Class 10: Halloween Mini-Project

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Importing the 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
```

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

There are 85 different brands of candies within this dataset. >Q2. How many fruity candy types are in the dataset?

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

```
[1] 38
```

There are 38 fruity candy types.

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

```
[1] 39.0119
```

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

```
[1] 76.7686
```

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

```
[1] 49.6535
```

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

My favorite candy in the dataset is Warheads, and it's winpercent is 39.01. >Q4. What is the winpercent value for "Kit Kat"?

76.77% >Q5. What is the winpercent value for "Tootsie Roll Snack Bars"?

49.65%

```
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?

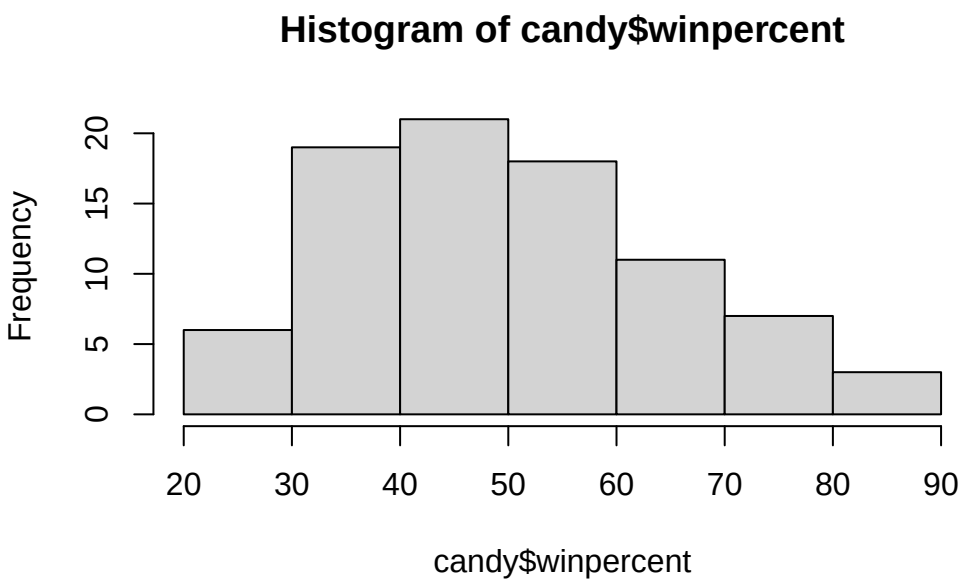
The winpercent row has values that go above 1 whereas the other rows range from only 0 to 1.

Q7. What do you think a zero and one represent for the candy$chocolate column?

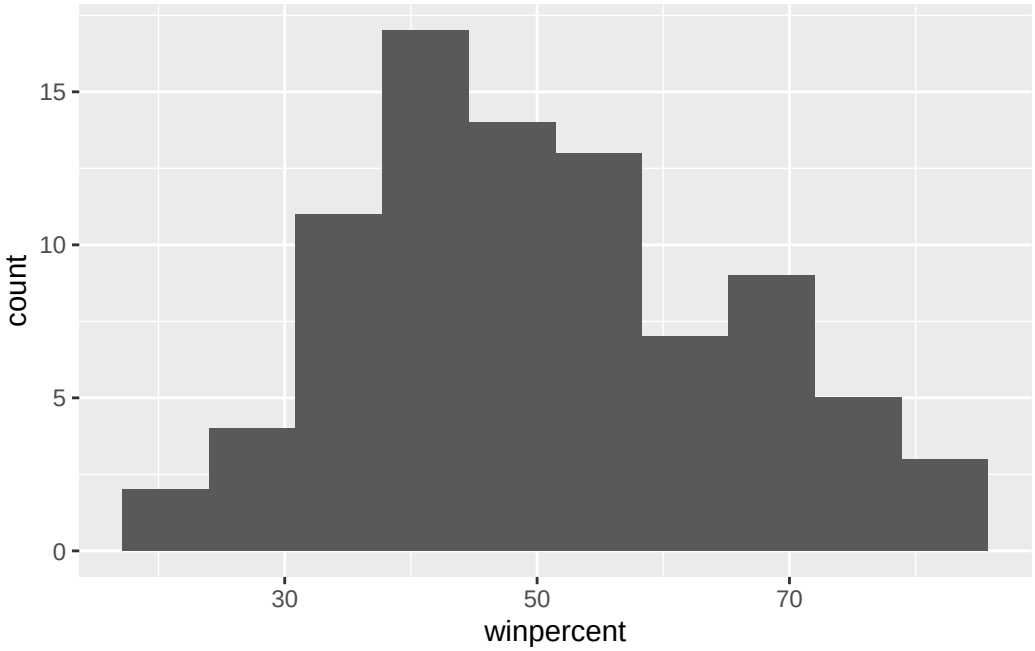
I believe a 0 represents a FALSE value where the candy isn't chocalate. A 1 represents TRUE where the candy is chocalate.

