Class10 Halloween

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Explore the dataset

```
# load the dataset
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

```
nrow(candy)
```

```
[1] 85
```

There are 85 types of candies.

Q2

```
sum(candy['fruity']==1)
```

```
[1] 38
```

There are 38 types of fruity candies.

Q3

```
candy['Air Heads',]$winpercent
```

```
[1] 52.34146
```

Q4

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

```
[1] 76.7686
```

Q5

```
candy['Tootsie Roll Snack Bars',]$winpercent
```

```
[1] 49.6535
```

```
# inspect dataset with skim
# install.packages('skim')
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

The variable winpercent is on a different scale.

Q7

n_missing is the number of NA entries, and complete_rate is how many of the entries are not NA.

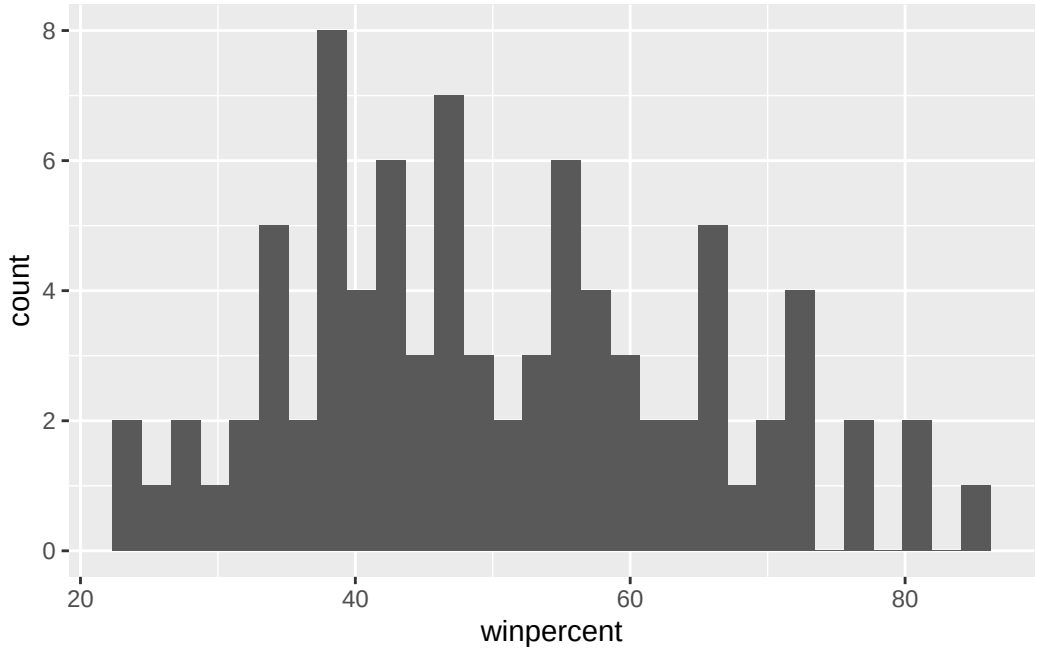
Examine the winpercent variable

Q8

```
library(ggplot2)

ggplot(candy)+
  aes(x=winpercent)+
  geom_histogram()
```

```
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Q9

The distribution is not symmetrical.

Q10

The center of distribution is below 50%.

Q11

```
mean(candy$winpercent[as.logical(candy$chocolate)])
```

```
[1] 60.92153
```

```
mean(candy$winpercent[as.logical(candy$fruity)])
```

```
[1] 44.11974
```

On average chocolate candies rank higher.

Q12

```
t.test(x=candy$winpercent[as.logical(candy$chocolate)], y=candy$winpercent[as.logical(cand
```

```
    Welch Two Sample t-test

data:  candy$winpercent[as.logical(candy$chocolate)] and candy$winpercent[as.logical(candy$fi
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.

Q13

```
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 %>% arrange(winpercent) %>% head(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
```

