lab10-miniproject

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Happy Halloween!!

1. Importing candy data

```
#reading in data and loading packages
candy <- read.csv("candy-data.csv", 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
```

```r
library(dplyr)
```

```
Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

    filter, lag

The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

```r
library(skimr)
library(rlang)
library(ggplot2)
```

The functions dim(), nrow(), table() and sum() may be useful for answering the first 2 questions.

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

```r
nrow(candy)
```

```
[1] 85
```

There are 85 candy types

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

```r
sum(candy$fruity==1)
```

```
[1] 38
```

There are 38 fruity candy types in the dataset

2. What is your favorate candy?

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

```r
#example -- candy["Twix", ]$winpercent
candy["Reese's Peanut Butter cup", ]$winpercent
```

```
[1] 84.18029
```

I love Reese’s peanut butter cups, winpercent value 84.18029

> Q4. What is the winpercent value for “Kit Kat”?

```r
candy["Kit Kat", ]$winpercent
```

```
[1] 76.7686
```

76.7686

> Q5. What is the winpercent value for “Tootsie Roll Snack Bars”?

```r
candy["Tootsie Roll Snack Bars", ]$winpercent
```

```
[1] 49.6535
```

49.6535

Hin (6 and 7): look at the “Variable type” print out from the skim() function. Most varables (i.e. columns) are on the zero to one scale but not all. Some columns such as chocolate are exclusively either zero or one values.

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

```r
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	

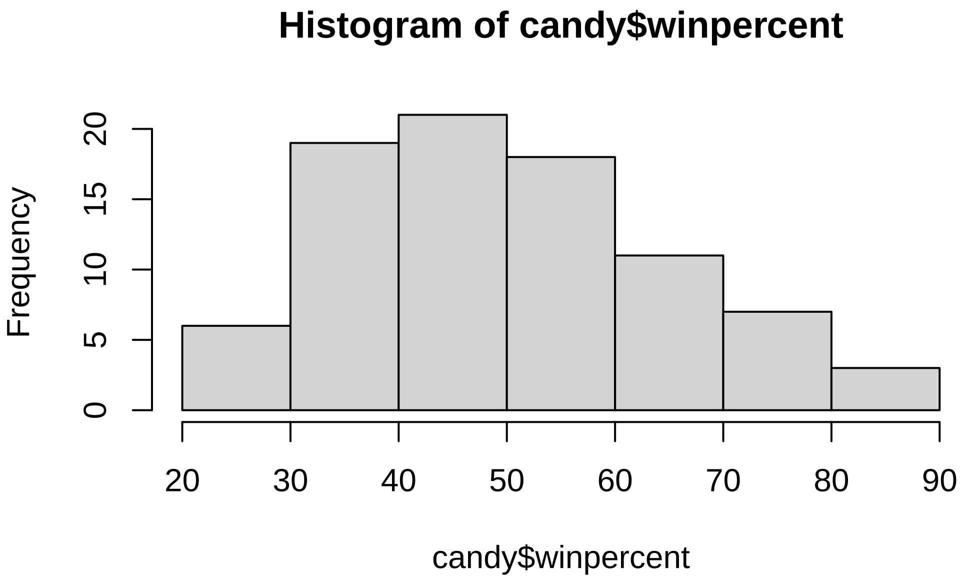
winpercent appears to be the only row with a mean more than 1, or without 0-1 values.

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

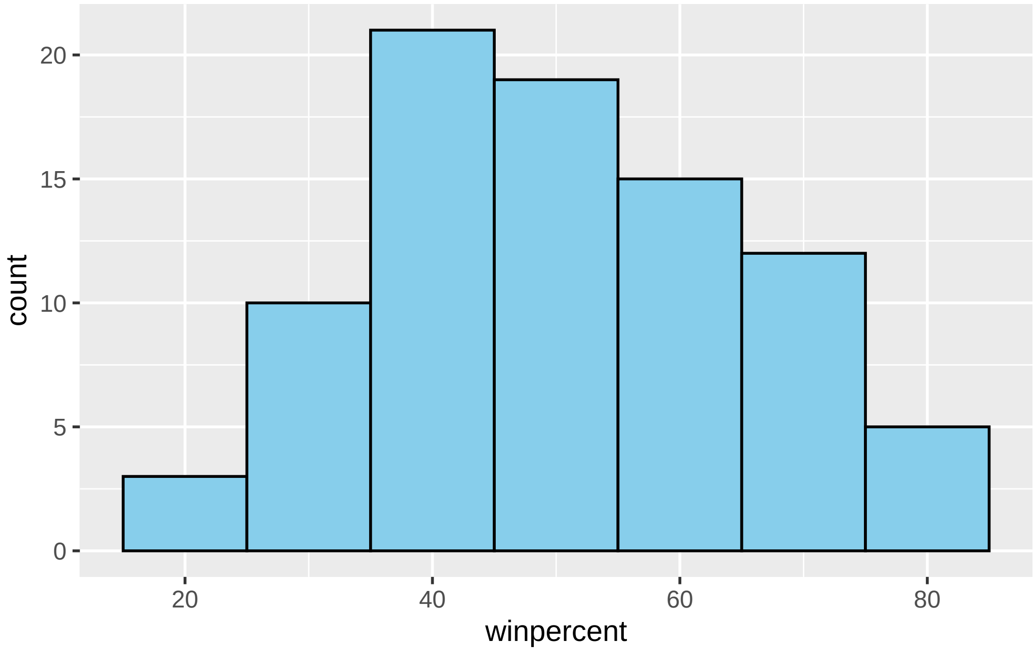
0 and 1 likely represent yes or no. For example, is this candy specified (for example, Air Heads) a chocolate. It is not, according to the dataset given by its value of zero. I agree with this evaluation.

