lab10

chan-yu

1. Importing candy 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
```

```
dim(candy)
```

```
[1] 85 12
```

- **Q1**. How many different candy types are in this dataset?
- there are in total 85 types of candies in this set.

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

```
[1] 38
```

- **Q2**. How many fruity candy types are in the dataset?
- there are 38 types of candy that have are fruity.

```
candy["Skittles original", ]$winpercent
```

```
[1] 63.08514
```

- **Q3**. What is your favorite candy in the dataset and what is it's **winpercent** value?
- Skittles original is my favorite candy and it has winpercent value of 63.085
- **Q4.** What is the **winpercent** value for "Kit Kat"?

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

```
[1] 76.7686
```

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

```
candy["Tootsie Roll Snack Bars", ]$winpercendt
```

```
NULL
```

```
library("skimr")
skim(candy)
```

Table 1: Data summary

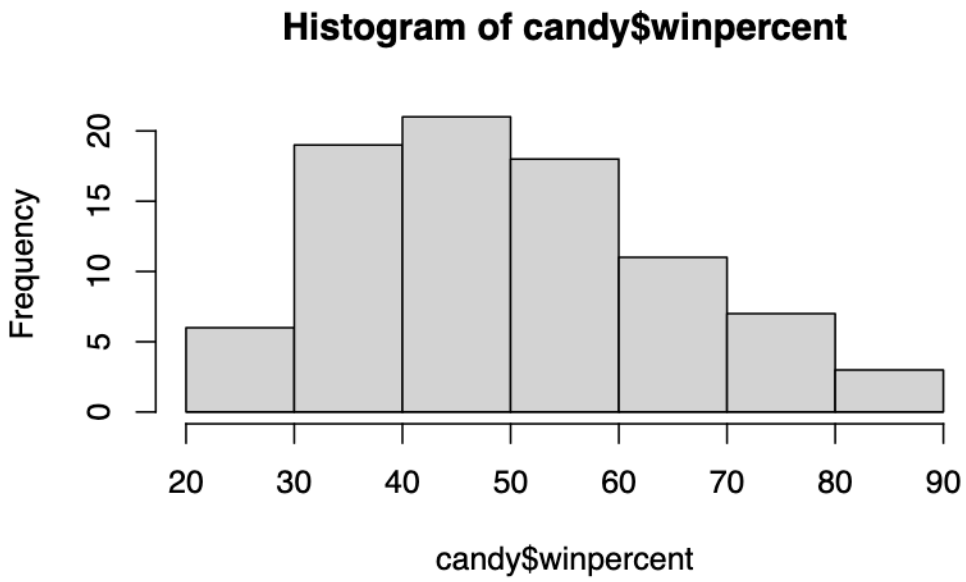
Name	candy
Number of rows	85
Number of columns	12
Column type frequency:	
numeric	12
Group variables	None

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?
- winpercent is on different scale than other type for mean values.
- **Q7**. What do you think a zero and one represent for the `candy$chocolate` column?
- 0 represent the candy does not have chocolate in it. 1 represent the candy has chocolate.
- Q8. Plot a histogram of `winpercent` values

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



- **Q9**. Is the distribution of `winpercent` values symmetrical?
- no, it seems like it is skewed to the right
- **Q10**. Is the center of the distribution above or below 50%?

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

```
[1] 50.31676
```

- I would say the center is slightly above 50%
- **Q11**. On average is chocolate candy higher or lower ranked than fruit candy?
- on average, higher ranked by winpercent.

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

```
[1] 60.92153
```

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

```
[1] 44.11974
```

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

```
    One Sample t-test

data:  candy$winpercent[as.logical(candy$chocolate)]
t = 28.926, df = 36, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 56.65009 65.19297
sample estimates:
mean of x
 60.92153
```

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