Q14

```
candy %>% arrange(winpercent) %>% tail(5)
```

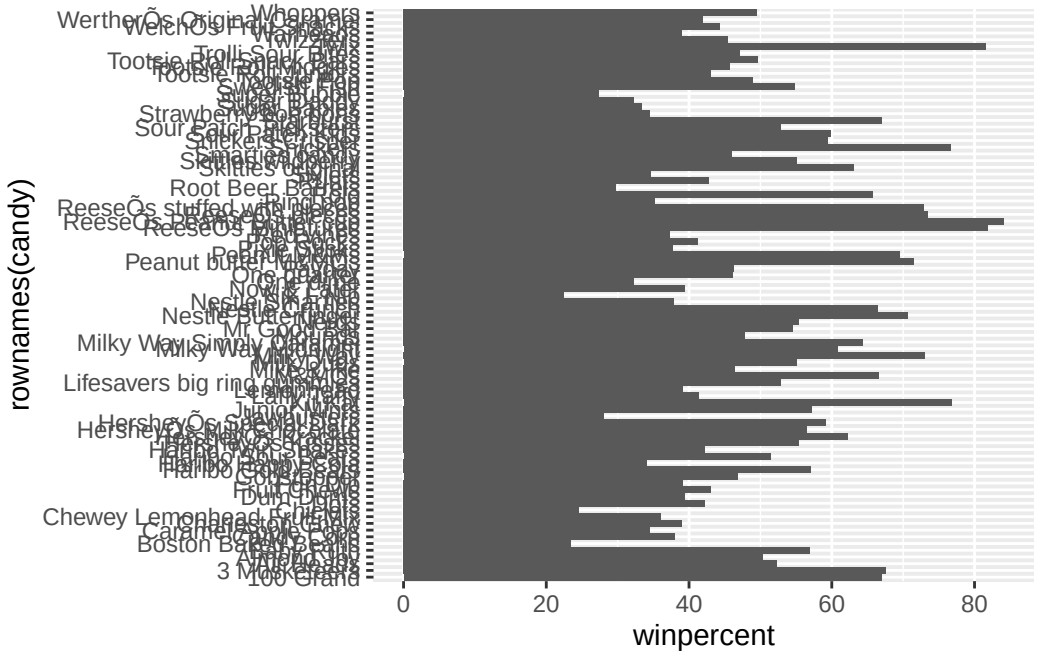
```
                          chocolate fruity caramel peanutyalmondy nougat
Snickers                          1      0       1              1      1
Kit Kat                           1      0       0              0      0
Twix                              1      0       1              0      0
ReeseÕs Miniatures                1      0       0              1      0
ReeseÕs 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
ReeseÕs Miniatures	0	0	0	0	0.034
ReeseÕs 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
ReeseÕs Miniatures	0.279	81.86626
ReeseÕs Peanut Butter cup	0.651	84.18029

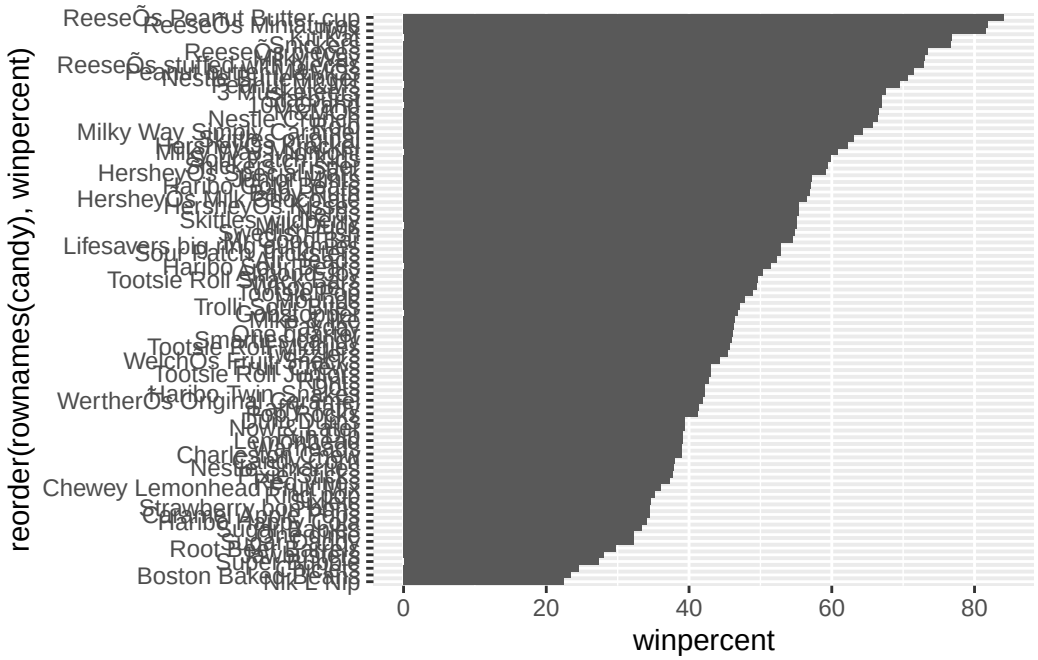
Q15