> Q8. Plot a histogram of winpercent values

```r
hist(candy$winpercent)
```



```
ggplot(candy,aes(winpercent))+
  geom_histogram(binwidth=10,fill="skyblue", col="black")
```



Q9. Is the distribution of winpercent values symmetrical?

```r
mean(candy$winpercent)
```

```
[1] 50.31676
```

```r
median(candy$winpercent)
```

```
[1] 47.82975
```

median<mean - data appears to have a slight left skew.

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

median<mean - center is below 50%.

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

```r
#need to find winpercent value for chocolate candy?

choc<- candy$chocolate==1 #defining chocolate candy
fruit<-candy$fruit==1 #defining fruit candy

choc.winp<-candy[choc,]$winpercent
fruit.winp<-candy[fruit,]$winpercent

choc.winp.avg<-mean(choc.winp) #mean of choc candy winpercent col.
fruit.winp.avg<-mean(fruit.winp) #mean of fruit candy winpercent col.

choc.winp.avg>fruit.winp.avg
```

```
[1] TRUE
```

Yes it is.

> Q12. Is this difference statistically significant?

```r
t.test(choc.winp,fruit.winp)
```

```
    Welch Two Sample t-test

data:  choc.winp and fruit.winp
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 
```

The difference **is** statistically significant.

##3. Overall Candy Rankings

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

```
library(dplyr)

candy.desc<-candy%>%
  arrange(winpercent)%>%
  head(5)
candy.desc
```

```
                   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
```

The 5 least popular candy are Nik L Nip, Boston Baked Beans, Chiclets, Super Bubble, and Jawbusters

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

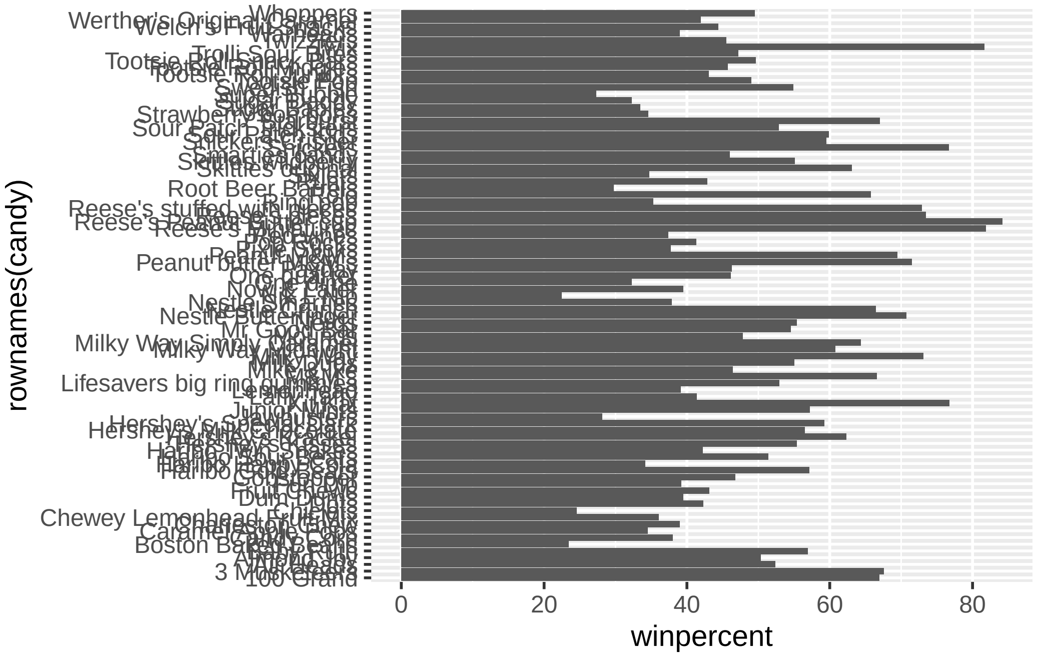
```r
candy.asc<-candy%>%
  arrange(winpercent)%>%
  tail(5)
candy.asc
```

