Class09

Tim

```r
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
```

Q1. How many different candy types are in this dataset? #85

```r
nrow(candy)
```

```
[1] 85
```

Q2. How many fruity candy types are in the dataset? #38

```
table(candy[,2])
```

```

 0  1 
47 38 
```

```
table(candy$fruity)
```

```

 0  1 
47 38 
```

Q3. What is your favorite candy in the dataset and what is it's winpercent value? #73.09956

```
candy["Milky Way", ]$winpercent
```

```
[1] 73.09956
```

Q4. What is the winpercent value for "Kit Kat"? #76.7686

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

```
[1] 76.7686
```

Q5. What is the winpercent value for "Tootsie Roll Snack Bars"? #49.6535

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

```
[1] 49.6535
```

```
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
candy |>
  filter(rownames(candy) %in% c("Kit Kat", "Milky Way")) |>
  select(winpercent)
```

```
          winpercent
Kit Kat     76.76860
Milky Way   73.09956
```

the %in% operator used to check the intervention of two vectors.

```r
candy |>
  filter(winpercent > 75) |>
  filter(pricepercent < 0.5)
```

```
                   chocolate fruity caramel peanutyalmondy nougat
Reese's Miniatures         1      0       0              1      0
                   crispedricewafer hard bar pluribus sugarpercent pricepercent
Reese's Miniatures                0    0   0        0        0.034        0.279
                   winpercent
Reese's Miniatures   81.86626
```

```r
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	

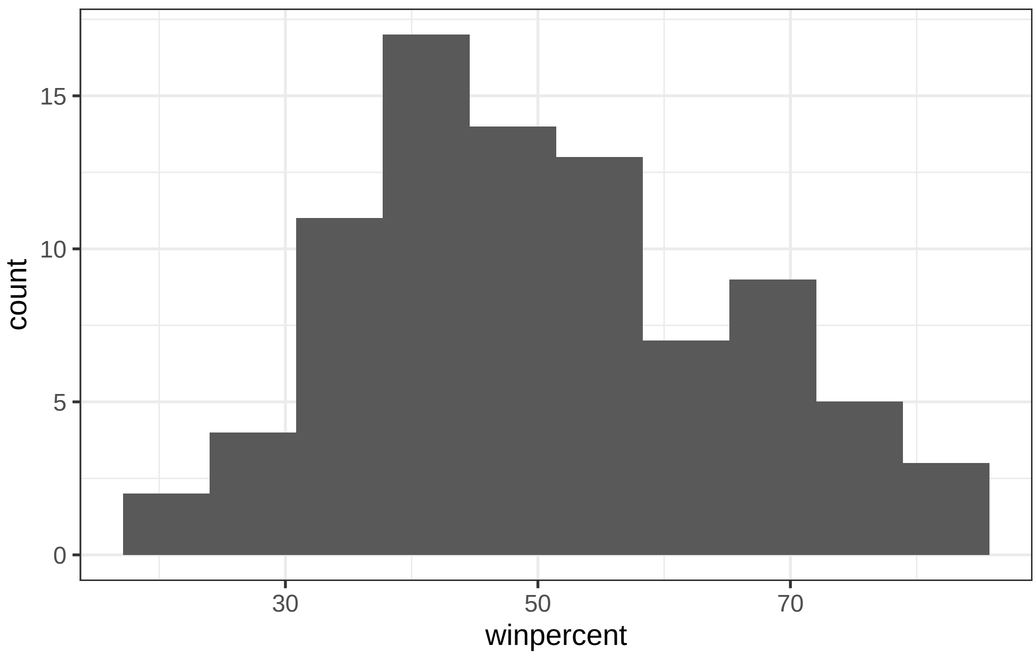
Q6. Is there any variable/column that looks to be on a different scale to the majority of the other columns in the dataset? #the winpercent data is so high since the data was not scaled

Q7. What do you think a zero and one represent for the candy$chocolate column? # they are False = 0 and True = 1, which shows if the individual candy has these items in it or not

Q8. Plot a histogram of winpercent values

```r
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 
```

Q9. Is the distribution of winpercent values symmetrical? #NO

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

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

```
inds <- as.logical(candy$chocolate)
candy[inds,]$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
```