```
    One Sample t-test

data:  candy$winpercent[as.logical(candy$fruity)]
t = 26.498, df = 37, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 40.74612 47.49337
sample estimates:
mean of x
 44.11974
```

- **Q12**. Is this difference statistically significant?

yes both mean values are statistically significant, therefore the result must be significant as well.

- **Q13**. What are the five least liked candy types in this set? (shown below)

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

```
candy %>% arrange(desc(winpercent)) %>% head(5)
```

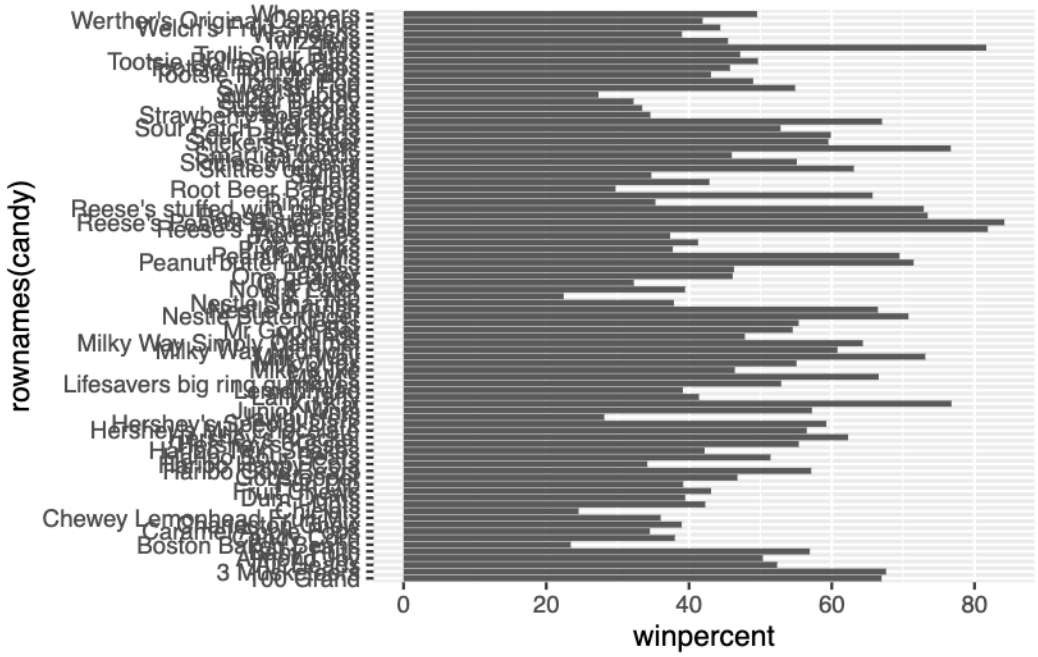
```
                        chocolate fruity caramel peanutyalmondy nougat
Reese's Peanut Butter cup         1      0       0              1      0
Reese's Miniatures                1      0       0              1      0
Twix                              1      0       1              0      0
Kit Kat                           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
```

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

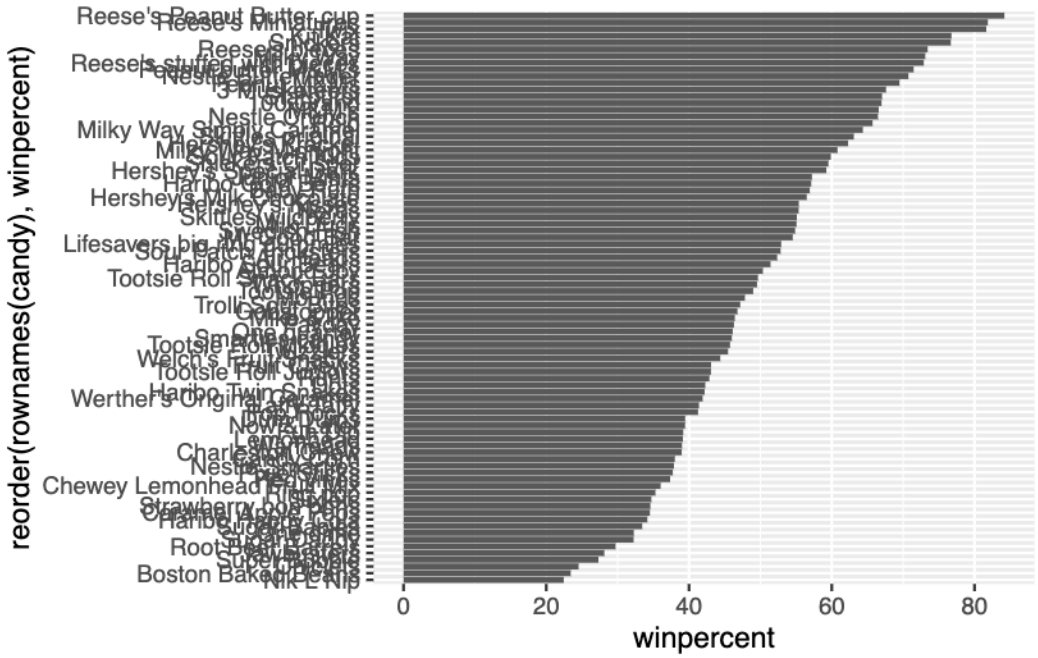
```
library(ggplot2)

