Class 09: Halloween Mini-Project

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1: Import data

```
candy_file<-"candy-data.csv"
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
```

```
nrow(candy)
```

```
[1] 85
```

```
sum(candy$fruity)
```

```
[1] 38
```

```
dim(candy)
```

```
[1] 85 12
```

2: Favorite Candy

```
candy["Dum Dums",]$winpercent
```

```
[1] 39.46056
```

```
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
```

```
candy|>
filter( rownames(candy)=="Dum Dums")|>
  select(winpercent)
```

```
          winpercent
Dum Dums   39.46056
```

```
candy|>
filter( rownames(candy)=="Kit Kat")|>
  select(winpercent)
```

```
        winpercent
Kit Kat    76.7686
```

```
candy|>
  filter(rownames(candy)%in% c("Kit Kat", "Tootsie Roll Snack Bars"))|>
  select(winpercent)
```

```
                        winpercent
Kit Kat                    76.7686
Tootsie Roll Snack Bars    49.6535
```

`%in%` operator useful for checking the intersection

Install "skimr" in console

```
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

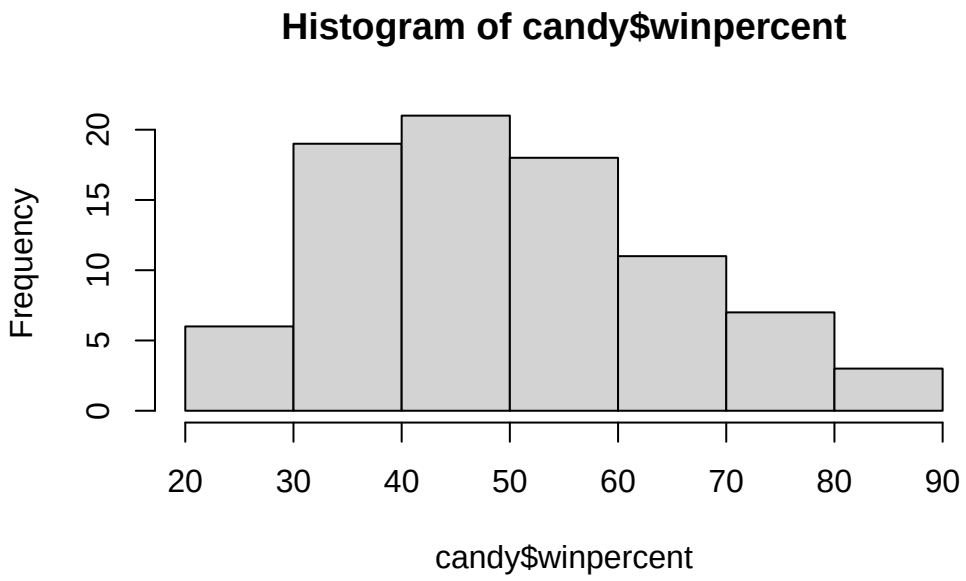
Variable type: numeric

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	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
winpercent	0	1	50.32	14.71	22.45	39.14	47.83	59.86	84.18	

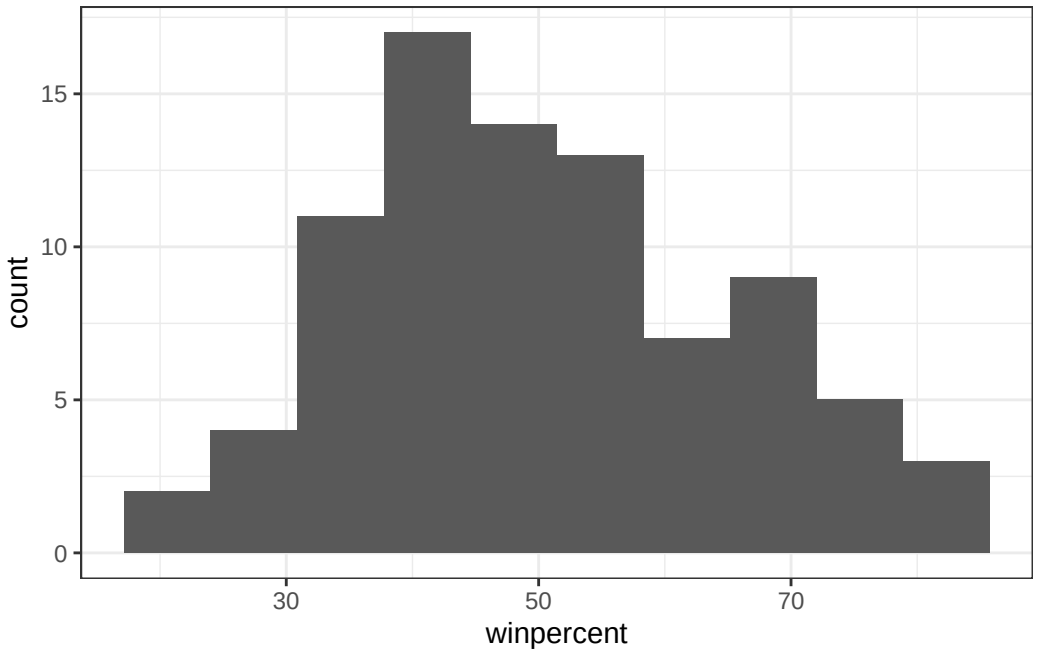
Q6:winpercent column is on a very different scale than the rest of the data. It will need to be scaled.

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




