class10

```
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 diferent candy types

```
nrow(candy)
```

```
[1] 85
```

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

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

```
[1] 38
```

```
candy["Twix", ]$winpercent
```

```
[1] 81.64291
```

Q3. What is your favorite candy in the dataset and what is it's winpercent value? M&M's winpercent is 66.57458%

```
candy["M&M's", ]$winpercent
```

```
[1] 66.57458
```

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 Bars", ]$winpercent
```

```
[1] 49.6535
```

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

Table 1: Data summary

Name	candy
Number of rows	85
Number of columns	12
_____	
Column type frequency:	
numeric	12

Table 1: Data summary

Group variables	None

Variable type: numeric

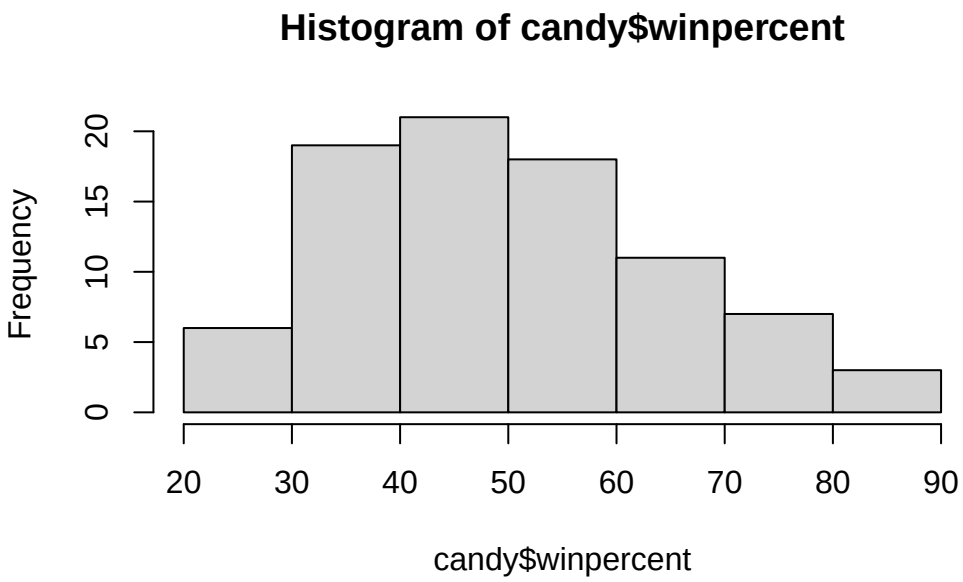
skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
chocolate	0	1	0.44	0.50	0.00	0.00	0.00	1.00	1.00	
fruity	0	1	0.45	0.50	0.00	0.00	0.00	1.00	1.00	
caramel	0	1	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
peanutyalmondy	0	1	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
nougat	0	1	0.08	0.28	0.00	0.00	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? It seems like n_missing and complete_rate look like they are on a binary scale instead of a continuous scale like the other columns are.

Q7. What do you think a zero and one represent for the candy$chocolate column? This means that it either has or does not have chocolate in it.

Q8. Plot a histogram of winpercent values

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



Q9. Is the distribution of winpercent values symmetrical? No, the distribution is right skewed.

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

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

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

```
[1] 60.92153
```

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

```
[1] 44.11974
```

Q12. Is this difference statistically significant? Yes, it is statistically significant since the p-value is less than 0.05.

