Class 10: Halloween Mini-Project

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```
candy_file <- "https://raw.githubusercontent.com/fivethirtyeight/data/master/candy-power-r
```

```
candy <- read.csv(candy_file, row.names = 1)
head(candy)
```

```
             chocolate fruity caramel peanutyalmondy nougat crispedricewafer
100 Grand            1      0       1              0      0                1
3 Musketeers         1      0       0              0      1                0
One dime             0      0       0              0      0                0
One quarter          0      0       0              0      0                0
Air Heads            0      1       0              0      0                0
Almond Joy           1      0       0              1      0                0
             hard bar pluribus sugarpercent pricepercent winpercent
100 Grand       0   1        0        0.732        0.860   66.97173
3 Musketeers    0   1        0        0.604        0.511   67.60294
One dime        0   0        0        0.011        0.116   32.26109
One quarter     0   0        0        0.011        0.511   46.11650
Air Heads       0   0        0        0.906        0.511   52.34146
Almond Joy      0   1        0        0.465        0.767   50.34755
```

Q1. How many different candy types are in this dataset?

```
n_candy_types <- nrow(candy)
n_candy_types
```

```
[1] 85
```

Q2. How many fruity candy types are in the dataset?

```
n_fruity_candies <- sum(candy$fruity == 1)
n_fruity_candies
```

```
[1] 38
```

Q3. What is your favorite candy in the dataset and what is it's winpercent value?

100 Grand

```
winpercent_100_grand <- candy["100 Grand", "winpercent"]

winpercent_100_grand
```

```
[1] 66.97173
```

Q4. What is the winpercent value for "Kit Kat"?

```
winpercent_kit_kat <- candy["Kit Kat", "winpercent"]
winpercent_kit_kat
```

```
[1] 76.7686
```

Q5. What is the winpercent value for "Tootsie Roll Snack Bars"?

```
winpercent_tootsie_roll <- candy["Tootsie Roll Snack Bars", "winpercent"]
winpercent_tootsie_roll
```

```
[1] 49.6535
```

```
install.packages("skimr")
```

```
Installing package into 'C:/Users/ITSloaner.DESKTOP-I89K3M9/AppData/Local/R/win-library/4.3'
(as 'lib' is unspecified)

package 'skimr' successfully unpacked and MD5 sums checked

The downloaded binary packages are in
    C:\Users\ITSloaner.DESKTOP-I89K3M9\AppData\Local\Temp\RtmpoBnDK2\downloaded_packages
```