```
library(ggplot2)

ggplot(candy)+ aes(winpercent)+
  geom_histogram(bins=10)+
  theme_bw()
```




```
summary(candy$winpercent)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  22.45   39.14   47.83   50.32   59.86   84.18
```

Q11: Chocolate ranks higher than fruity candy

```
inds<-candy$chocolate==1
candy[inds,]$winpercent
```

```
 [1] 66.97173 67.60294 50.34755 56.91455 38.97504 55.37545 62.28448 56.49050
 [9] 59.23612 57.21925 76.76860 71.46505 66.57458 55.06407 73.09956 60.80070
[17] 64.35334 47.82975 54.52645 70.73564 66.47068 69.48379 81.86626 84.18029
[25] 73.43499 72.88790 65.71629 34.72200 37.88719 76.67378 59.52925 48.98265
[33] 43.06890 45.73675 49.65350 81.64291 49.52411
```

```
chocolate.win<-candy|>
  filter(chocolate==1)|>
  select(winpercent)
```

```r
fruit.win<-candy|>
  filter(fruity==1)|>
  select(winpercent)
```

```r
t.test(fruit.win,chocolate.win)
```

```
    Welch Two Sample t-test

data:  fruit.win and chocolate.win
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:
 -22.15795 -11.44563
sample estimates:
mean of x mean of y
 44.11974  60.92153
```

3: Candy Rankings

Lowest ranking candies: Nik L Nip,Boston Baked Beans,Chiclets,Super Bubble,Jawbusters Highest ranking candies: Reese's Peanut Butter cup,Reese's Miniatures,Twix,Kit Kat,Snickers

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

```
                  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
```

```
sort(candy$winpercent)
```

```
 [1] 22.44534 23.41782 24.52499 27.30386 28.12744 29.70369 32.23100 32.26109
 [9] 33.43755 34.15896 34.51768 34.57899 34.72200 35.29076 36.01763 37.34852
[17] 37.72234 37.88719 38.01096 38.97504 39.01190 39.14106 39.18550 39.44680
[25] 39.46056 41.26551 41.38956 41.90431 42.17877 42.27208 42.84914 43.06890
[33] 43.08892 44.37552 45.46628 45.73675 45.99583 46.11650 46.29660 46.41172
[41] 46.78335 47.17323 47.82975 48.98265 49.52411 49.65350 50.34755 51.41243
[49] 52.34146 52.82595 52.91139 54.52645 54.86111 55.06407 55.10370 55.35405
[57] 55.37545 56.49050 56.91455 57.11974 57.21925 59.23612 59.52925 59.86400
[65] 60.80070 62.28448 63.08514 64.35334 65.71629 66.47068 66.57458 66.97173
[73] 67.03763 67.60294 69.48379 70.73564 71.46505 72.88790 73.09956 73.43499
[81] 76.67378 76.76860 81.64291 81.86626 84.18029
```