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

```
    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
```

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

```
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
```

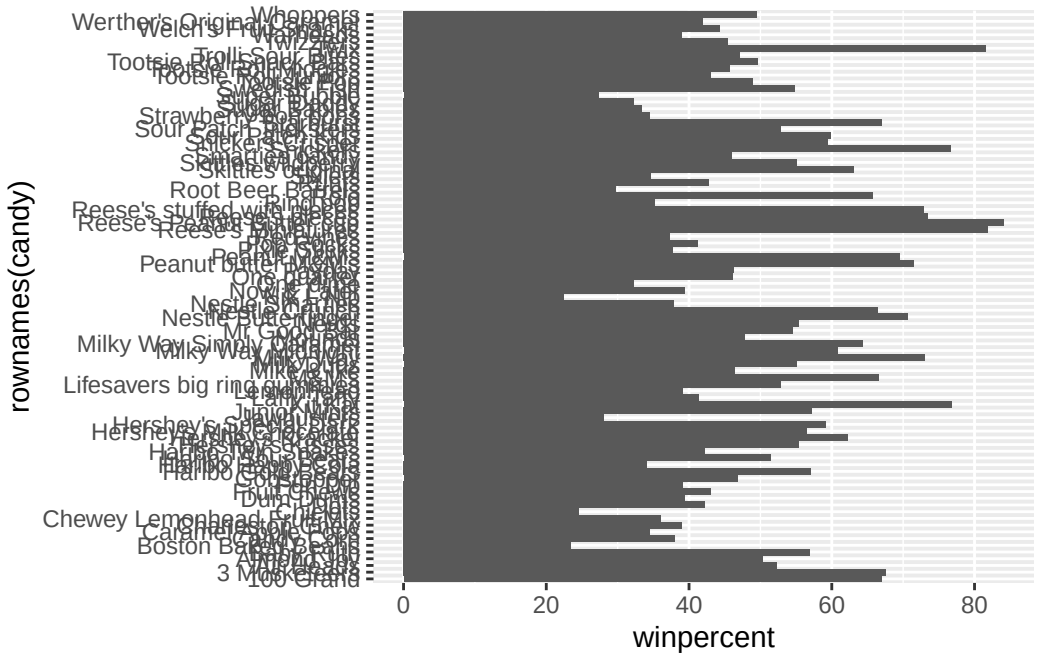
Q14. What are the top 5 all time favorite candy types out of this set? Reese's Peanut Butter cup, Reese's Miniatures,Twix, Kit Kat, Snickers

```
tail(candy[order(candy$winpercent),], n=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
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
```

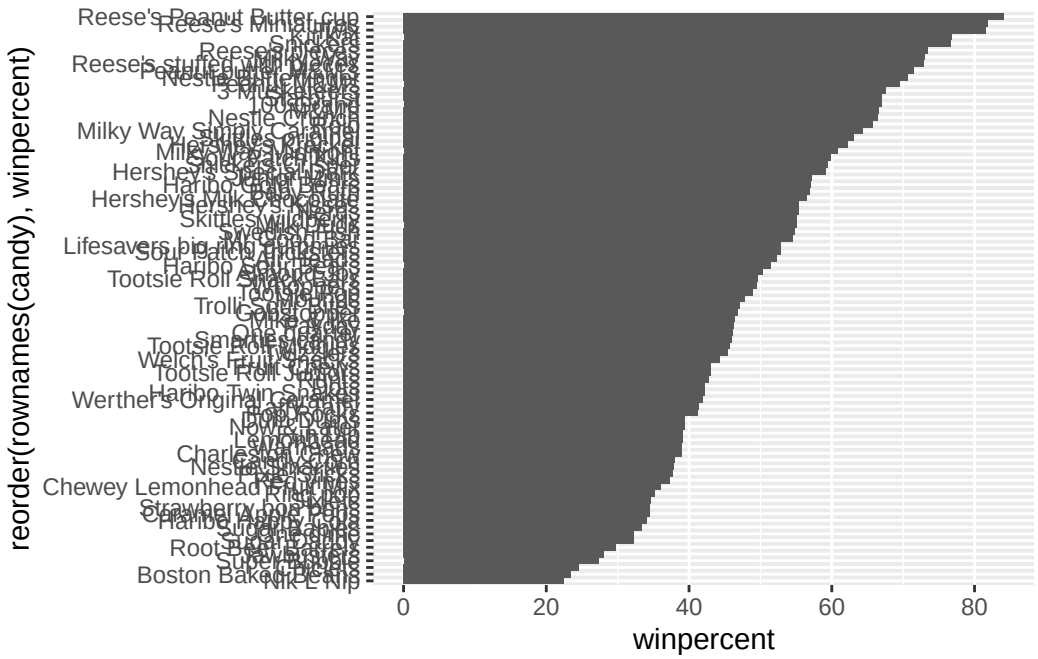
Q15. Make a first barplot of candy ranking based on winpercent values.

```
library(ggplot2)

ggplot(candy) +
  aes(winpercent, rownames(candy)) +
  geom_bar(stat="identity")
```