```
library("skimr")
```

```
skim(candy)
```

Table 1: Data summary

Name	candy
Number of rows	85
Number of columns	12
_____	
Column type frequency:	
numeric	12
_____	
Group variables	None

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
chocolate	0	1	0.44	0.50	0.00	0.00	0.00	1.00	1.00	
fruity	0	1	0.45	0.50	0.00	0.00	0.00	1.00	1.00	
caramel	0	1	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
peanutyalmondy	0	1	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
nougat	0	1	0.08	0.28	0.00	0.00	0.00	0.00	1.00	
crispedricewafer	0	1	0.08	0.28	0.00	0.00	0.00	0.00	1.00	
hard	0	1	0.18	0.38	0.00	0.00	0.00	0.00	1.00	
bar	0	1	0.25	0.43	0.00	0.00	0.00	0.00	1.00	
pluribus	0	1	0.52	0.50	0.00	0.00	1.00	1.00	1.00	
sugarpercent	0	1	0.48	0.28	0.01	0.22	0.47	0.73	0.99	
pricepercent	0	1	0.47	0.29	0.01	0.26	0.47	0.65	0.98	
winpercent	0	1	50.32	14.71	22.45	39.14	47.83	59.86	84.18	

Q6. Is there any variable/column that looks to be on a different scale to the majority of the other columns in the dataset?

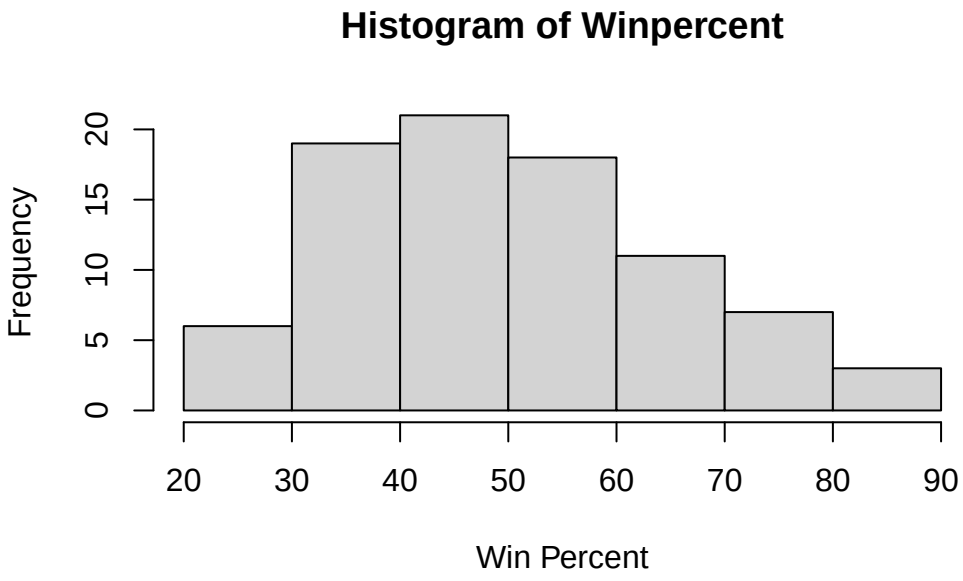
Yes, sugarpercent, pricepercent, and winpercent which appear to have values randing from between -.01 to near 1.00 values and even larger numbers above 50, whereas all other columns strictly have values at 0.00 or 1.00 only.

Q7. What do you think a zero and one represent for the candy$chocolate column?

1 is that it has chocolate and 0 is that it does not have chocolate

Q8. Plot a histogram of winpercent values

```
hist(candy$winpercent, main="Histogram of Winpercent", xlab="Win Percent")
```



Q9. Is the distribution of winpercent values symmetrical?

Distribution is skewed to the right

Q10. Is the center of the distribution above or below 50%?

Center is above 50%

Q11. On average is chocolate candy higher or lower ranked than fruit candy?

```r
avg_chocolate <- mean(candy$winpercent[candy$chocolate == 1])
avg_fruity <- mean(candy$winpercent[candy$fruity == 1])
avg_chocolate
```

```
[1] 60.92153
```

```r
avg_fruity
```

```
[1] 44.11974
```

Chocolate is higher ranked

Q12. Is this difference statistically significant?

```r
t.test(candy$winpercent[candy$chocolate == 1], candy$winpercent[candy$fruity == 1])
```

```
    Welch Two Sample t-test

data:  candy$winpercent[candy$chocolate == 1] and candy$winpercent[candy$fruity == 1]
t = 6.2582, df = 68.882, p-value = 2.871e-08
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 11.44563 22.15795
sample estimates:
mean of x mean of y
 60.92153  44.11974
```

Q13. What are the five least liked candy types in this set?

```r
least_liked <- head(candy[order(candy$winpercent), ], n = 5)
least_liked
```

```
                  chocolate fruity caramel peanutyalmondy nougat
Nik L Nip                 0      1       0              0      0
Boston Baked Beans        0      0       0              1      0
Chiclets                  0      1       0              0      0
Super Bubble              0      1       0              0      0
```