```
inds<-order(candy$winpercent)
head(candy[inds,])
```

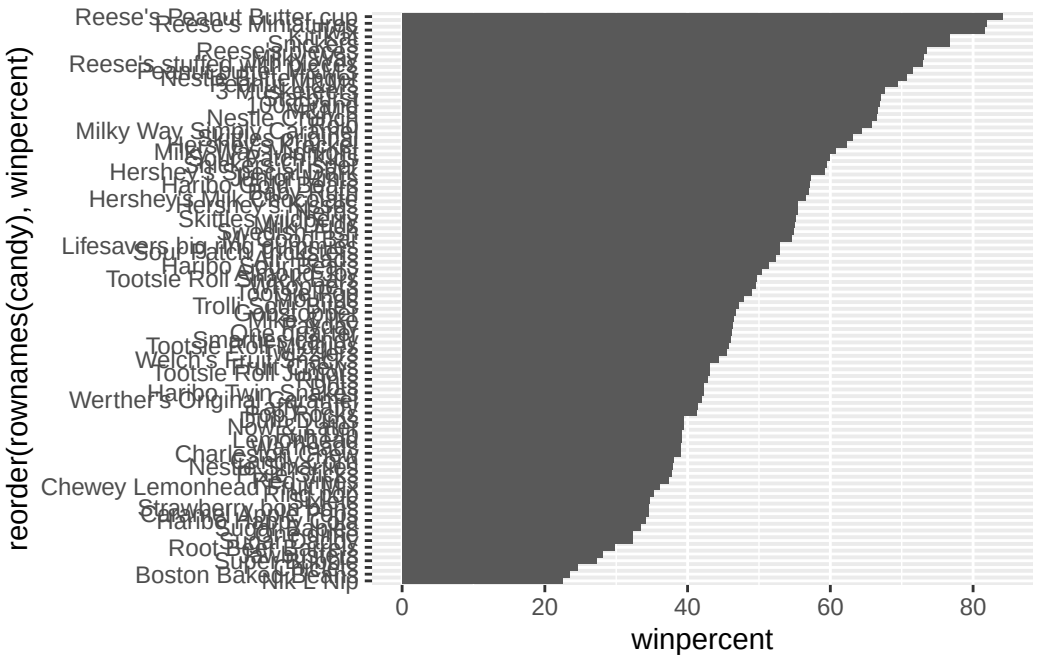
```
                  chocolate fruity caramel peanutyalmondy nougat
Nik L Nip                 0      1       0              0      0
Boston Baked Beans        0      0       0              1      0
Chiclets                  0      1       0              0      0
Super Bubble              0      1       0              0      0
Jawbusters                0      1       0              0      0
Root Beer Barrels         0      0       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
Root Beer Barrels                0    1   0        1        0.732        0.069
                  winpercent
Nik L Nip           22.44534
Boston Baked Beans  23.41782
Chiclets            24.52499
Super Bubble        27.30386
```

```
Jawbusters           28.12744
Root Beer Barrels    29.70369
```

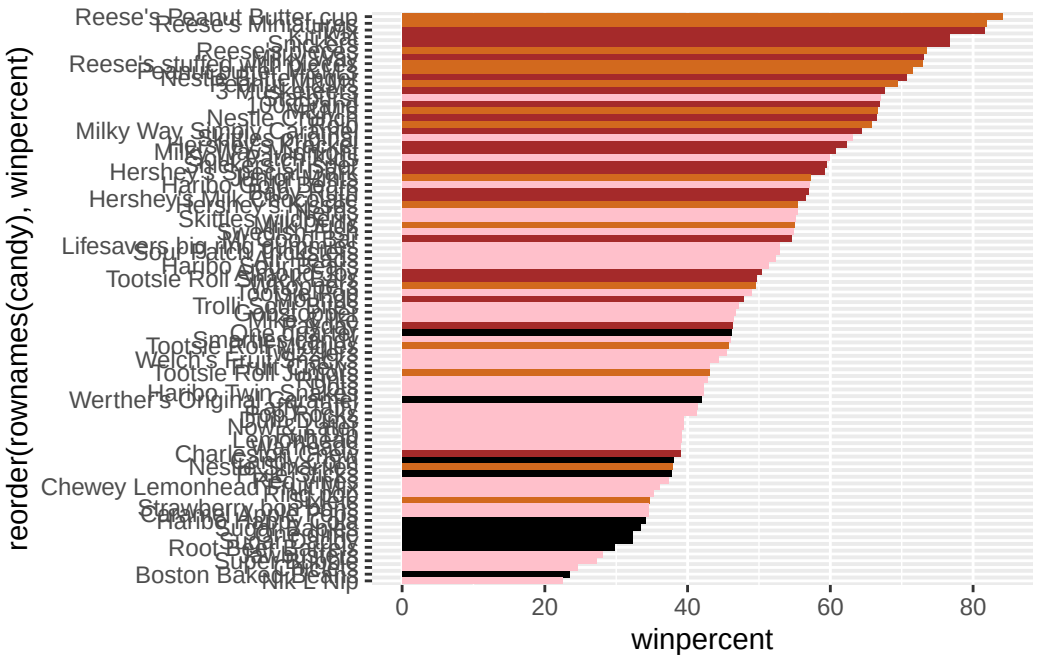
```
inds<-order(candy$winpercent,decreasing=T)
head(candy[inds,],5)
```