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

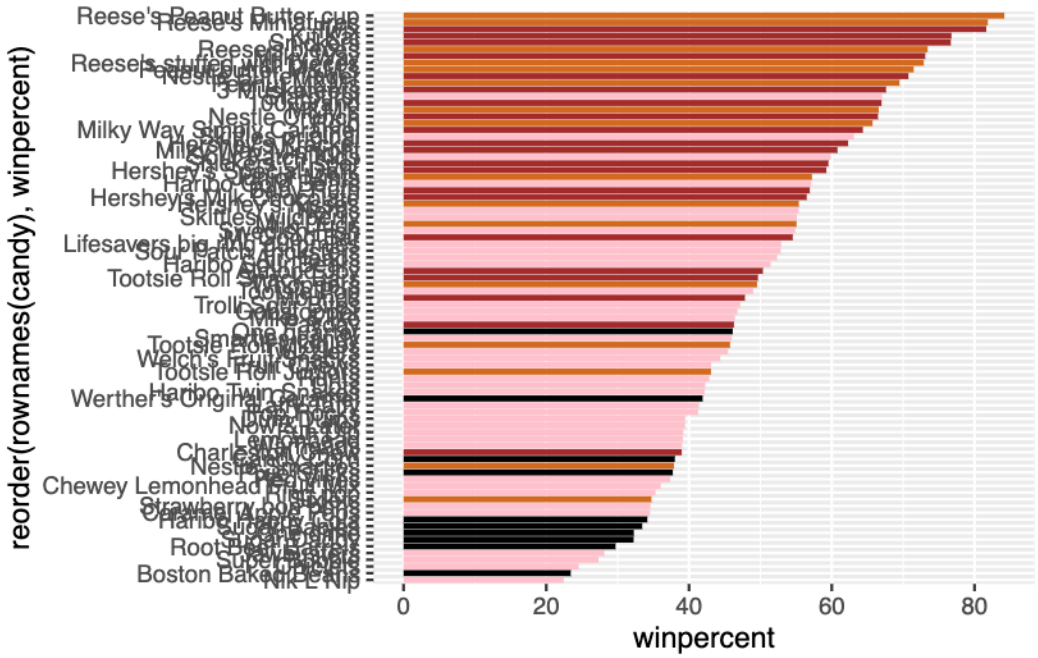


- **Q16**. This is quite ugly, use the `reorder()` function to get the bars sorted by `winpercent`?