```
Jawbusters                  0      1       0              0      0
                  crispedricewafer hard bar pluribus sugarpercent pricepercent
Nik L Nip                        0    0   0        1        0.197        0.976
Boston Baked Beans               0    0   0        1        0.313        0.511
Chiclets                         0    0   0        1        0.046        0.325
Super Bubble                     0    0   0        0        0.162        0.116
Jawbusters                       0    1   0        1        0.093        0.511
                  winpercent
Nik L Nip           22.44534
Boston Baked Beans  23.41782
Chiclets            24.52499
Super Bubble        27.30386
Jawbusters          28.12744
```

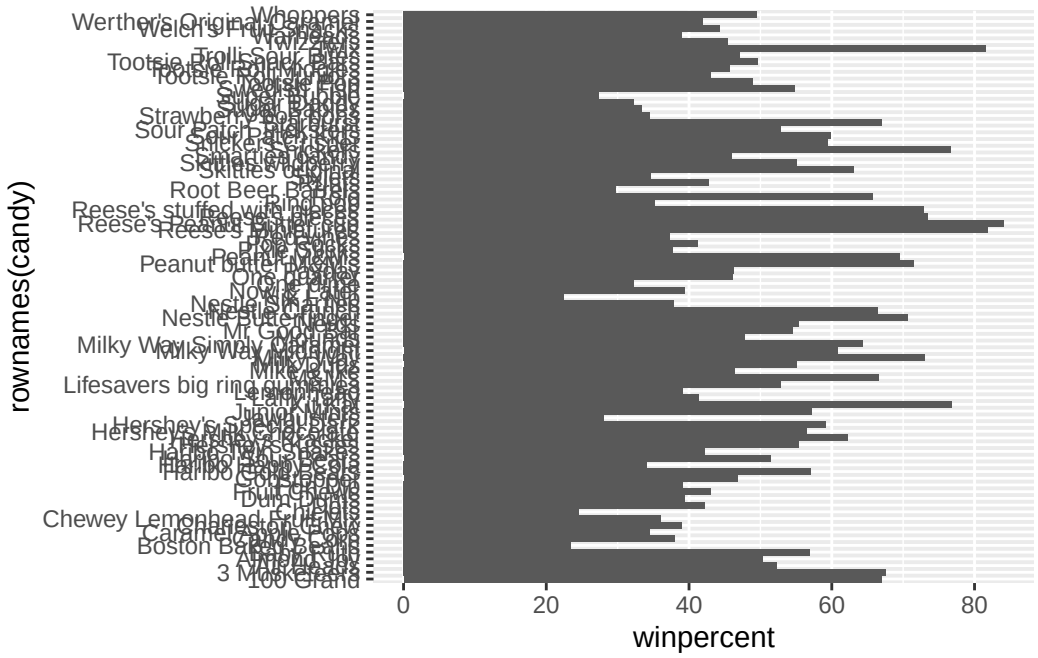
Q14. What are the top 5 all time favorite candy types out of this set?

```
most_liked <- head(candy[order(candy$winpercent, decreasing = TRUE), ], n = 5)
most_liked
```

```
                        chocolate fruity caramel peanutyalmondy nougat
Reese's Peanut Butter cup         1      0       0              1      0
Reese's Miniatures                1      0       0              1      0
Twix                              1      0       1              0      0
Kit Kat                           1      0       0              0      0
Snickers                          1      0       1              1      1
                        crispedricewafer hard bar pluribus sugarpercent
Reese's Peanut Butter cup                0    0   0        0        0.720
Reese's Miniatures                       0    0   0        0        0.034
Twix                                     1    0   1        0        0.546
Kit Kat                                  1    0   1        0        0.313
Snickers                                 0    0   1        0        0.546
                        pricepercent winpercent
Reese's Peanut Butter cup        0.651   84.18029
Reese's Miniatures               0.279   81.86626
Twix                             0.906   81.64291
Kit Kat                          0.511   76.76860
Snickers                         0.651   76.67378
```

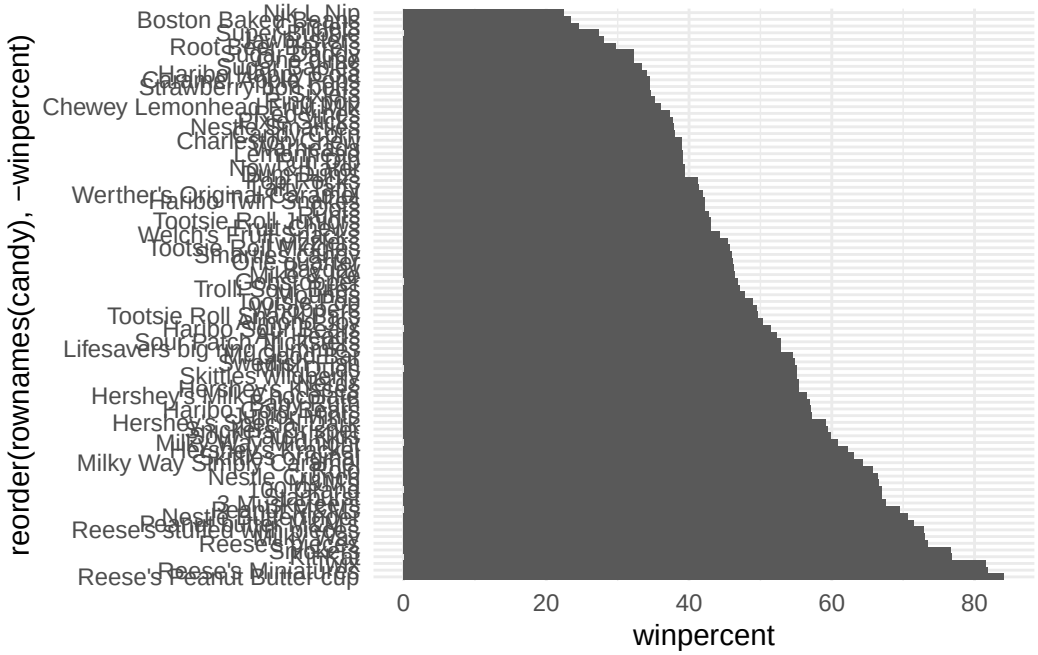
Q15. Make a first barplot of candy ranking based on winpercent values.