```
                         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
```

```
ggplot(candy)+
  aes(x=winpercent, y=reorder(rownames(candy),winpercent))+
  geom_col()
```



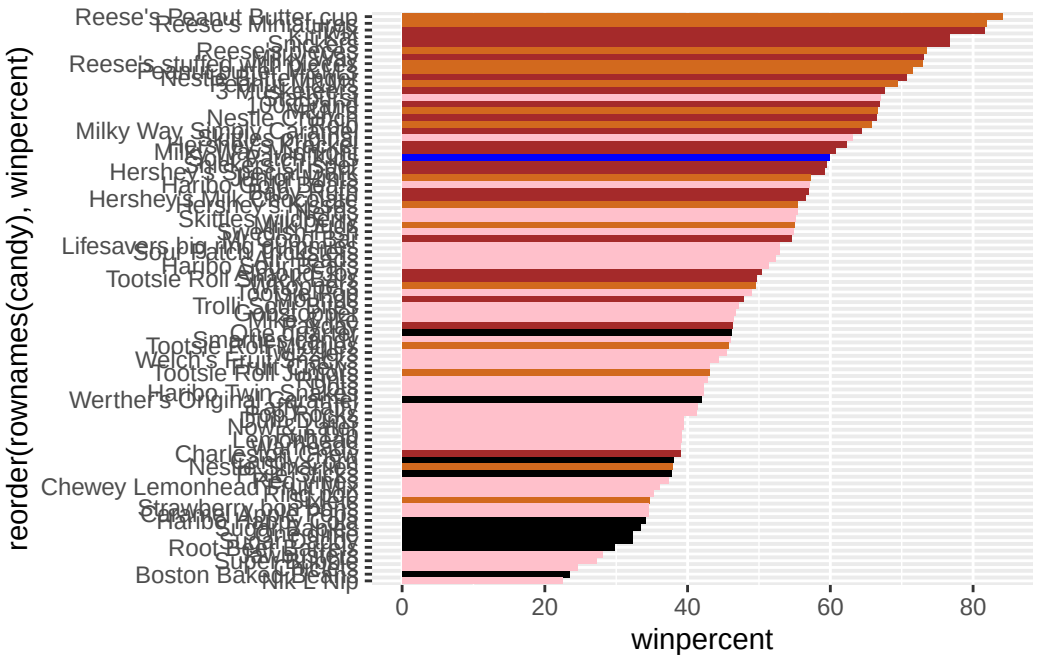

```
my_cols=rep("black", nrow(candy))
my_cols[as.logical(candy$chocolate)] = "chocolate"
my_cols[as.logical(candy$bar)] = "brown"
my_cols[as.logical(candy$fruity)] = "pink"
ggplot(candy)+
  aes(x=winpercent, y=reorder(rownames(candy),winpercent))+
  geom_col(fill=my_cols)
```



Worst chocolate ranked: Sixlets Best fruity candy ranked: Starbursts