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



Q17. What is the worst ranked chocolate candy?

sixlets

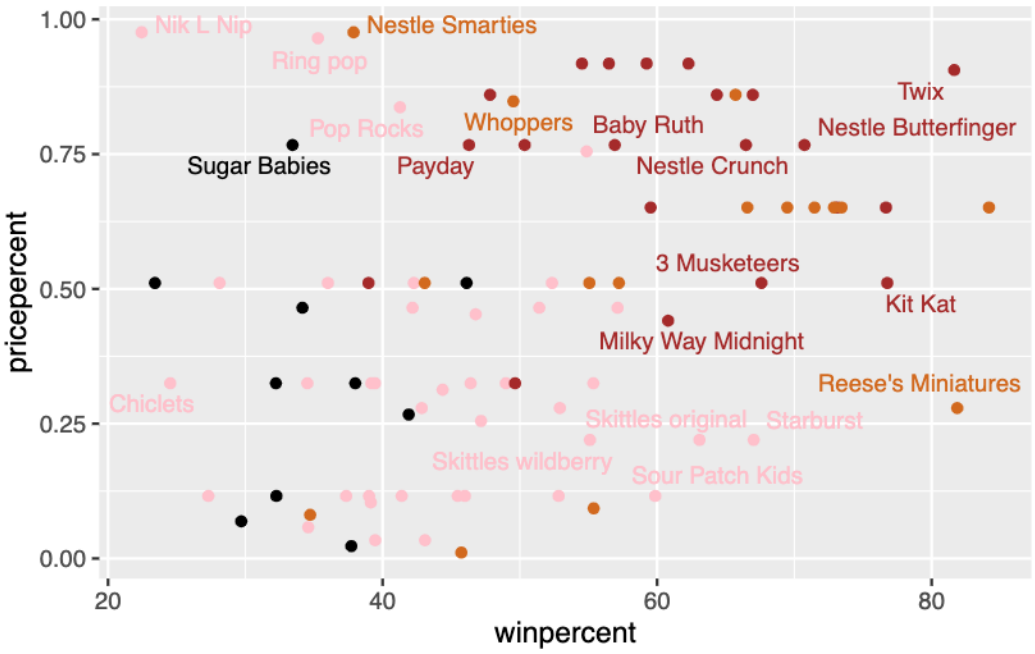
Q18. What is the best ranked fruity candy?

starburst

```
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 = 5)
```

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



- **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?

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

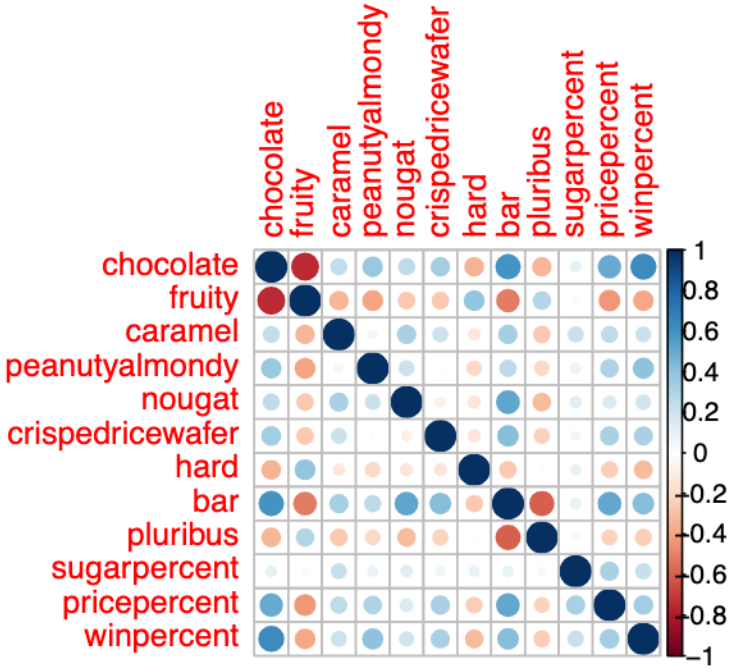
```
                           pricepercent winpercent
Nik L Nip                         0.976   22.44534
Nestle Smarties                   0.976   37.88719
Ring pop                          0.965   35.29076
Hershey's Krackel                 0.918   62.28448
Hershey's Milk Chocolate          0.918  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

- Nick L Nip, Ring pop, Nestle Smarties,hershey's milk chocolate, and hershey's krackel
- Nik L Nip is the least popular.
- 5 Exploring the correlation structure