```
library(ggplot2)
ggplot(candy) +
  aes(winpercent, rownames(candy)) +
  geom_bar(stat = "identity")
```



Q16. This is quite ugly, use the reorder() function to get the bars sorted by winpercent?

```
library(ggplot2)
ggplot(candy, aes(x = reorder(rownames(candy), -winpercent), y = winpercent)) +
geom_bar(stat = "identity") +
coord_flip() +
theme_minimal()
```



Q17. What is the worst ranked chocolate candy?

```
worst_chocolate <- candy[candy$chocolate == 1, ] [which.min(candy[candy$chocolate == 1, "w
worst_chocolate
```

```
        chocolate fruity caramel peanutyalmondy nougat crispedricewafer hard
Sixlets         1      0       0              0      0                 0    0
        bar pluribus sugarpercent pricepercent winpercent
Sixlets   0        1         0.22        0.081     34.722
```

Q18. What is the best ranked fruity candy?

```
best_fruity <- candy[candy$fruity == 1, ] [which.max(candy[candy$fruity == 1, "winpercent"
best_fruity
```

```
          chocolate fruity caramel peanutyalmondy nougat crispedricewafer hard
Starburst         0      1       0              0      0                 0    0
          bar pluribus sugarpercent pricepercent winpercent
Starburst   0        1        0.151         0.22   67.03763
```

```
install.packages("ggrepel")
```

```
Installing package into 'C:/Users/ITSloaner.DESKTOP-I89K3M9/AppData/Local/R/win-library/4.3'
(as 'lib' is unspecified)
```