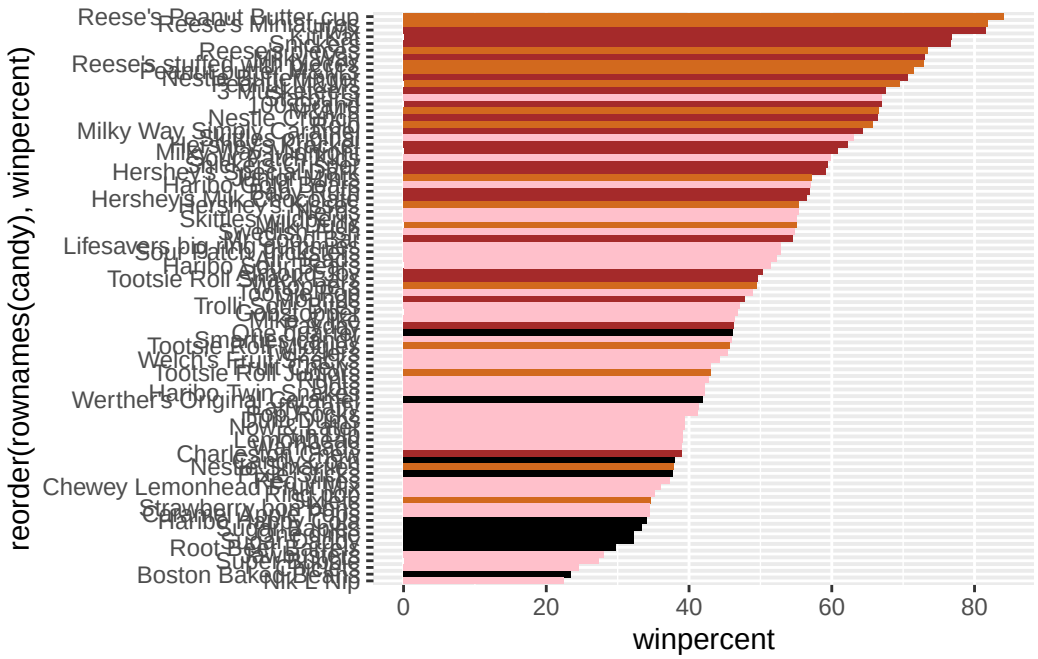
Q16. This is quite ugly, use the reorder() function to get the bars sorted by winpercent?

```
ggplot(candy) +
  aes(winpercent, reorder(rownames(candy),winpercent)) +
  geom_bar(stat="identity")
```




```
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"
```