```
library(corrplot)
```

```
corrplot 0.92 loaded
```

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



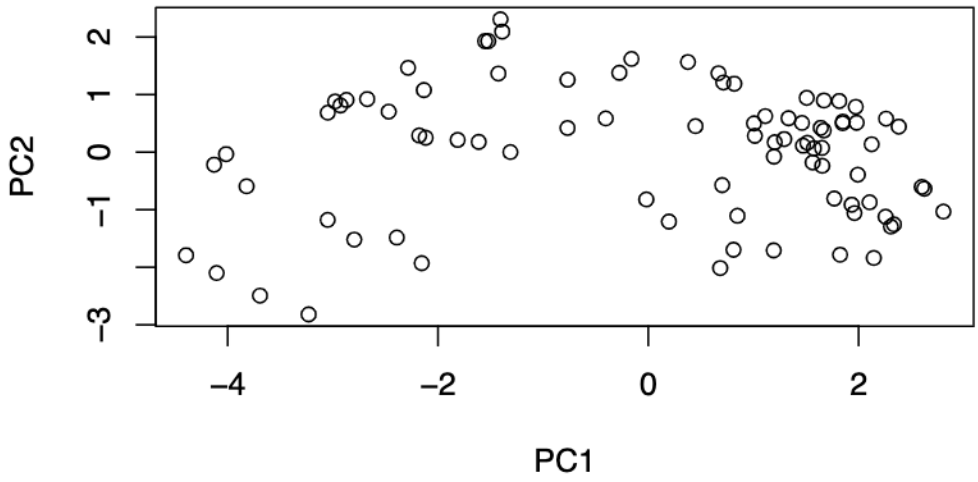
- **Q22**. Examining this plot what two variables are anti-correlated (i.e. have minus values)?
- fruity and chocolate
- **Q23**. Similarly, what two variables are most positively correlated?
- chocolate and winpercent
- PCA

```
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
```

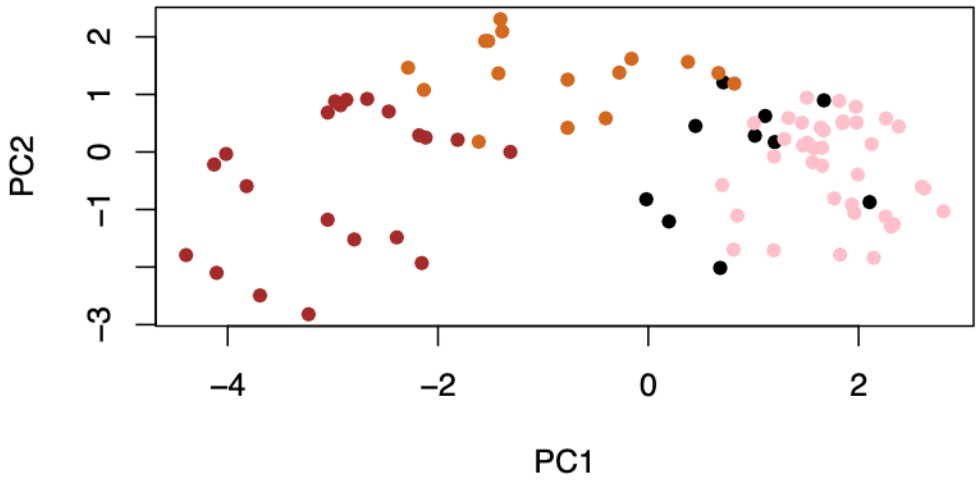
```
                          PC1     PC2     PC3     PC4     PC5
Standard deviation     0.74530 0.67824 0.62349 0.43974 0.39760
Proportion of Variance 0.04629 0.03833 0.03239 0.01611 0.01317
Cumulative Proportion  0.89998 0.93832 0.97071 0.98683 1.00000
```