```
package 'ggrepel' successfully unpacked and MD5 sums checked
```

```
The downloaded binary packages are in
    C:\Users\ITSloaner.DESKTOP-I89K3M9\AppData\Local\Temp\RtmpoBnDK2\downloaded_packages
```

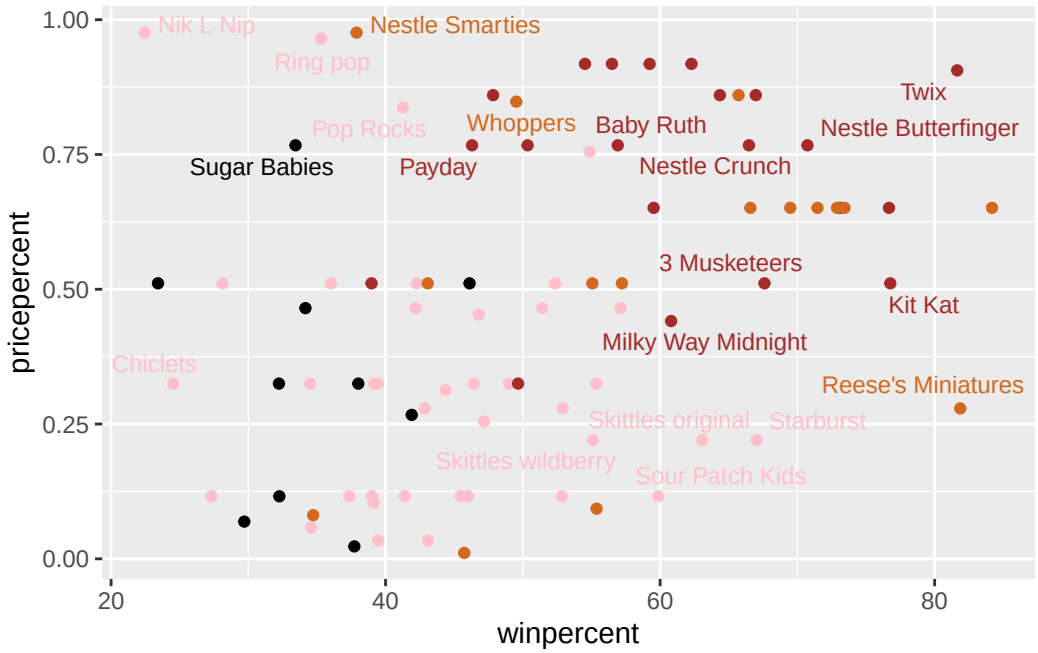
```
library(ggrepel)
```

Q19. Which candy type is the highest ranked in terms of winpercent for the least money - i.e. offers the most bang for your buck?

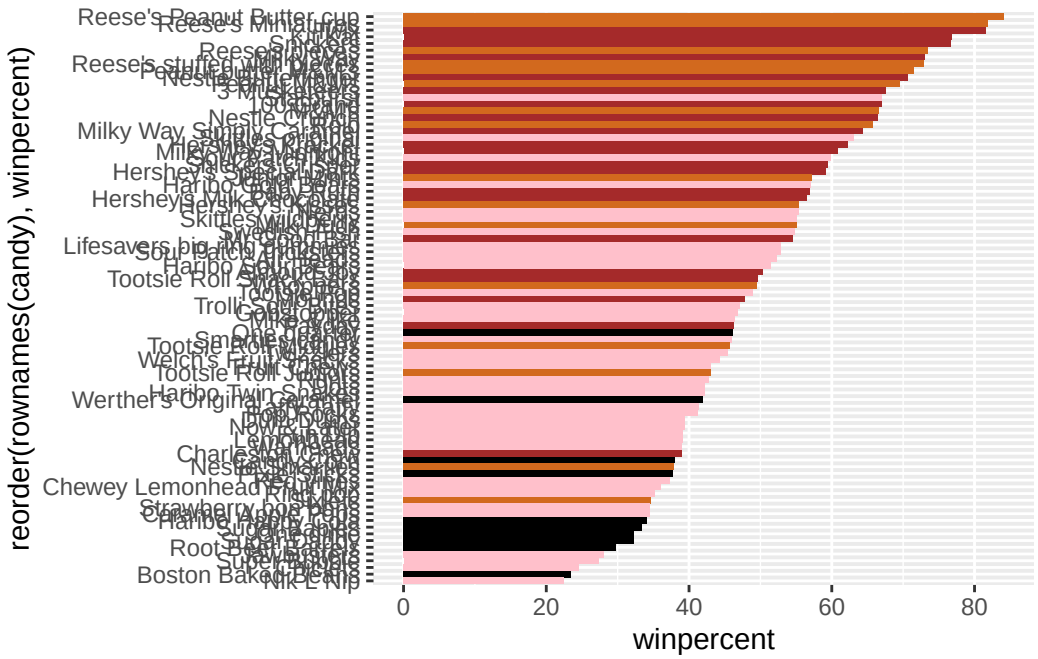
```
my_cols=rep("black", nrow(candy))
my_cols[as.logical(candy$chocolate)] = "chocolate"
my_cols[as.logical(candy$bar)] = "brown"
my_cols[as.logical(candy$fruity)] = "pink"
```