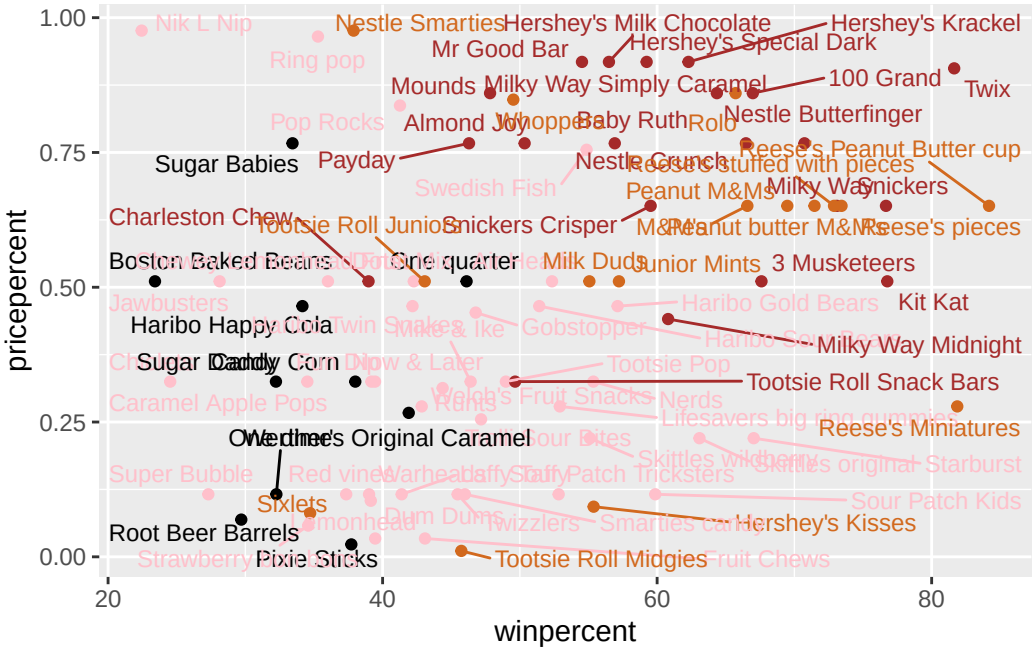
```
ggplot(candy) +
  aes(winpercent, reorder(rownames(candy),winpercent)) +
  geom_col(fill=my_cols)
```



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 = Inf)
```



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? Fruity

Q20. What are the top 5 most expensive candy types in the dataset and of these which is the least popular? Nik L Kip (least popular), Nestle Smarties, Ring pop, Hershey's Krackel, Hershey's Milk Chocolate

```
tail(candy[order(candy$pricepercent),], n=7)
```

```
                      chocolate fruity caramel peanutyalmondy nougat
Hershey's Krackel             1      0       0              0      0
Hershey's Milk Chocolate      1      0       0              0      0
Hershey's Special Dark        1      0       0              0      0
Mr Good Bar                   1      0       0              1      0
Ring pop                      0      1       0              0      0
Nik L Nip                     0      1       0              0      0
Nestle Smarties               1      0       0              0      0
                      crispedricewafer hard bar pluribus sugarpercent
Hershey's Krackel                    1    0   1        0        0.430
Hershey's Milk Chocolate             0    0   1        0        0.430
Hershey's Special Dark               0    0   1        0        0.430
Mr Good Bar                          0    0   1        0        0.313
```