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

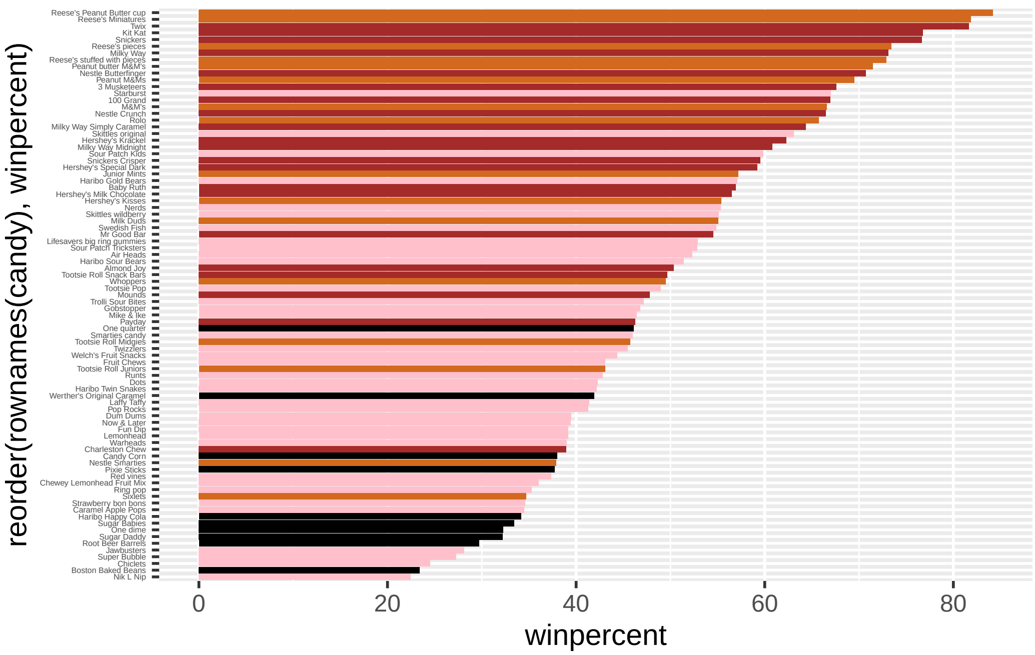
The 5 most popular are Reese’s Peanut Butter cups, Reese’s Miniatures, Twix, Kit Kat, Snickers.

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

```r
#simple plot not ordered
ggplot(candy,aes(winpercent,rownames(candy)))+
  geom_bar(stat="identity")
```



```
#defining colours
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"

#plot organised by colour
ggplot(candy) +
  aes(winpercent, reorder(rownames(candy),winpercent)) +
  geom_col(fill=my_cols) +
  theme(axis.text.y = element_text(size = 3))
```



Now, for the first time, using this plot we can answer questions like: > Q17. What is the worst ranked chocolate candy?

