different color schemes based on the data from the Happy Planet Index dataset.

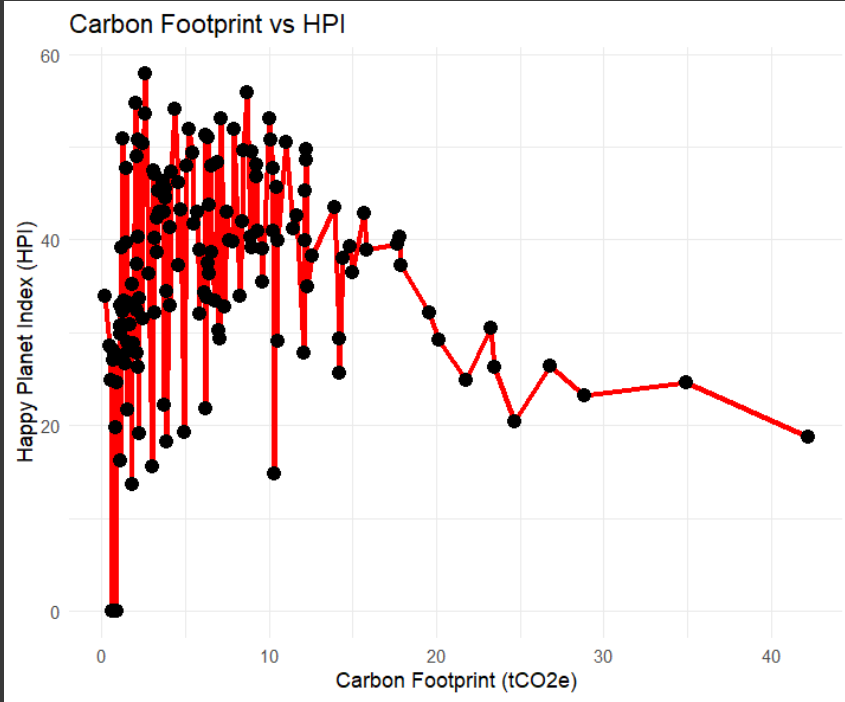
SCATTERPLOT

```
ggplot(mydata, aes(x = `Population (thousands)`, y = `Life Expectancy (years)`) +
  geom_point(color = "dodgerblue", size = 3) +
  labs(x = "Population (thousands)", y = "Life Expectancy (years)",
       title = "Population vs Life Expectancy") +
  theme_minimal())
```



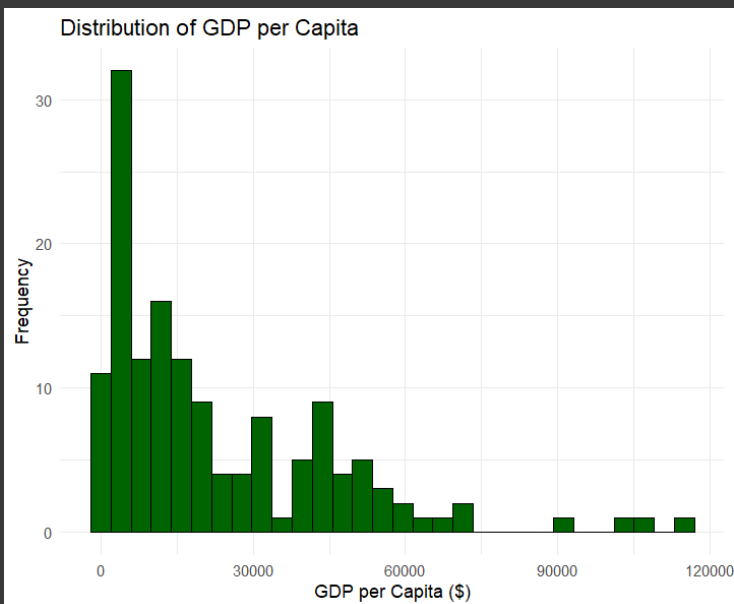
LINE PLOT

```
> ggplot(mydata, aes(x = `Carbon Footprint (tCO2e)`, y = HPI, group = 1)) +  
+   geom_line(color = "red", linewidth = 1.2) +  
+   geom_point(color = "black", size = 3) +  
+   labs(x = "Carbon Footprint (tCO2e)", y = "Happy Planet Index (HPI)",  
+       title = "Carbon Footprint vs HPI") +  
+   theme_minimal()
```