```
Ring pop                              0    1   0        0        0.732
Nik L Nip                             0    0   0        1        0.197
Nestle Smarties                       0    0   0        1        0.267
                          pricepercent winpercent
Hershey's Krackel                0.918   62.28448
Hershey's Milk Chocolate         0.918   56.49050
Hershey's Special Dark           0.918   59.23612
Mr Good Bar                      0.918   54.52645
Ring pop                         0.965   35.29076
Nik L Nip                        0.976   22.44534
Nestle Smarties                  0.976   37.88719
```

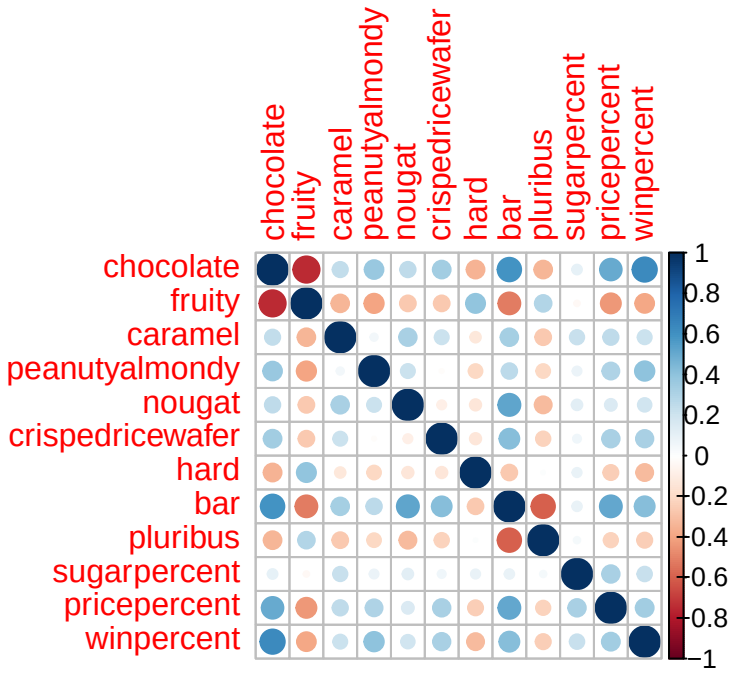
```
ord <- order(candy$pricepercent, decreasing = TRUE)
head( candy[ord,c(11,12)], n=5 )
```

```
                          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
```

```
library(corrplot)
```

```
corrplot 0.92 loaded
```

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



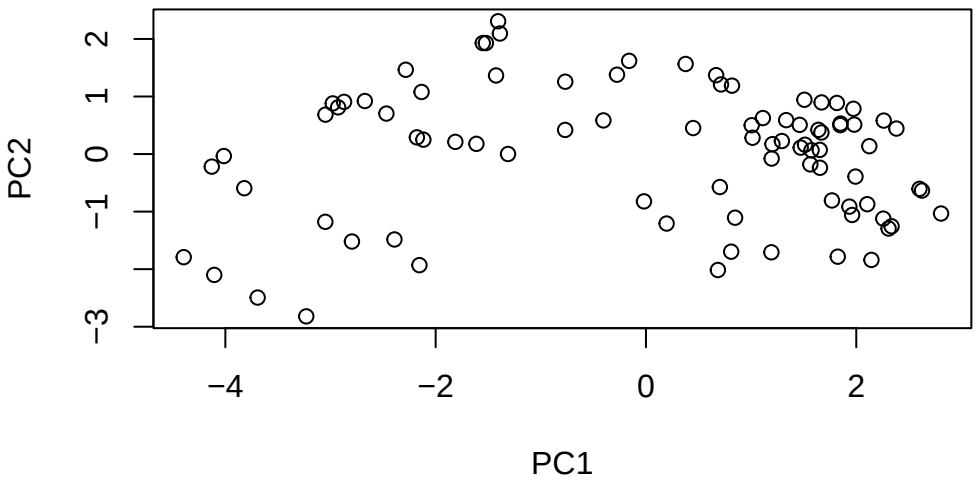
Q22. Examining this plot what two variables are anti-correlated (i.e. have minus values)? Chocolaty and Fruity are the most anti-correlated.

Q23. Similarly, what two variables are most positively correlated? Chocolaty and Bar are the most positively correlated.

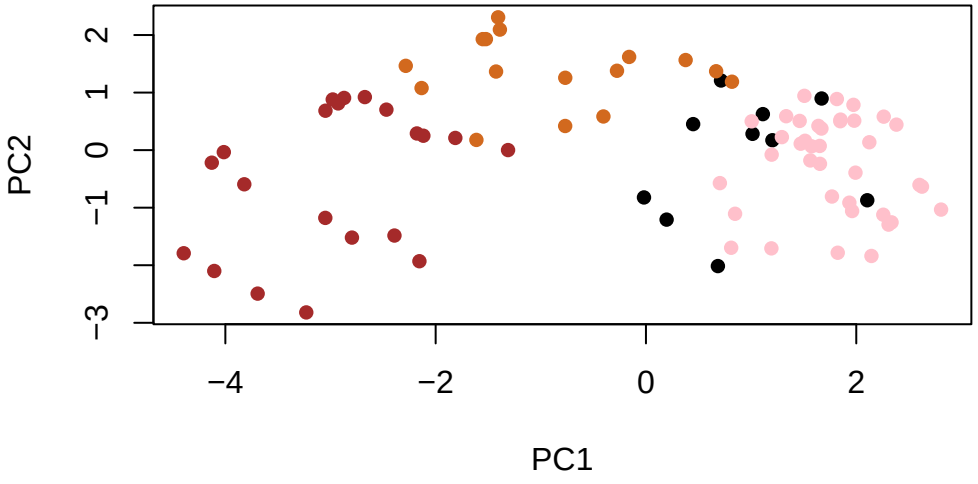
```
pca <- prcomp(candy, scale=TRUE)
summary(pca)
```