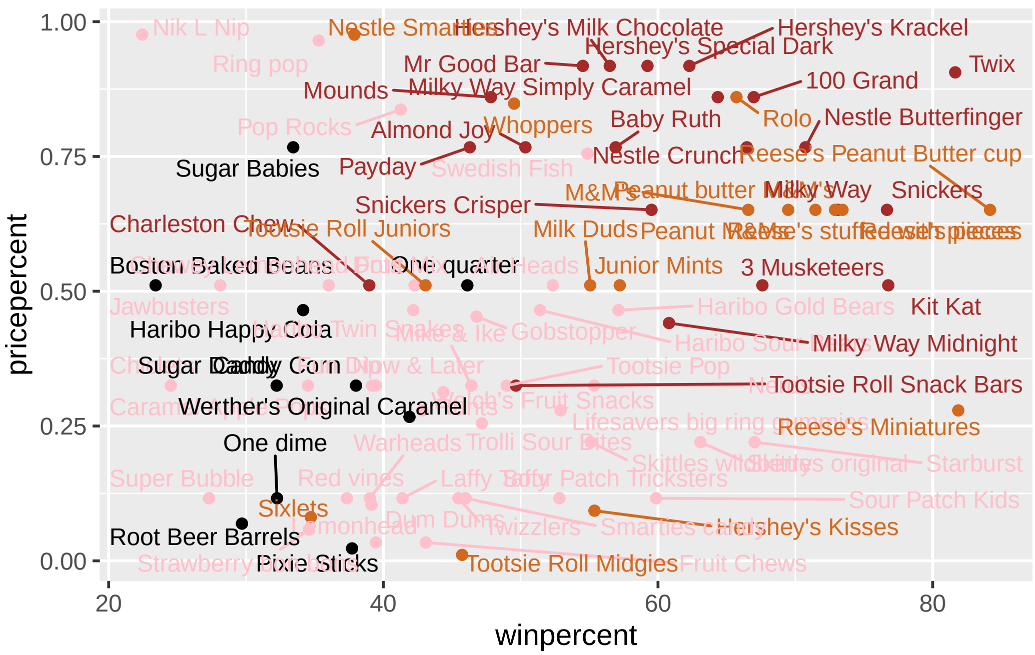
Sixlets

> Q18. What is the best ranked fruity candy?

Starburst

4. Taking a look at pricepercent

```
library(ggrepel)

# How about a plot of price vs win
ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols, size=3.3, max.overlaps = 30)
```



> 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?

Reese's Miniatures

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

```r
ord <- order(candy$pricepercent, decreasing = TRUE)
head(candy[ord,c(11,12)], n=5)
```

```
                         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
```

Nik L Nip, Nestle Smarties, Ring pop, Hershey's Krackel, Hershey's Milk Chocolate

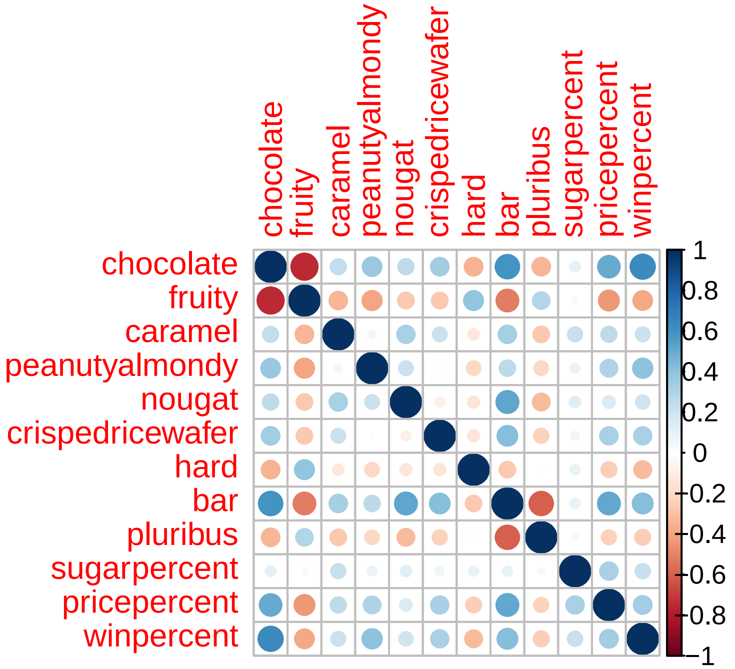
> OPTIONAL Q21. Make a barplot again with geom_col() this time using pricepercent and then improve this step by step, first ordering the x-axis by value and finally making a so called "dot chat" or "lollipop" chart by swapping geom_col() for geom_point() + geom_segment().

5 Exploring the correlation structure

```r
library(corrplot)
```

```
corrplot 0.95 loaded
```

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



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

Fruity and Chocolate

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

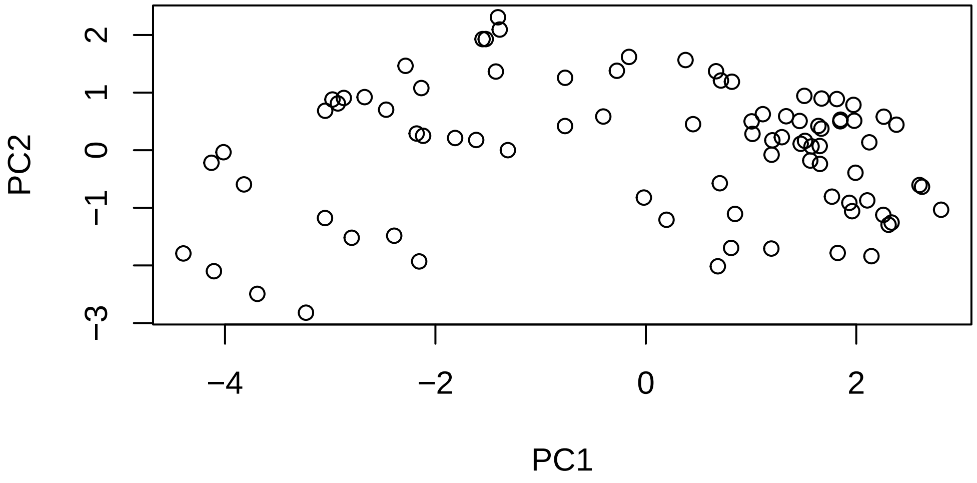
Bar and Chocolate, Chocolate and Winpercent. I am choosing to not count the self comparisons (dark blue circles) since these will be 1 by default.