```
ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols, size=3.3, max.overlaps = 5)
```

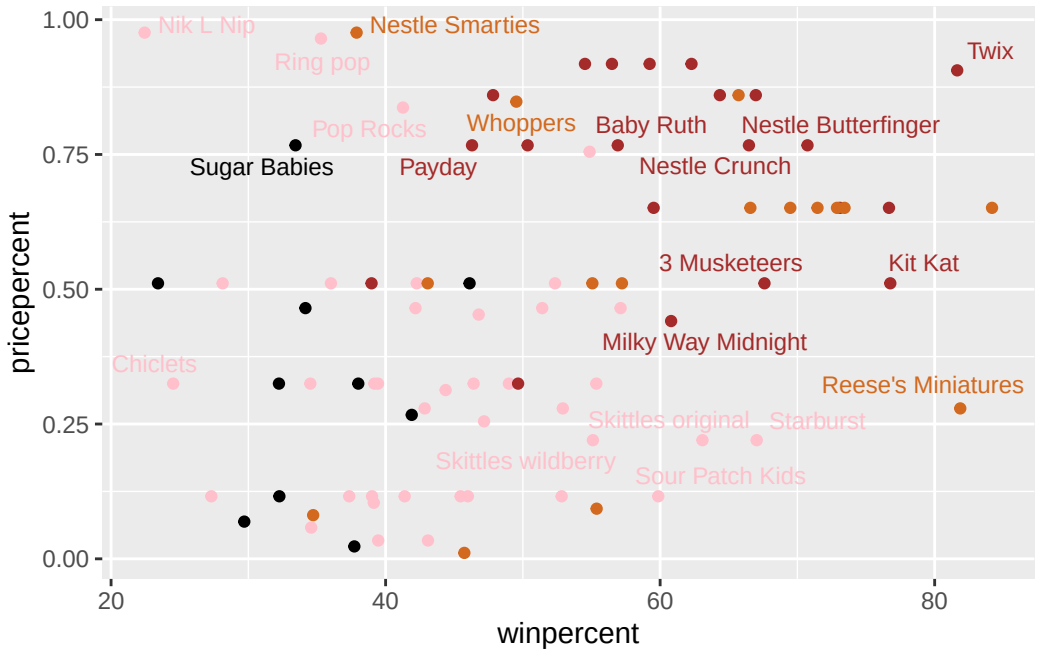
```
Warning: ggrepel: 65 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```




```
ggplot(candy) +
  aes(winpercent, reorder(rownames(candy),winpercent)) +
  geom_col(fill=my_cols)
```




```
ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols, size=3.3, max.overlaps = 5)
```



Reese'e Minatures

Q20. What are the top 5 most expensive candy types in the dataset and of these which is the least popular?

```
ord <- order(candy$pricepercent, decreasing = TRUE)
expensive_candies <- head(candy[ord, ], n = 5)
print(expensive_candies)
```

```
                      chocolate fruity caramel peanutyalmondy nougat
Nik L Nip                     0      1       0              0      0
Nestle Smarties               1      0       0              0      0
Ring pop                      0      1       0              0      0
Hershey's Krackel             1      0       0              0      0
Hershey's Milk Chocolate      1      0       0              0      0
                      crispedricewafer hard bar pluribus sugarpercent
Nik L Nip                            0    0   0        1        0.197
Nestle Smarties                      0    0   0        1        0.267
Ring pop                             0    1   0        0        0.732
Hershey's Krackel                    1    0   1        0        0.430
Hershey's Milk Chocolate             0    0   1        0        0.430
                      pricepercent winpercent
```

```
Nik L Nip                       0.976   22.44534
Nestle Smarties                 0.976   37.88719
Ring pop                        0.965   35.29076
Hershey's Krackel               0.918   62.28448
Hershey's Milk Chocolate        0.918   56.49050
```

```
install.packages("corrplot")
```

```
Installing package into 'C:/Users/ITSloaner.DESKTOP-I89K3M9/AppData/Local/R/win-library/4.3'
(as 'lib' is unspecified)
```