```
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])
```

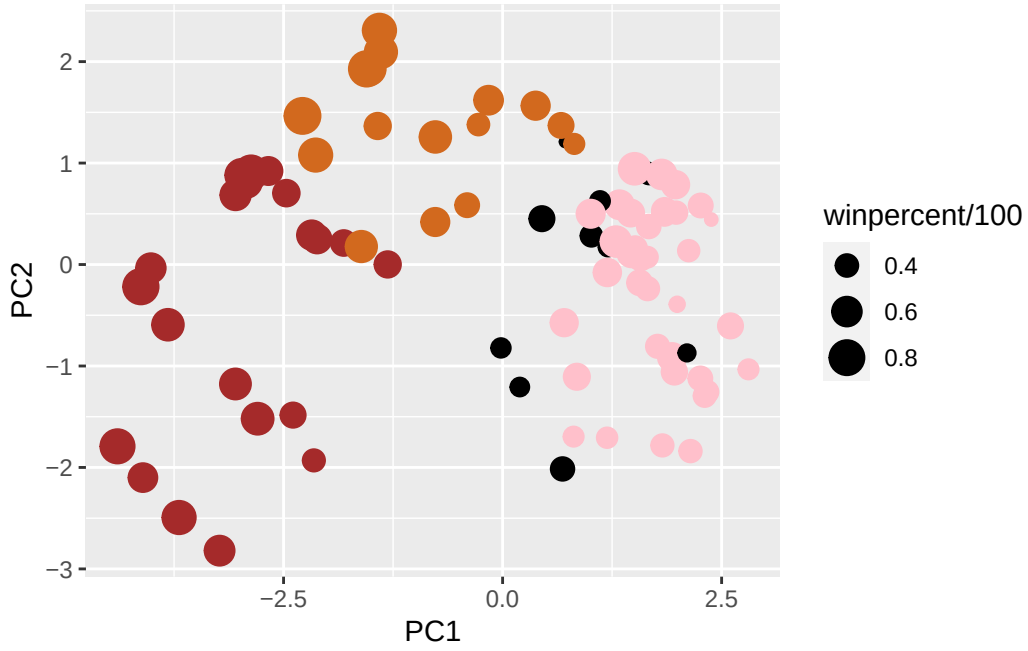