```
ggplot(candy)+
  aes(winpercent, rownames(candy))+
  geom_col()
```



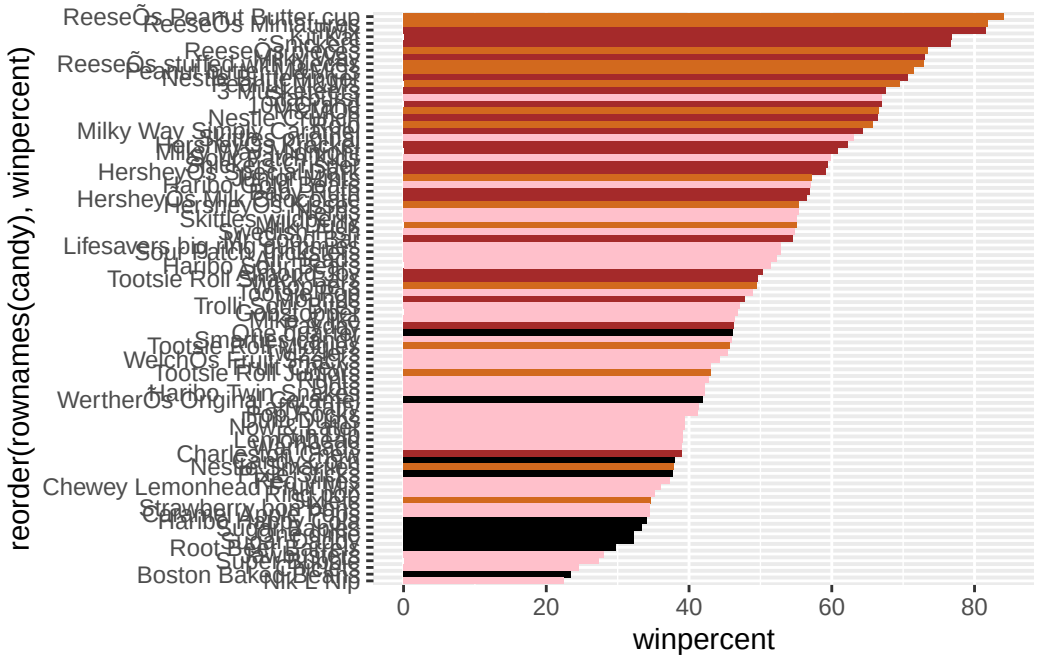
Q16

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




```
# prepare a sequence of colors by candy type
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, reorder(rownames(candy), winpercent))+
  geom_col(fill=my_cols)
```



Q17

The worst chocolate candy is Charleston Chew.

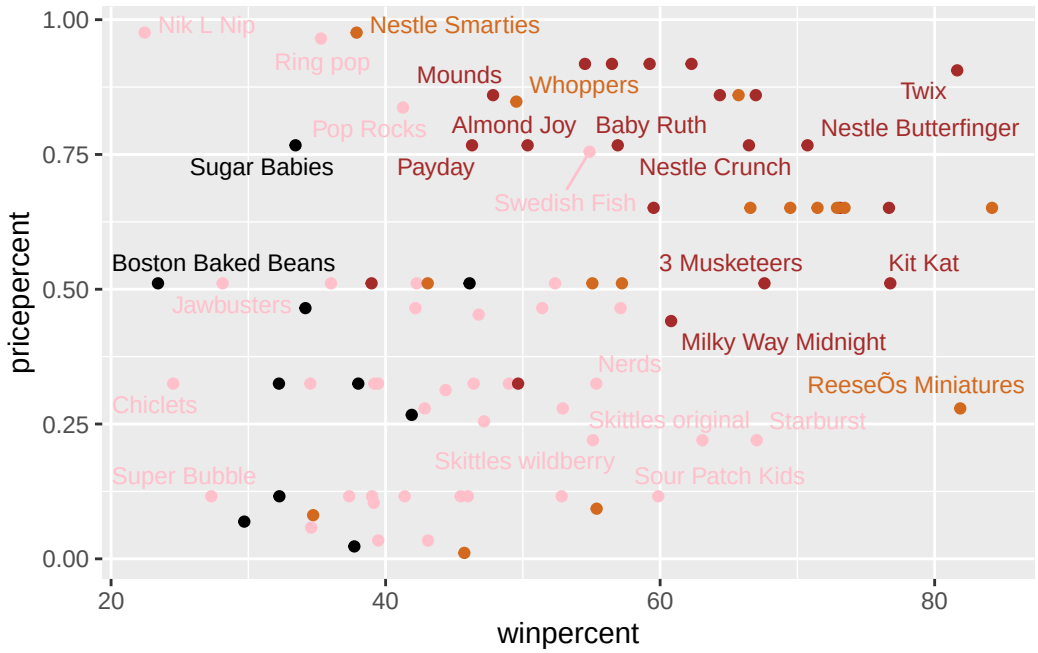
Q18

The worst fruity candy is Nik L Nip.

Examine the pricepercent variable