```
#Finding Sour Patch Kids and coloring the bar

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"
my_cols[rownames(candy)=="Sour Patch Kids"] = "blue"
ggplot(candy)+
  aes(x=winpercent, y=reorder(rownames(candy),winpercent))+
  geom_col(fill=my_cols)
```




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

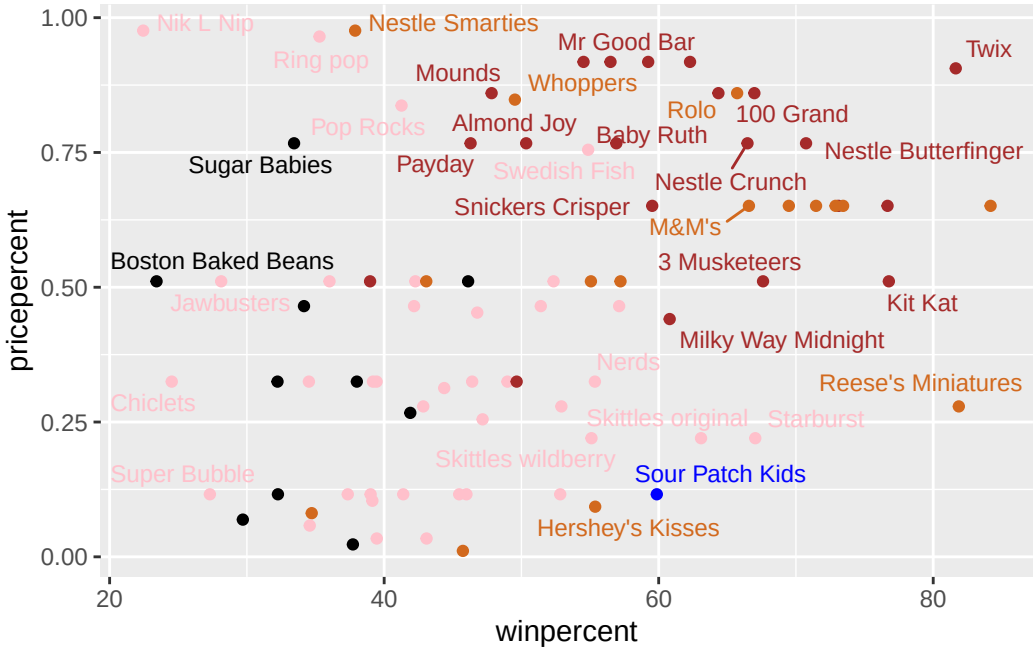
```
                      pricepercent winpercent
Nik L Nip                    0.976   22.44534
Nestle Smarties              0.976   37.88719
Ring pop                     0.965   35.29076
Hershey's Krackel            0.918   62.28448
Hershey's Milk Chocolate     0.918   56.49050
```

4:Taking a look at pricepercent

```
library(ggrepel)

ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols, size=3.3, max.overlaps = 8)
```

```
Warning: ggrepel: 52 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```

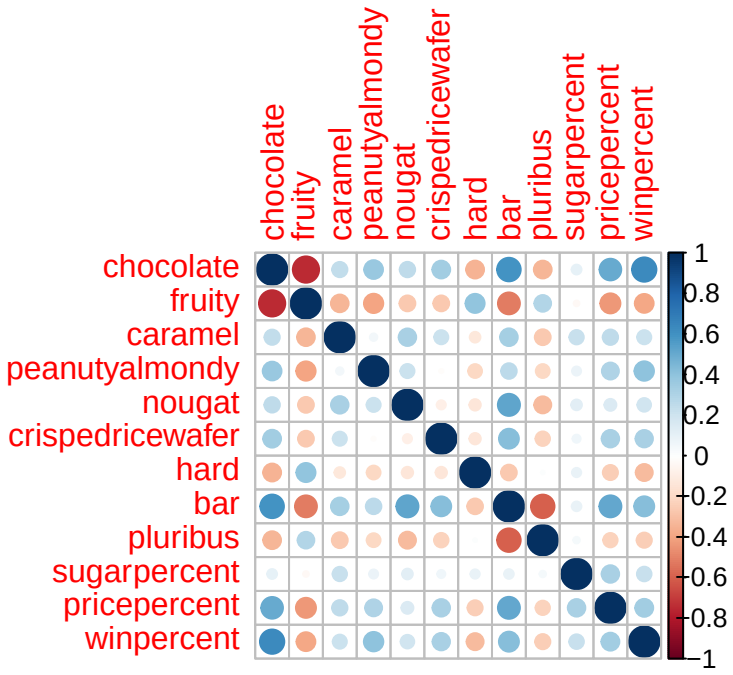


5: Exploring the correlation structure

```
library(corrplot)
```

```
corrplot 0.95 loaded
```