```r
candy |>
  filter(chocolate == 1) |>
  select(winpercent)
```

```
                            winpercent
100 Grand                     66.97173
3 Musketeers                  67.60294
Almond Joy                    50.34755
Baby Ruth                     56.91455
Charleston Chew               38.97504
Hershey's Kisses              55.37545
Hershey's Krackel             62.28448
Hershey's Milk Chocolate      56.49050
Hershey's Special Dark        59.23612
Junior Mints                  57.21925
Kit Kat                       76.76860
Peanut butter M&M's           71.46505
M&M's                         66.57458
Milk Duds                     55.06407
Milky Way                     73.09956
Milky Way Midnight            60.80070
Milky Way Simply Caramel      64.35334
Mounds                        47.82975
Mr Good Bar                   54.52645
Nestle Butterfinger           70.73564
Nestle Crunch                 66.47068
Peanut M&Ms                   69.48379
Reese's Miniatures            81.86626
Reese's Peanut Butter cup     84.18029
Reese's pieces                73.43499
Reese's stuffed with pieces   72.88790
Rolo                          65.71629
Sixlets                       34.72200
Nestle Smarties               37.88719
Snickers                      76.67378
Snickers Crisper              59.52925
Tootsie Pop                   48.98265
Tootsie Roll Juniors          43.06890
Tootsie Roll Midgies          45.73675
Tootsie Roll Snack Bars       49.65350
Twix                          81.64291
Whoppers                      49.52411
```

```
inds <- candy$fruity ==1
fruit.win <- candy[inds,]$winpercent

inds <- as.logical(candy$chocolate)
choc.win <- candy[inds,]$winpercent
```

```
summary(choc.win)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  34.72   50.35   60.80   60.92   70.74   84.18 
```

```
summary(fruit.win)
```

```
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max. 
  22.45   39.04   42.97   44.12   52.11   67.04 
```

Q12. Is this difference statistically significant? #yes becasue the P-value is below 0.5%

```
t.test(fruit.win, choc.win)
```

```

	Welch Two Sample t-test

data:  fruit.win and choc.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 
```

Two functions to use `sort()` and `order()`

```
play <- c(2,1,5,3)

order(play)
```

```
[1] 2 1 4 3
```

```r
play <- c(2,1,5,3)

sort(play)
```

```
[1] 1 2 3 5
```

```r
l <- c("c", "a", "b")

sort(l)
```

```
[1] "a" "b" "c"
```

```r
l <- c("c", "a", "b")

order(l)
```

```
[1] 2 3 1
```

Q13. What are the five least liked candy types in this set? #Nik L Nip, Boston Baked Beans, Chiclets, Super Bubble, Jawbusters

```r
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
```

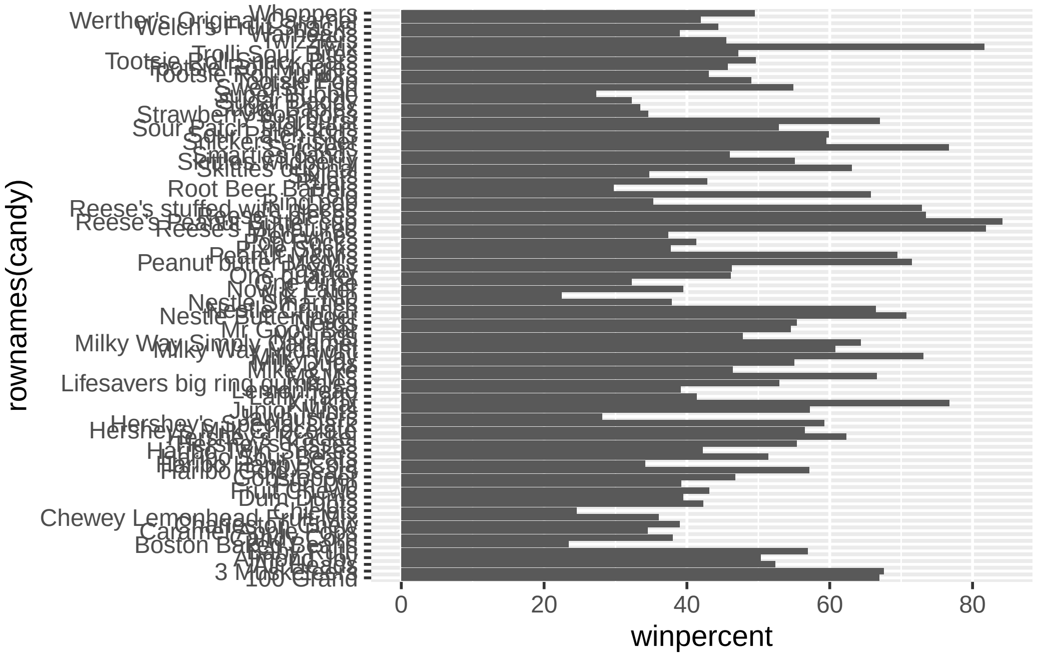
Q14. What are the top 5 all time favorite candy types out of this set? #Reese’s Peanut Butter cup, Reese’s Miniatures, Twix, Kit Kat, Snickers

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