6. Principal Component Analysis

```
pca <- prcomp(candy, scale=TRUE)
summary(pca)
```

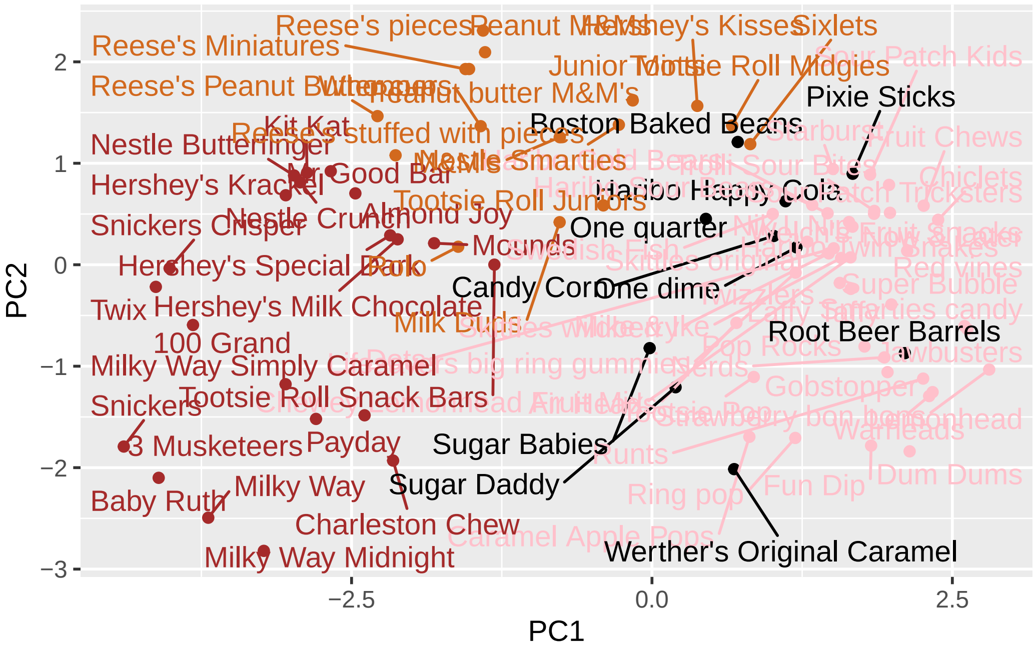
```
Importance of components:
                          PC1    PC2    PC3     PC4    PC5     PC6     PC7
Standard deviation     2.0788 1.1378 1.1092 1.07533 0.9518 0.81923 0.81530
Proportion of Variance 0.3601 0.1079 0.1025 0.09636 0.0755 0.05593 0.05539
Cumulative Proportion  0.3601 0.4680 0.5705 0.66688 0.7424 0.79830 0.85369
                           PC8     PC9    PC10    PC11    PC12
Standard deviation     0.74530 0.67824 0.62349 0.43974 0.39760
Proportion of Variance 0.04629 0.03833 0.03239 0.01611 0.01317
Cumulative Proportion  0.89998 0.93832 0.97071 0.98683 1.00000
```

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



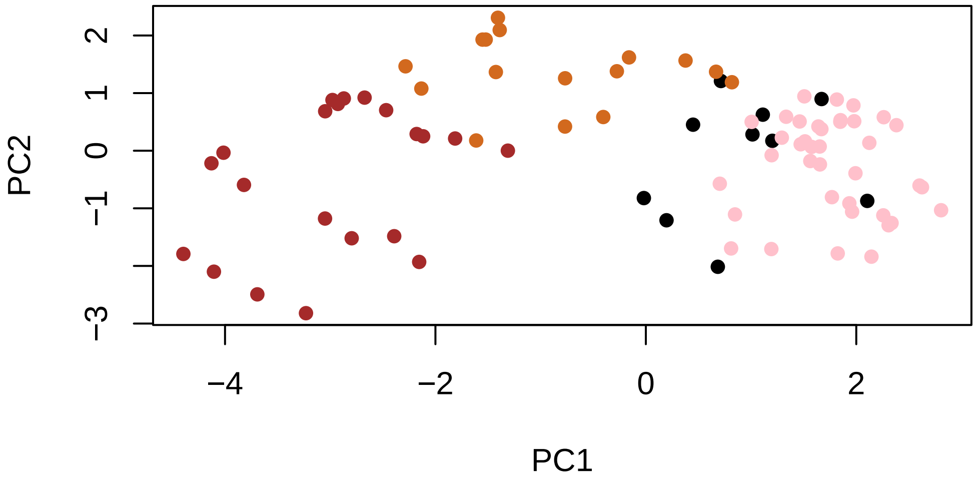
```
pc1<-pca$x[,1]
```

```r
ggplot(pca$x,aes(PC1,PC2,label=rownames(pca$x)))+
  geom_point(col=my_cols)+
  geom_text_repel(col=my_cols,max.overlaps=100) #increased max overlap to see everything - bu
```