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

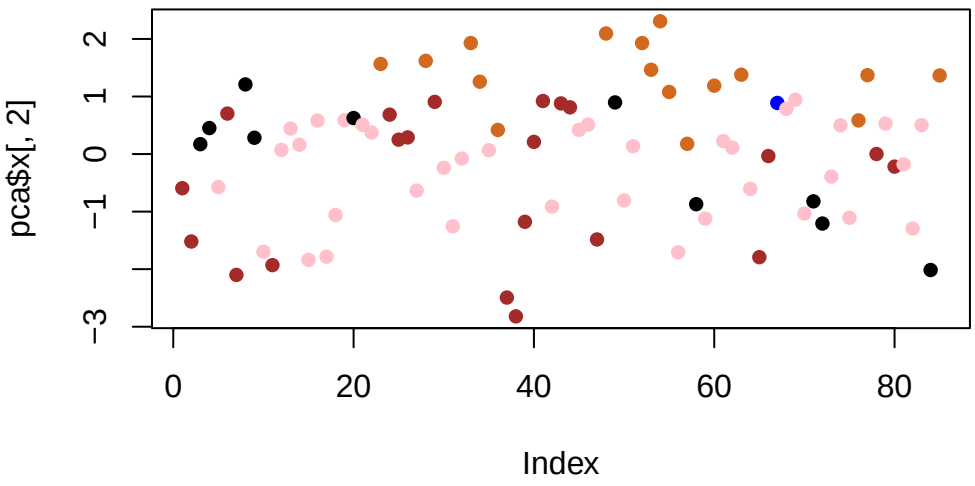


6: Principal Component Analysis

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

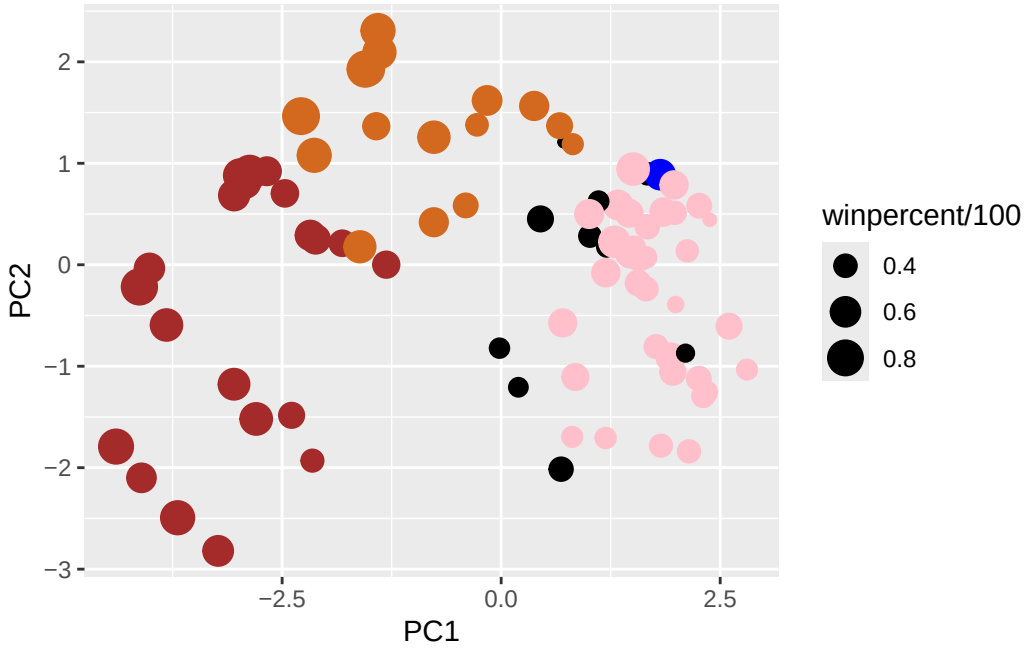
```
Importance of components:
                          PC1    PC2    PC3     PC4    PC5     PC6     PC7
Standard deviation     2.0788 1.1378 1.1092 1.07533 0.9518 0.81923 0.81530
Proportion of Variance 0.3601 0.1079 0.1025 0.09636 0.0755 0.05593 0.05539
Cumulative Proportion  0.3601 0.4680 0.5705 0.66688 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[,2],col=my_cols,pch=16)
```