```
                          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
Reese's pieces                    1      0       0              1      0
                          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
Reese's pieces                           0    0   0        1        0.406
                          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
Reese's pieces                   0.651   73.43499
```

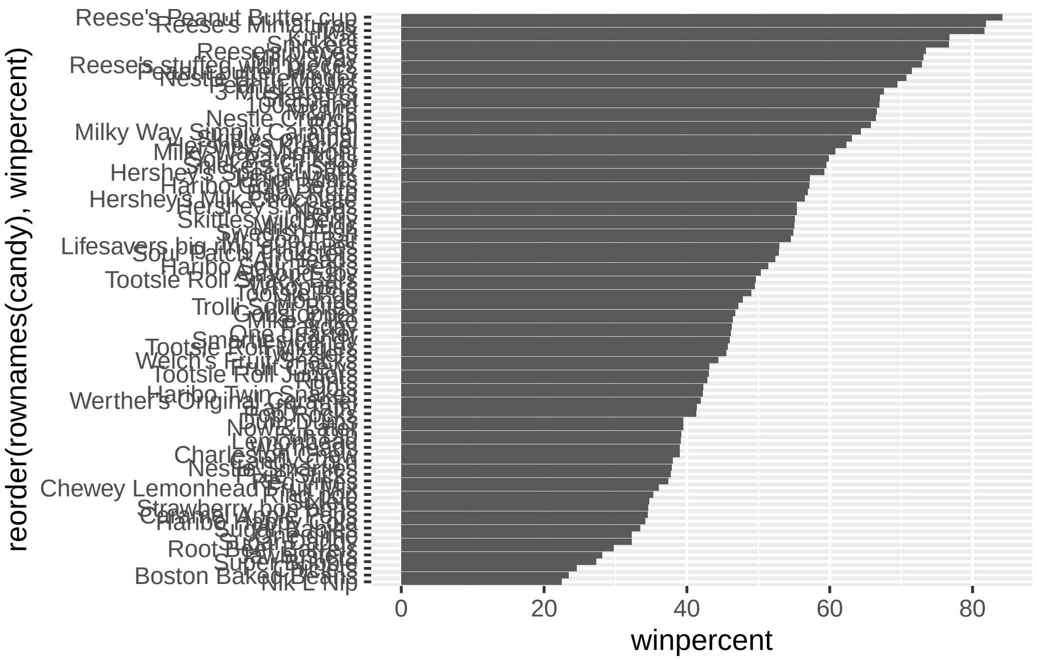
Q15. Make a first barplot of candy ranking based on winpercent values.

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



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

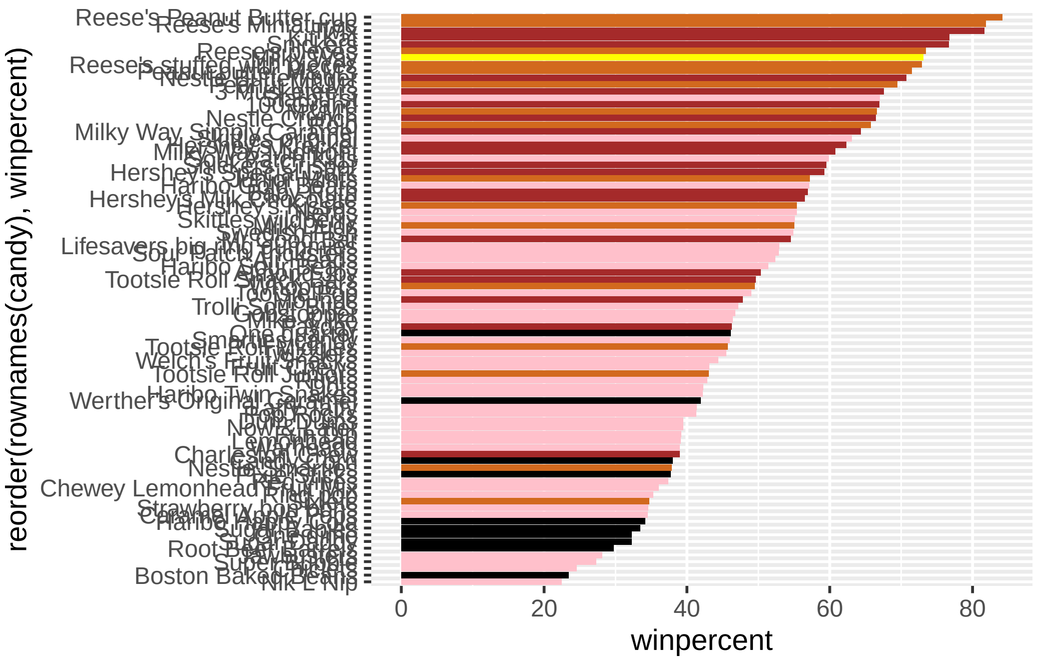
```
ggplot(candy) +
  aes(x=winpercent, y= reorder (rownames(candy), winpercent)) +
  geom_col()
```



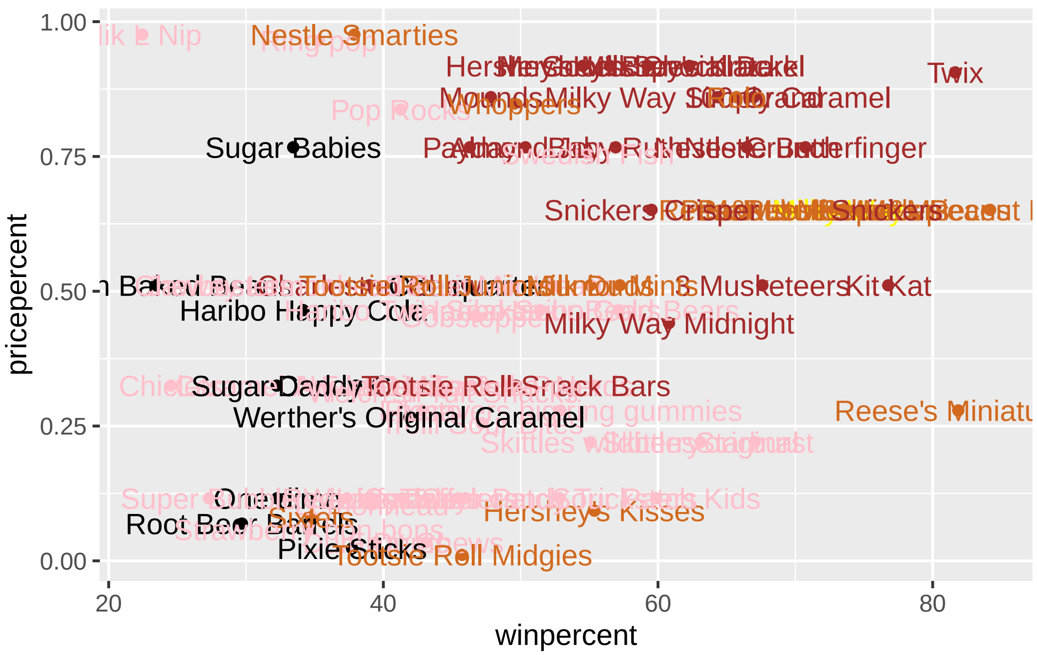
I want to define my own colors I am start with a place-holder vector of colors all “black”