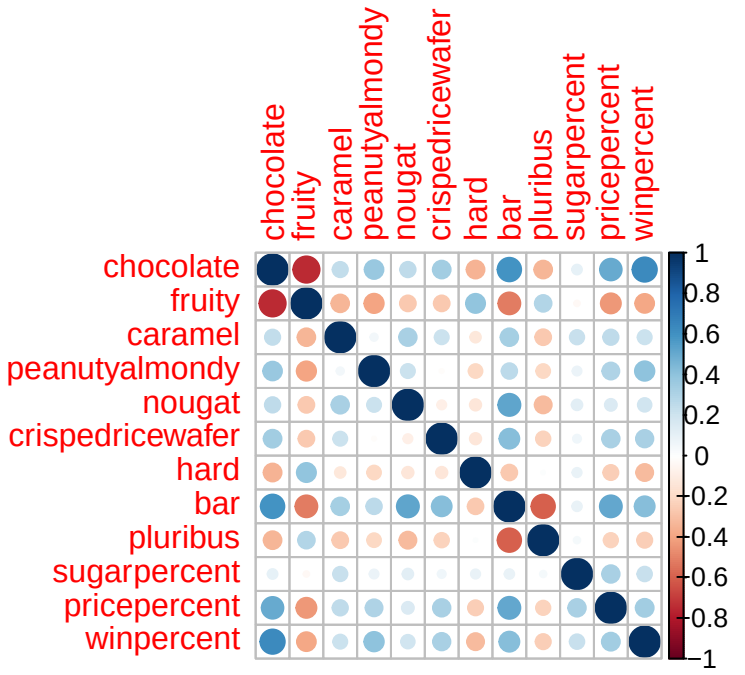
```
package 'corrplot' successfully unpacked and MD5 sums checked
```

```
The downloaded binary packages are in
    C:\Users\ITSloaner.DESKTOP-I89K3M9\AppData\Local\Temp\RtmpoBnDK2\downloaded_packages
```

```
library(corrplot)
```

```
corrplot 0.92 loaded
```

```
cij <- cor(candy)
corrplot(cij)
```



Q22. Examining this plot what two variables are anti-correlated (i.e. have minus values)?

Chocolate & sugarpercent

Q23. Similarly, what two variables are most positively correlated?

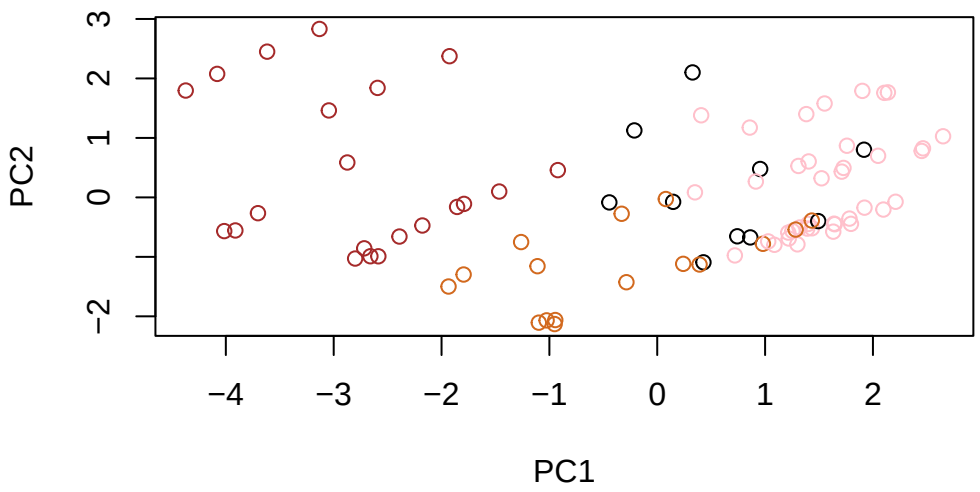
Chocolate & nougat

Q24. What original variables are picked up strongly by PC1 in the positive direction? Do these make sense to you?

```
pca <- prcomp(candy[, -1], scale. = TRUE)
summary(pca)
```