```r
plot(pca$x[,1], pca$x[,2], xlab="PC1", ylab="PC2")
```




```r
## x is used to call the table that include PCA with respect to each row_name
```

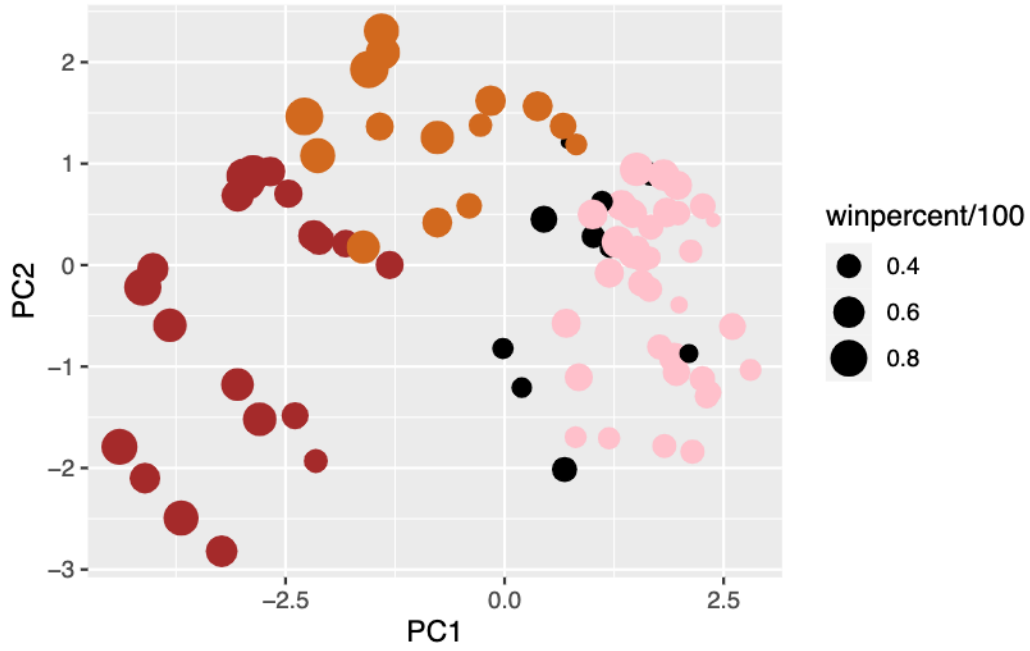
```r
plot(pca$x[,1:2], col=my_cols, pch=16)
```