```
mycols <- rep("black", nrow(candy))
mycols[as.logical(candy$chocolate)] <- "chocolate"
mycols[as.logical(candy$bar)] <- "brown"
mycols[as.logical(candy$fruity)] <- "pink"
mycols[rownames(candy) == "Milky Way"] <- "yellow"
```

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



```
ggplot(candy) +
  aes(winpercent,pricepercent, label = rownames(candy)) +
  geom_point(col= mycols) +
  geom_text(col= mycols)
```



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

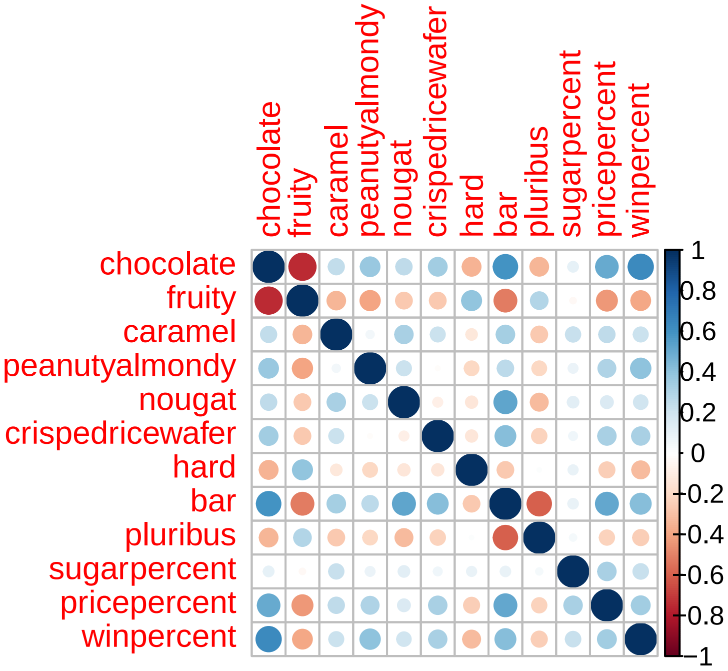
```
my_data <- cbind(candy, pca$x[,1:3])
```

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