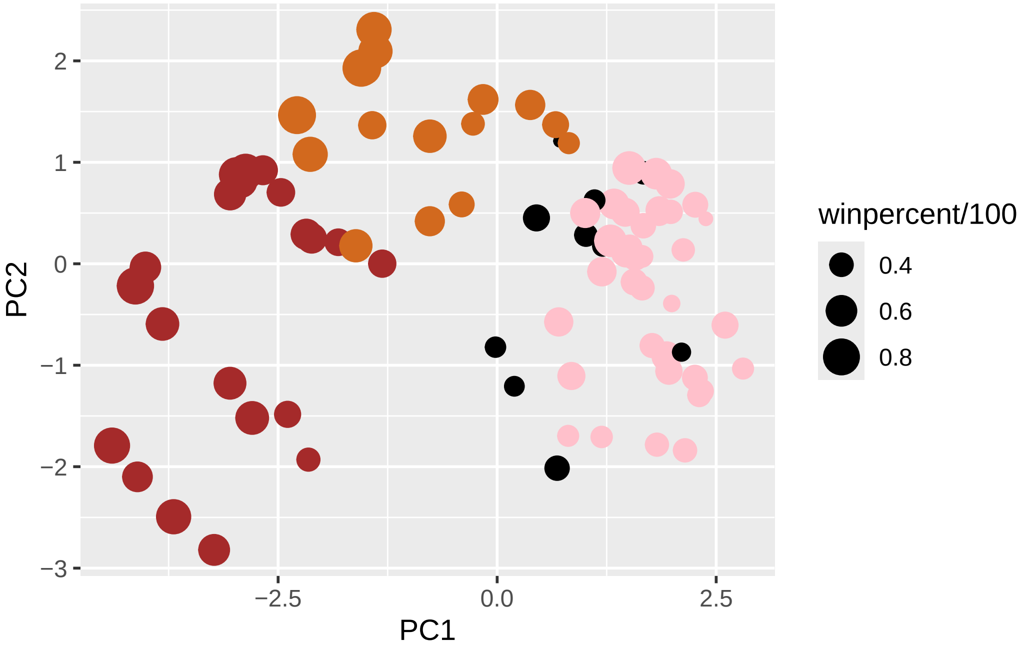
We can change the plotting character and add some color:

```r
plot(pca$x[,1:2], col=my_cols, pch=16)
```



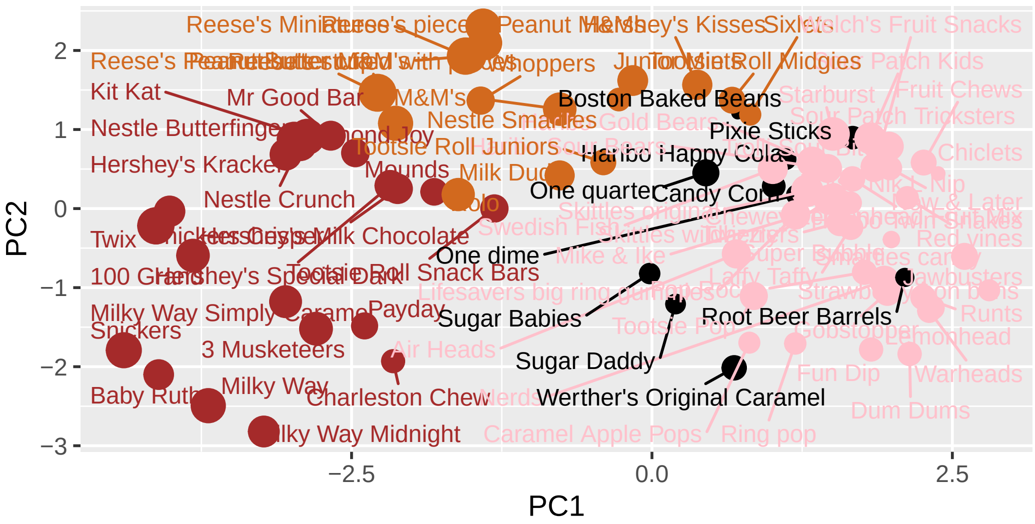
nicer plot with ggplot

```
# Make a new data-frame with our PCA results and candy data
my_data <- cbind(candy, pca$x[,1:3])

p <- ggplot(my_data) +
        aes(x=PC1, y=PC2,
            size=winpercent/100,
            text=rownames(my_data),
            label=rownames(my_data)) +
        geom_point(col=my_cols)

p
```