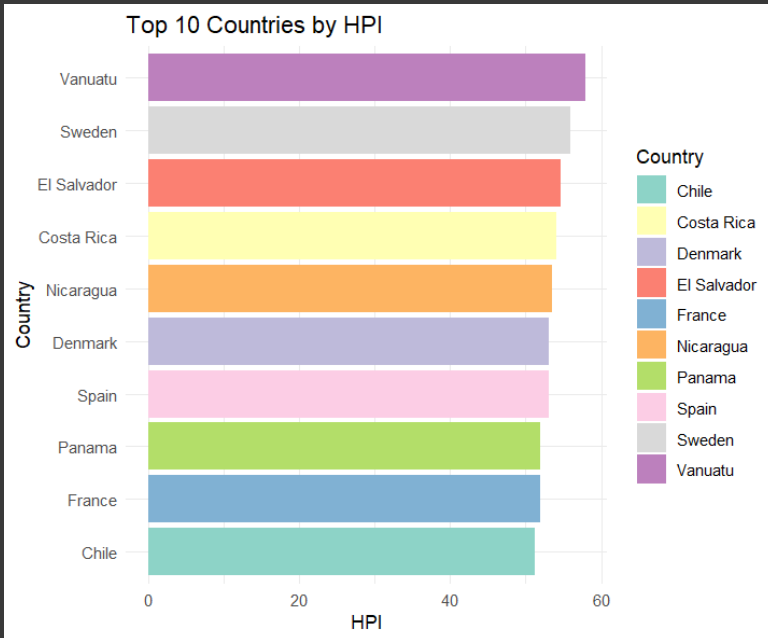
HISTOGRAM

```
ggplot(mydata, aes(x = `GDP per capita ($)`)) +  
  geom_histogram(fill = "darkgreen", color = "black", bins = 30) +  
  labs(x = "GDP per Capita ($)", y = "Frequency",  
       title = "Distribution of GDP per Capita") +  
  theme_minimal()
```



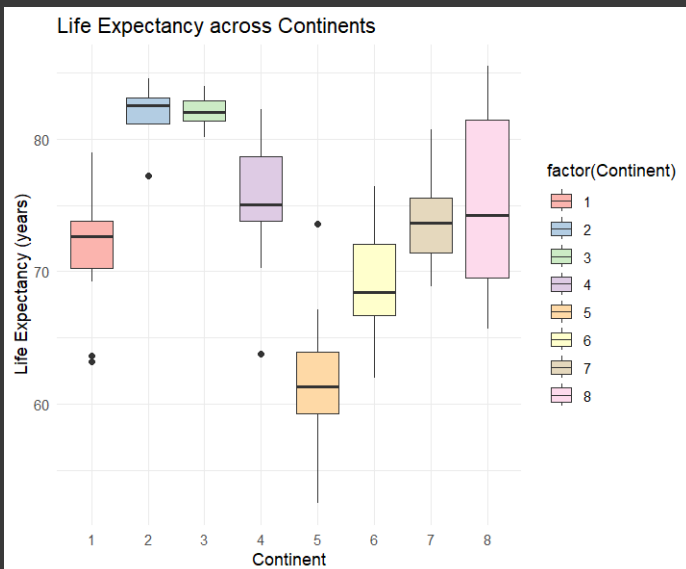
BAR PLOT

```
top10_hpi <- mydata[order(-mydata$HPI),][1:10,]
ggplot(top10_hpi, aes(x = reorder(Country, HPI), y = HPI, fill = Country)) +
  geom_bar(stat = "identity") +
  coord_flip() +
  scale_fill_brewer(palette = "Set3") +
  labs(x = "Country", y = "HPI", title = "Top 10 Countries by HPI") +
  theme_minimal()
```



BOX PLOT

```
ggplot(mydata, aes(x = factor(Continent), y = `Life Expectancy (years)`, fill =
factor(Continent))) +
  geom_boxplot() +
  scale_fill_brewer(palette = "Pastel1") +
  labs(x = "Continent", y = "Life Expectancy (years)",
       title = "Life Expectancy across Continents") +
  theme_minimal()
```