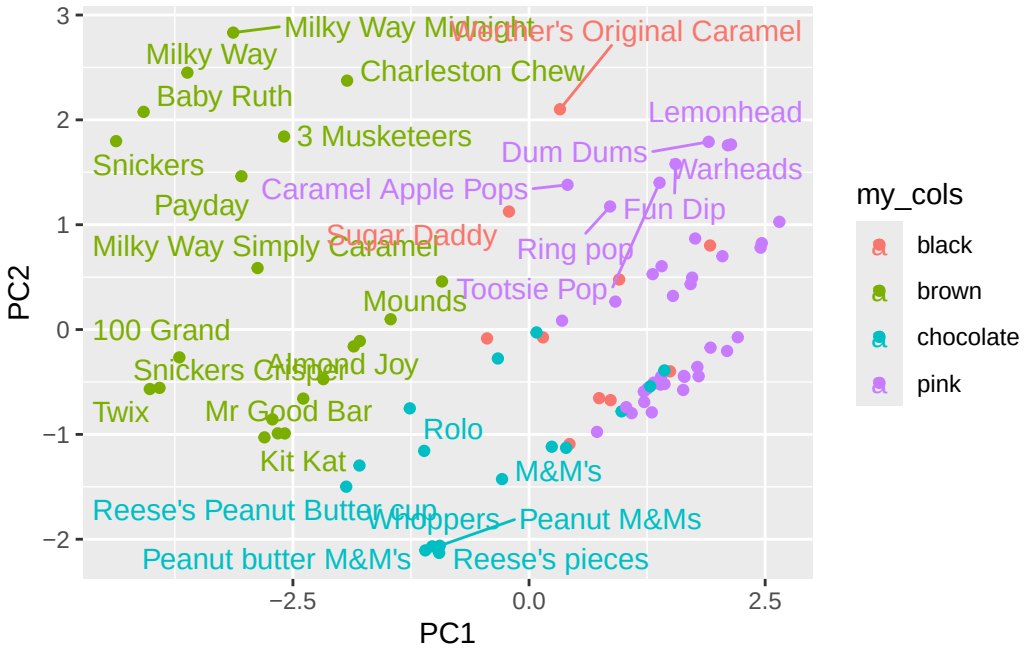
```
Importance of components:
                          PC1    PC2    PC3    PC4     PC5     PC6     PC7
Standard deviation     1.9200 1.1143 1.1085 1.0751 0.95010 0.81815 0.81352
Proportion of Variance 0.3351 0.1129 0.1117 0.1051 0.08206 0.06085 0.06016
Cumulative Proportion  0.3351 0.4480 0.5597 0.6648 0.74685 0.80770 0.86787
                           PC8     PC9    PC10    PC11
Standard deviation     0.68950 0.64410 0.60875 0.43887
Proportion of Variance 0.04322 0.03772 0.03369 0.01751
Cumulative Proportion  0.91109 0.94880 0.98249 1.00000
```

```
plot(pca$x[, 1:2], col = my_cols)
```




```
# Adding color and labels to PCA plot
ggplot(as.data.frame(pca$x[, 1:2]), aes(x = PC1, y = PC2, color = my_cols, label = rowname
geom_point() +
geom_text_repel()
```

```
Warning: ggrepel: 54 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```


Milky Way Midnight
Milky Way
Baby Ruth
Charleston Chew
Wonka's Original Caramel
Lemonhead
3 Musketeers
Dum Dums
Snickers
Warheads
Caramel Apple Pops
Payday
Fun Dip
Sugar Daddy
Milky Way Simply Caramel
Ring pop
Tootsie Pop
Mounds
100 Grand
Snickers Crisper
Almond Joy
Twix
Mr Good Bar
Rolo
Kit Kat
M&M's
Reese's Peanut Butter cup
Whoppers
Peanut M&Ms
Peanut butter M&M's
Reese's pieces
PC2
PC1
3
2
1
0
−1
−2
−2.5
0.0
2.5
my_cols
black
brown
chocolate
pink