adding in labels

```
p + geom_text_repel(size=3.3, col=my_cols, max.overlaps = 50)  +
  theme(legend.position = "none") +
  labs(title="Halloween Candy PCA Space",
       subtitle="Colored by type: chocolate bar (dark brown), chocolate other (light brown),
       caption="Data from 538")
```



Halloween Candy PCA Space

Colored by type: chocolate bar (dark brown), chocolate other (light brown),

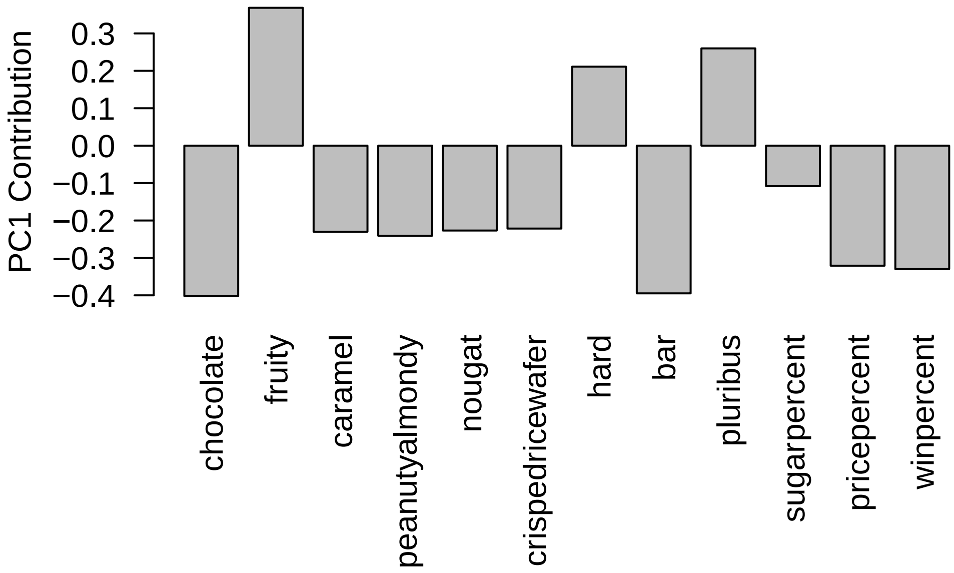
Data from 538

using plotly to generate an interactive plot

```
library(plotly)
```

```
Attaching package: 'plotly'

The following object is masked from 'package:ggplot2':

    last_plot

The following object is masked from 'package:stats':

    filter

The following object is masked from 'package:graphics':

    layout
```

```
#ggplotly(p)

par(mar=c(8,4,2,2))
barplot(pca$rotation[,1], las=2, ylab="PC1 Contribution")
```