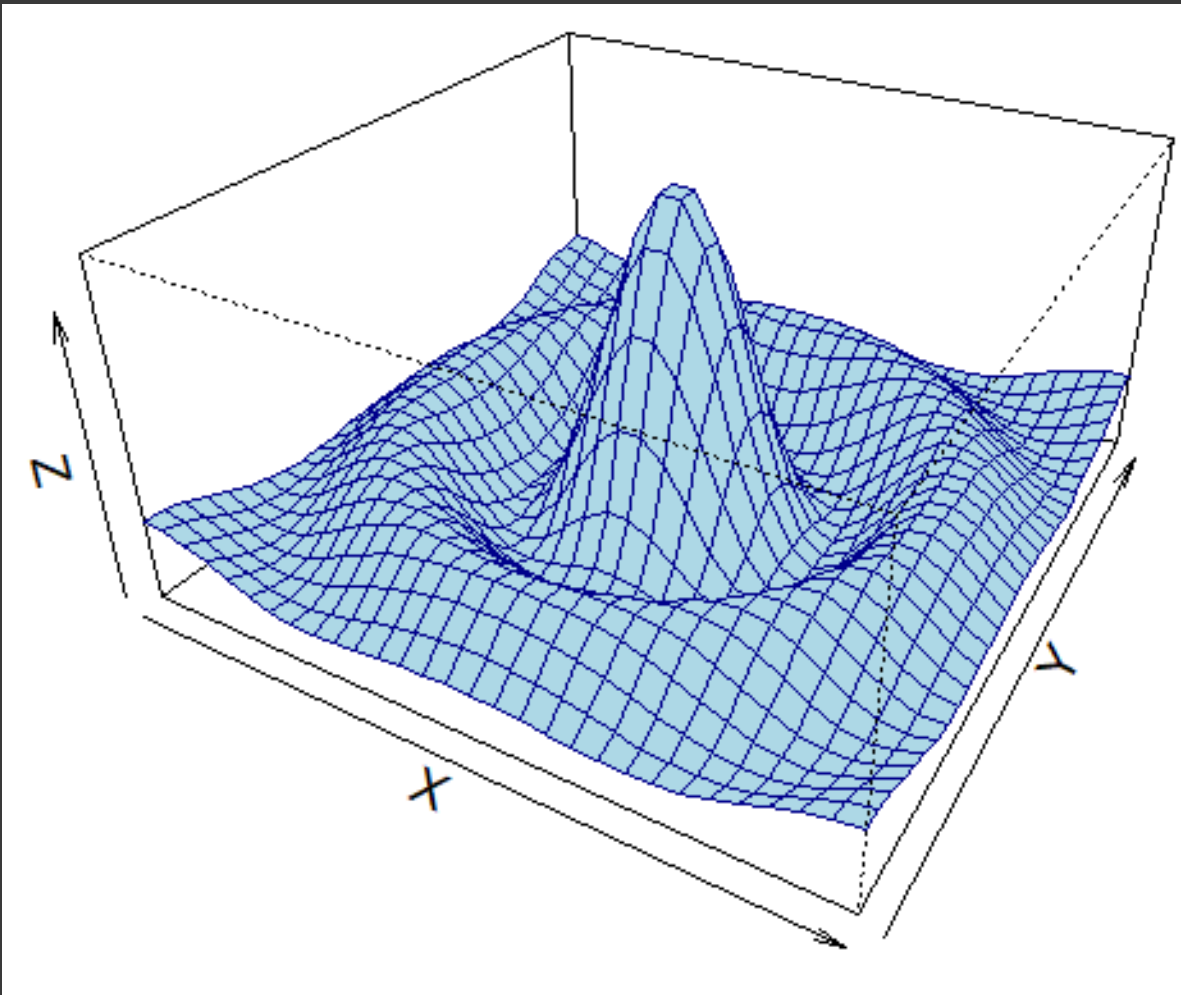
3D PERSPECTIVE PLOT

```
x <- seq(-10, 10, length=30)
y <- x

# Define the function for z values
f <- function(x, y) {
  r <- sqrt(x^2 + y^2)
  z <- sin(r) / r
  z[is.na(z)] <- 1 # Handle NaN values
  return(z)
}

# Create the z matrix
z <- outer(x, y, f)

# Create the 3D perspective plot
persp(x, y, z, theta = 30, phi = 30,
      expand = 0.5, col="lightblue", border="darkblue",
      xlab="X", ylab="Y", zlab="Z")
```



PIE CHART

```
continent_co2 <- aggregate(`CO2 threshold for year (tCO2e)` ~ Continent, data = mydata,
sum)
pie(continent_co2$`CO2 threshold for year (tCO2e)`,
  labels = continent_co2$Continent,
  col = rainbow(length(continent_co2$Continent)),
  main = "CO2 Thresholds by Continent")
```