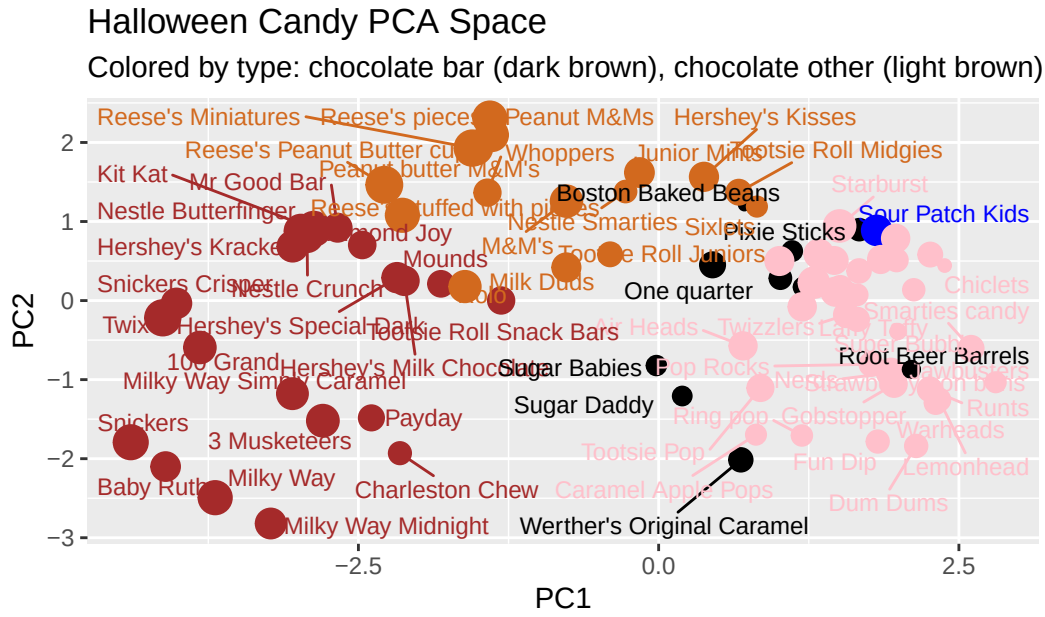
ggplot version

```
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
```



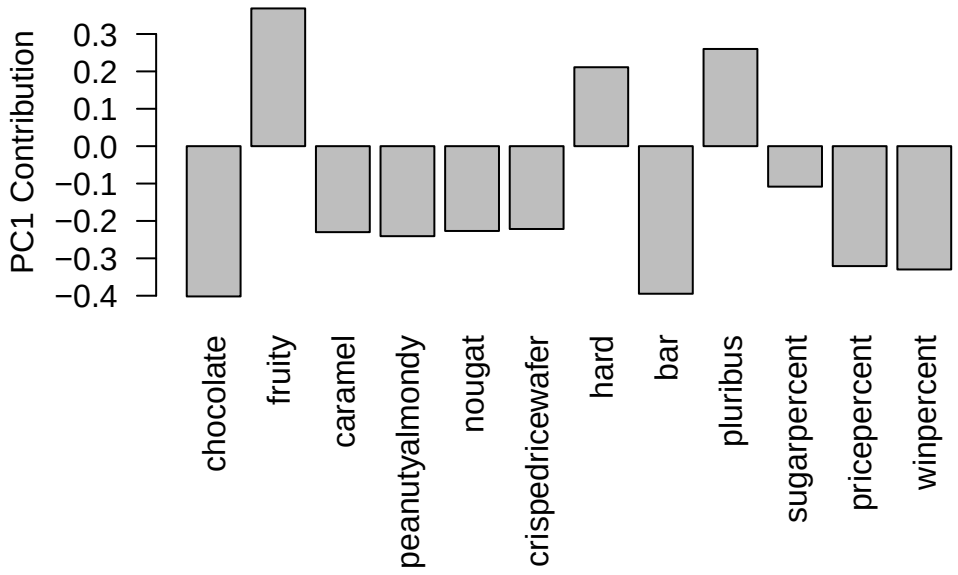

```
p + geom_text_repel(size=3.3, col=my_cols, max.overlaps = 20)  +
  theme(legend.position = "none") +
  labs(title="Halloween Candy PCA Space",
       subtitle="Colored by type: chocolate bar (dark brown), chocolate other (light brown),
       caption="Data from 538")
```

```
Warning: ggrepel: 20 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```



Data from 538

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



Q24: Fruity,hard and pluribus make sense to be correlated with each other because that is how that type of candy is usually seen. The PC1 reflects that.