```
library(corrplot)
```

```
corrplot 0.95 loaded
```

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

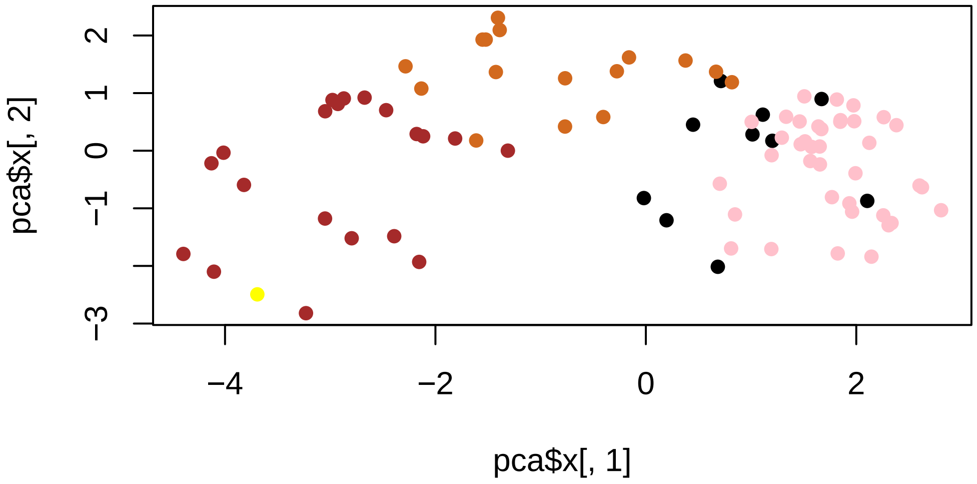


#Principal Component Analysis

```
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
```

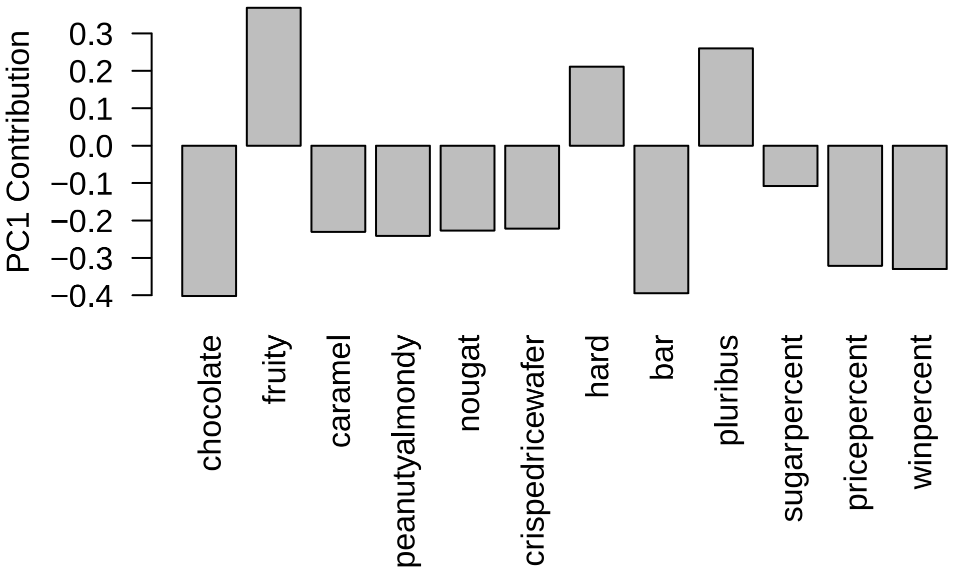
```
plot(pca$x[,1], pca$x[,2], col=mycols, pch= 16)
```



```
pca$rotation[,1]
```

```
       chocolate           fruity          caramel    peanutyalmondy
      -0.4019466        0.3683883       -0.2299709        -0.2407155
          nougat crispedricewafer             hard               bar
      -0.2268102       -0.2215182        0.2111587        -0.3947433
        pluribus     sugarpercent     pricepercent        winpercent
       0.2600041       -0.1083088       -0.3207361        -0.3298035
```

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


PC1 Contribution
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
chocolate
fruity
caramel
peanutyalmondy
nougat
crispedricewafer
hard
bar
pluribus
sugarpercent
pricepercent
winpercent