```r
## my_cols were defined before
```

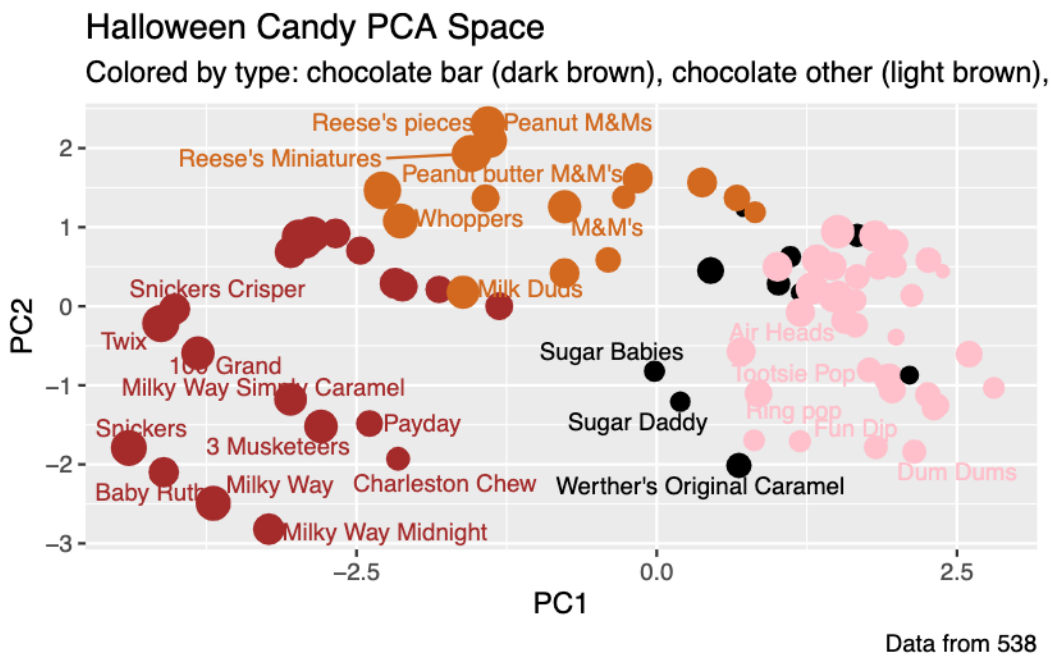
```
# Make a new data-frame with our PCA results and candy data
my_data <- cbind(candy, pca$x[,1:3])
p <- ggplot(my_data) +
        aes(x=PC1, y=PC2,
            size=winpercent/100,
            text=rownames(my_data),
            label=rownames(my_data)) +
        geom_point(col=my_cols)

p
```

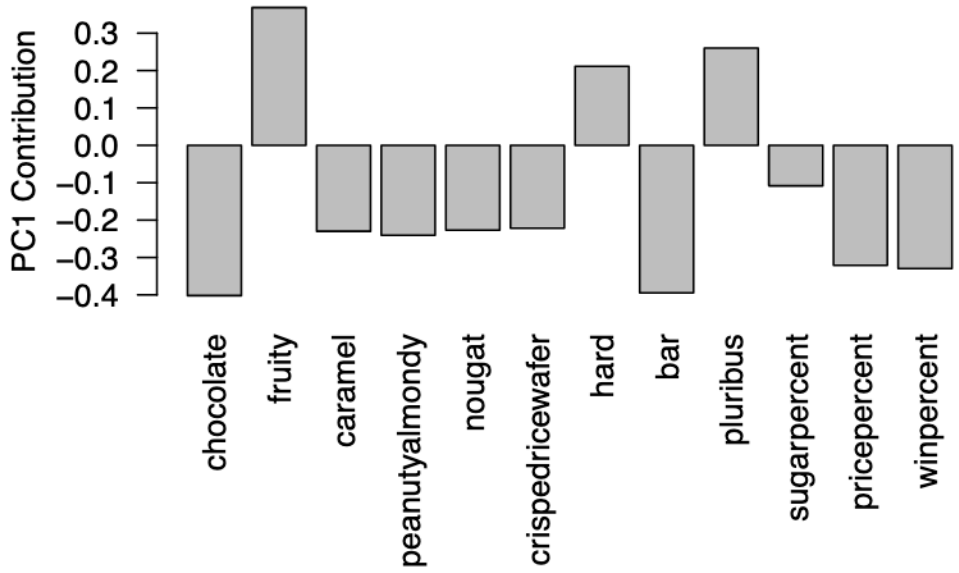



```
p + geom_text_repel(size=3.3, col=my_cols, max.overlaps = 7)  +
  theme(legend.position = "none") +
  labs(title="Halloween Candy PCA Space",
       subtitle="Colored by type: chocolate bar (dark brown), chocolate other (light brown
       caption="Data from 538")
```

```
Warning: ggrepel: 59 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```




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



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

- fruity and pluribus were two variable that strongly picked up by PC1 in the positive direction. The selection make sense becasue fruity or chocolate makes the biggest difference. when candy comes into a big bag, the candy are usually bad tasting(?). Therefore, for candy that come in big bag also usually have lowest winpercent.