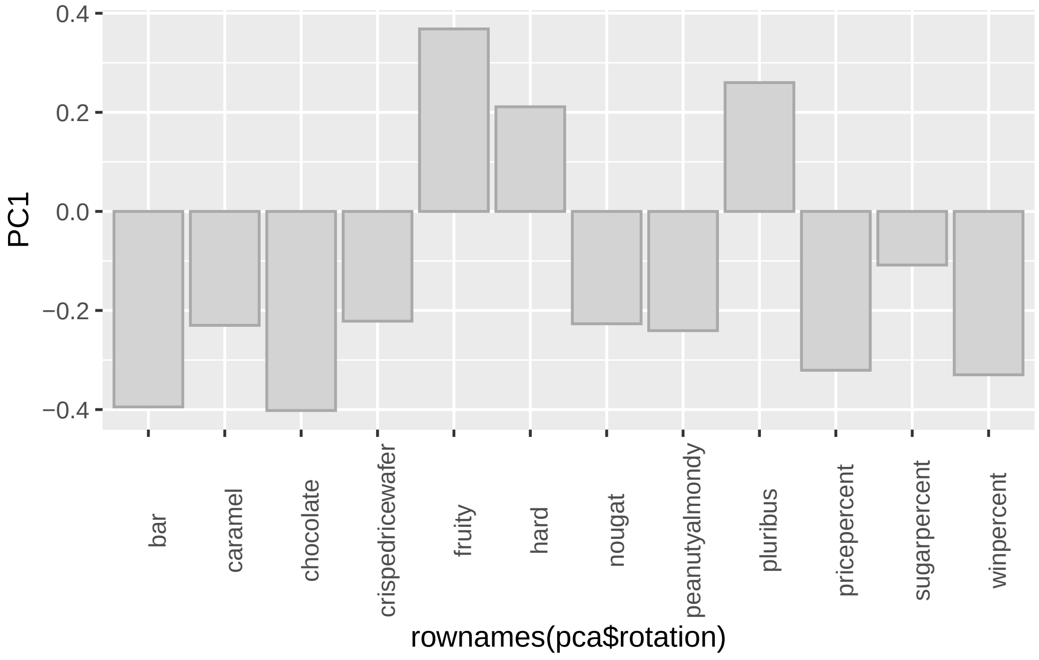


```r
pca$rotation
```

```
                        PC1         PC2         PC3          PC4          PC5
chocolate        -0.4019466  0.21404160 -0.01601358  0.016673032 -0.066035846
fruity            0.3683883 -0.18304666  0.13765612  0.004479829 -0.143535325
caramel          -0.2299709 -0.40349894  0.13294166  0.024889542  0.507301501
peanutyalmondy   -0.2407155  0.22446919 -0.18272802 -0.466784287 -0.399930245
nougat           -0.2268102 -0.47016599 -0.33970244 -0.299581403  0.188852418
crispedricewafer -0.2215182  0.09719527  0.36485542  0.605594730 -0.034652316
hard              0.2111587 -0.43262603  0.20295368  0.032249660 -0.574557816
bar              -0.3947433 -0.22255618 -0.10696092  0.186914549 -0.077794806
pluribus          0.2600041  0.36920922  0.26813772 -0.287246604  0.392796479
sugarpercent     -0.1083088 -0.23647379  0.65509692 -0.433896248 -0.007469103
pricepercent     -0.3207361  0.05883628  0.33048843 -0.063557149 -0.043358887
winpercent       -0.3298035  0.21115347  0.13531766 -0.117930997 -0.168755073
                         PC6         PC7         PC8          PC9         PC10
chocolate         0.09018950  0.08360642 -0.49084856  0.151651568  0.107661356
fruity            0.04266105 -0.46147889  0.39805802  0.001248306  0.362062502
caramel           0.40346502  0.44274741  0.26963447 -0.019186442  0.229799010
peanutyalmondy    0.09416259  0.25710489  0.45771445 -0.381068550 -0.145912362
nougat           -0.09012643 -0.36663902 -0.18793955 -0.385278987  0.011323453
crispedricewafer  0.09007640 -0.13077042  0.13567736 -0.511634999 -0.264810144
```

```
hard              0.12767365  0.31933477 -0.38881683 -0.258154433  0.220779142
bar              -0.25307332 -0.24192992 -0.02982691 -0.091872886 -0.003232321
pluribus         -0.03184932 -0.04066352 -0.28652547 -0.529954405  0.199303452
sugarpercent     -0.02737834 -0.14721840 -0.04114076  0.217685759 -0.488103337
pricepercent     -0.62908570  0.14308215  0.16722078  0.048991557  0.507716043
winpercent        0.56947283 -0.40260385 -0.02936405  0.124440117  0.358431235
                        PC11        PC12
chocolate        -0.10045278 -0.69784924
fruity           -0.17494902 -0.50624242
caramel          -0.13515820 -0.07548984
peanutyalmondy   -0.11244275 -0.12972756
nougat            0.38954473 -0.09223698
crispedricewafer  0.22615618 -0.11727369
hard             -0.01342330  0.10430092
bar              -0.74956878  0.22010569
pluribus         -0.27971527  0.06169246
sugarpercent     -0.05373286 -0.04733985
pricepercent      0.26396582  0.06698291
winpercent        0.11251626  0.37693153
```

```
ggplot(pca$rotation,aes(rownames(pca$rotation),y=PC1))+
  geom_bar(stat="identity",col="darkgrey",fill="lightgrey")+
  theme(axis.text.x = element_text(angle = 90))
```



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

Fruity is the strongest positive variable in PC1. Other positive variables that are not as strong are hard and pluribus. This means that these variables correlate together, which makes logical sense since most fruity candy is hard and come in multiples. As PC1 value goes up (further along the x axis), these variables increase.