```
# plot winpercent against pricepercent to assess the candies
# install.packages('ggrepel')

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=7)
```



Q19

It's the ReeseOs Miniatures.

Q20

```
head(candy[order(candy$pricepercent, decreasing = T), 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
HersheyÕs Krackel                0.918   62.28448
HersheyÕs Milk Chocolate         0.918   56.49050
```

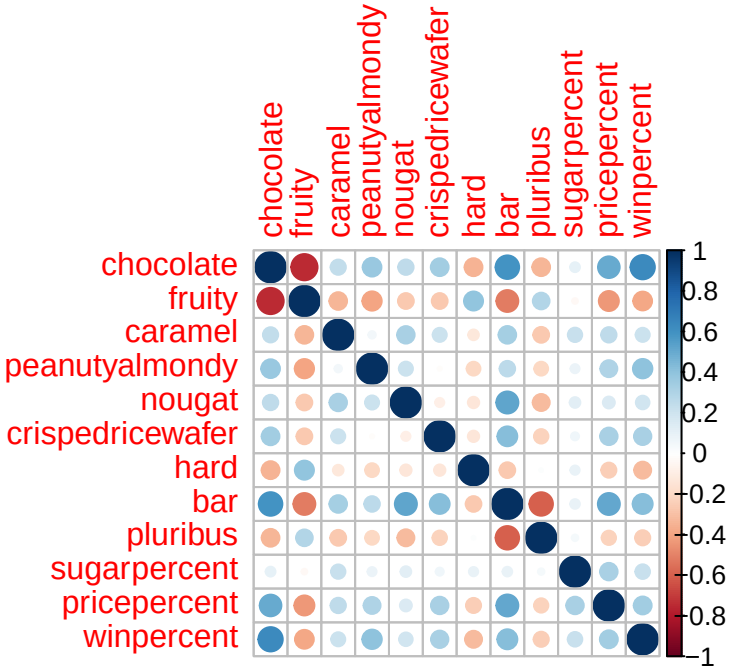
Correlation Structure

```
# examine correlations between the variables with corrplot
# install.packages('corrplot')

library(corrplot)
```

```
corrplot 0.92 loaded
```

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



Q22

chocolate and fruity, bar and pluribus, bar and fruity are evidently anti-correlated.

Q23

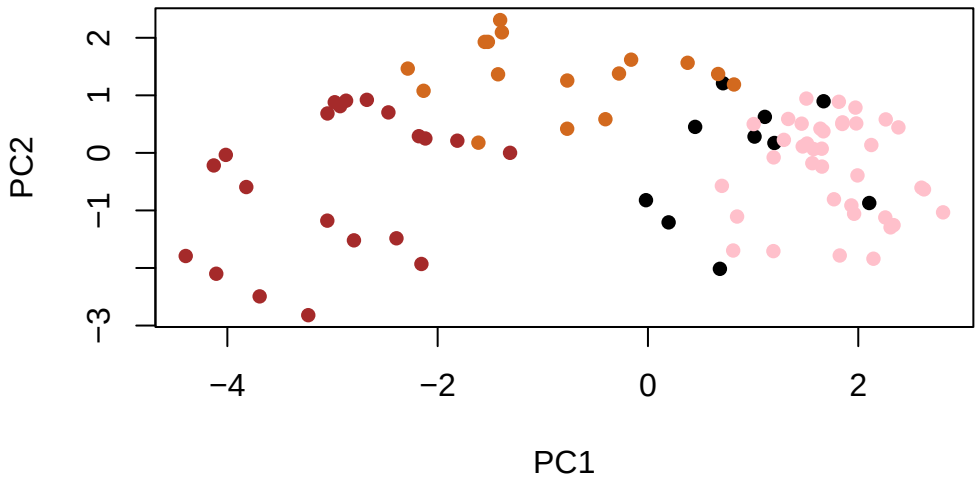
chocolate and winpercent seem to be most postively correlated.

PCA

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

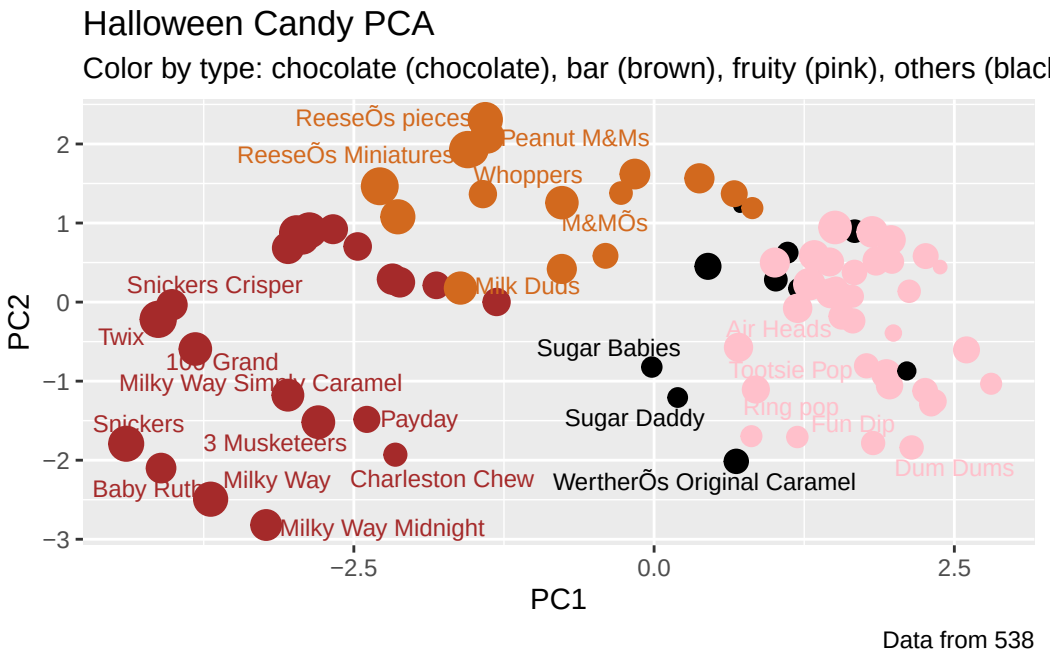
```
plot(pca$x[,1:2], col=my_cols, pch=16)
```