```
plot(pca$x[,1:2], col=my_cols, pch=16)
```

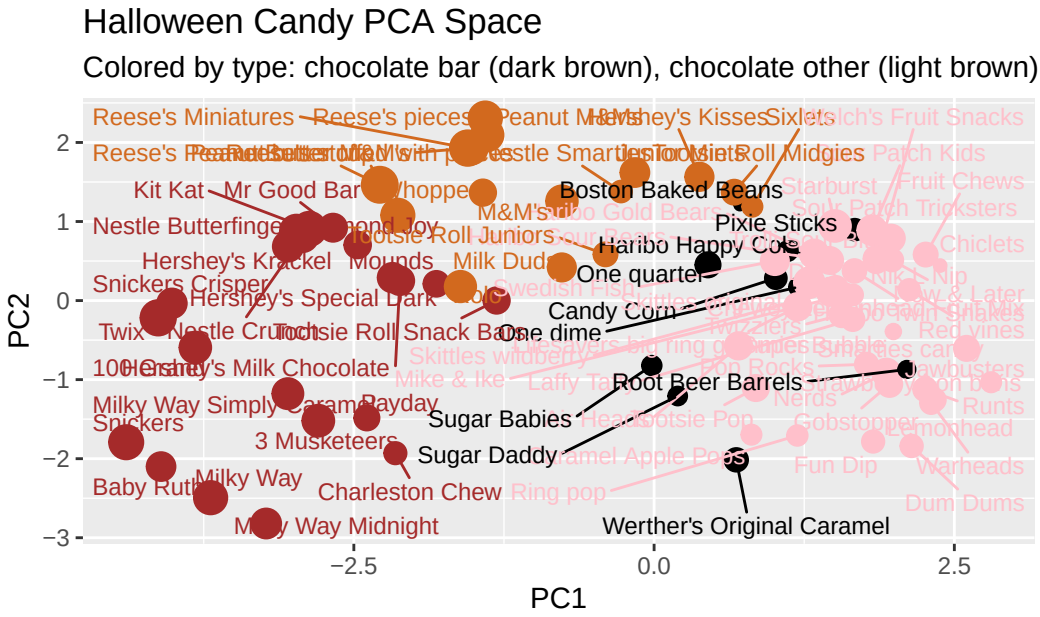


```
# Make a new data-frame with our PCA results and candy data
my_data <- cbind(candy, pca$x[,1:3])
```

```
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
```




```
library(ggrepel)

p + geom_text_repel(size=3.3, col=my_cols, max.overlaps = Inf)  +
  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")
```



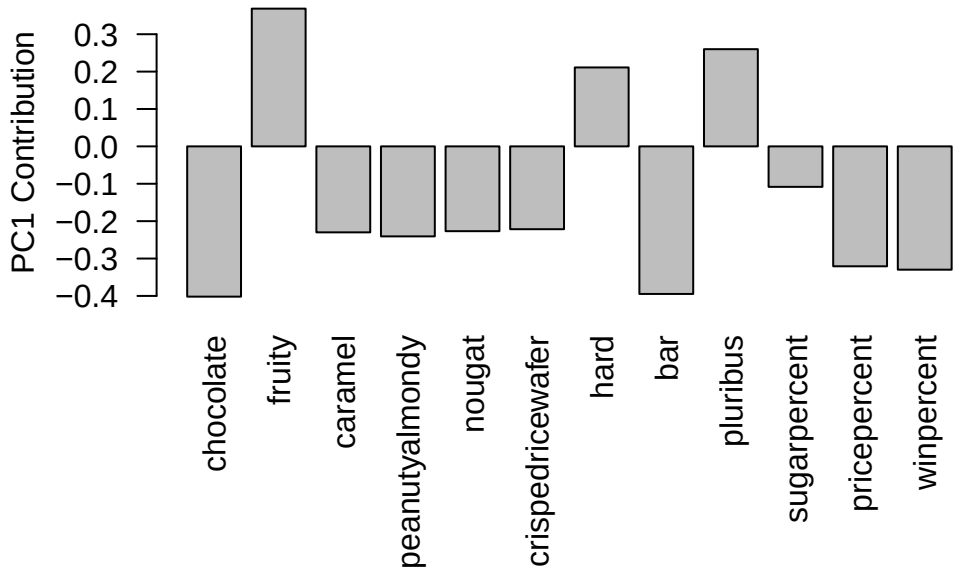
Data from 538

```
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")
```



Q24. What original variables are picked up strongly by PC1 in the positive direction? Do these make sense to you? Yes since they all were inexpensive and had moderate to low winpercent.Fruity, hard, and pluribus