```
# plot PCs and see how they relate to variables of interest
# include text and label for ggrepel
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 + geom_text_repel(col=my_cols, size=3.3, max.overlaps = 7)+
  theme(legend.position = 'none')+
  labs(title = 'Halloween Candy PCA', subtitle = 'Color by type: chocolate (chocolate), ba
```



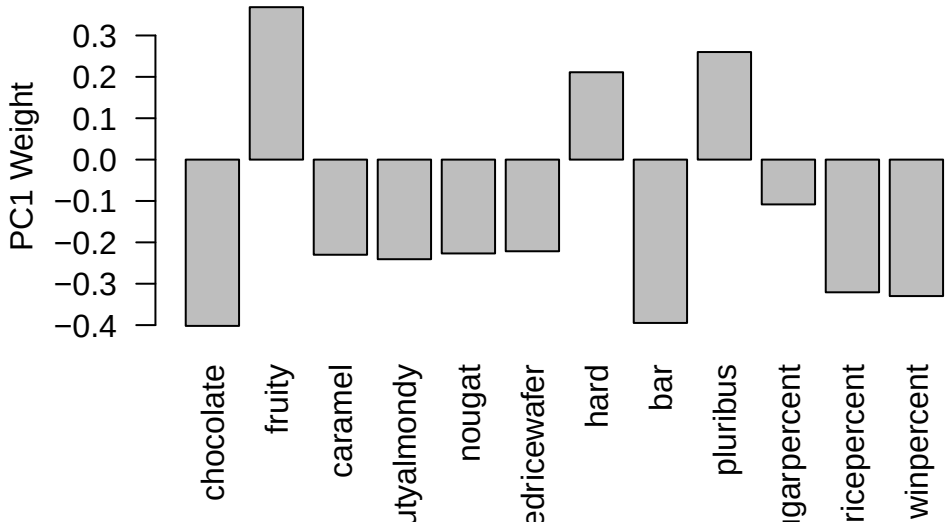

```
# interactive plot with plotly
# install.packages('plotly')
#library(plotly)

#ggplotly(p)
```

```
# variable contribution to PC1
par(margin=c(8,4,2,2))
```

```
Warning in par(margin = c(8, 4, 2, 2)): "margin" is not a graphical parameter
```

```r
barplot(pca$rotation[,1], las=2, ylab = 'PC1 Weight')
```



Q24

Fruity, hard and pluribus are shown to have positive contributions. Since PC1 largely separates the 3 types fruity, chocolate and bar, it makes sense that fruity shows strong positive contribution. Pluribus seems to be positively correlated with fruity and makes similar contribution as fruity candy are usually pluribus, whereas chocolates are usually packed as bars.