Q8. Plot a histogram of winpercent values

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




```
library(ggplot2)

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



Q9. Is the distribution of winpercent values symmetrical?

No it is skewed right towards higher winpercents.

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

```
median(candy$winpercent)
```

```
[1] 47.82975
```

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

```
[1] 50.31676
```

The center of the distribution is above 50%.

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

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

```
[1] 60.92153
```

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

```
[1] 44.11974
```

The average for chocalate candy is higher.

Q12. Is this difference statistically significant?

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

```
    Welch Two Sample t-test

data:  candy$winpercent[as.logical(candy$fruity)] and candy$winpercent[as.logical(candy$choc
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
```

The difference between the averages of chocalate and fruity candy is statistically significant since the p-value obtained is 2.871e-08 which is much smaller than 0.05.

Q13. What are the five least liked candy types in this set?

```
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
```

The five least liked candies by winpercent are Nik L Nik L Nip, Boston Baked Beans, Chiclets, Super Bubble, and Jawbusters.

Q14. What are the top 5 all time favorite candy types out of this set?

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

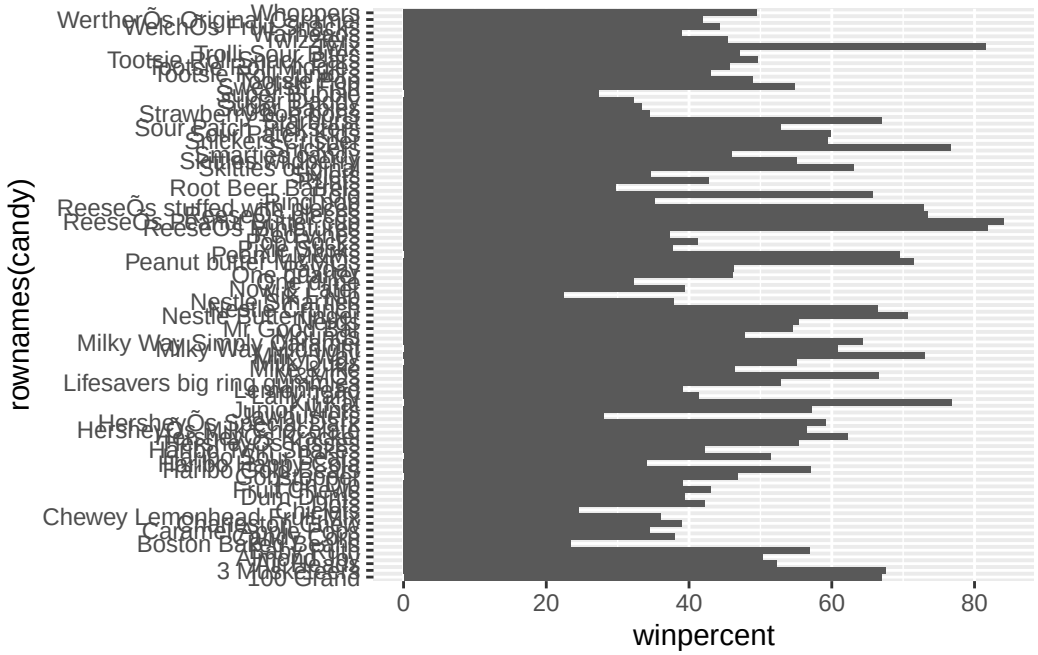
```
                        chocolate fruity caramel peanutyalmondy nougat
ReeseÕs Peanut Butter cup         1      0       0              1      0
ReeseÕs Miniatures                1      0       0              1      0
Twix                              1      0       1              0      0
Kit Kat                           1      0       0              0      0
Snickers                          1      0       1              1      1
                        crispedricewafer hard bar pluribus sugarpercent
ReeseÕs Peanut Butter cup                0    0   0        0        0.720
ReeseÕs 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
```

```
ReeseÕs Peanut Butter cup        0.651   84.18029
ReeseÕs Miniatures               0.279   81.86626
Twix                             0.906   81.64291
Kit Kat                          0.511   76.76860
Snickers                         0.651   76.67378
```

The 5 most liked candies by winpercent are Reese's Peanut Butter cup, Reese's Miniatures, Twix, Kit Kat, and Snickers.

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

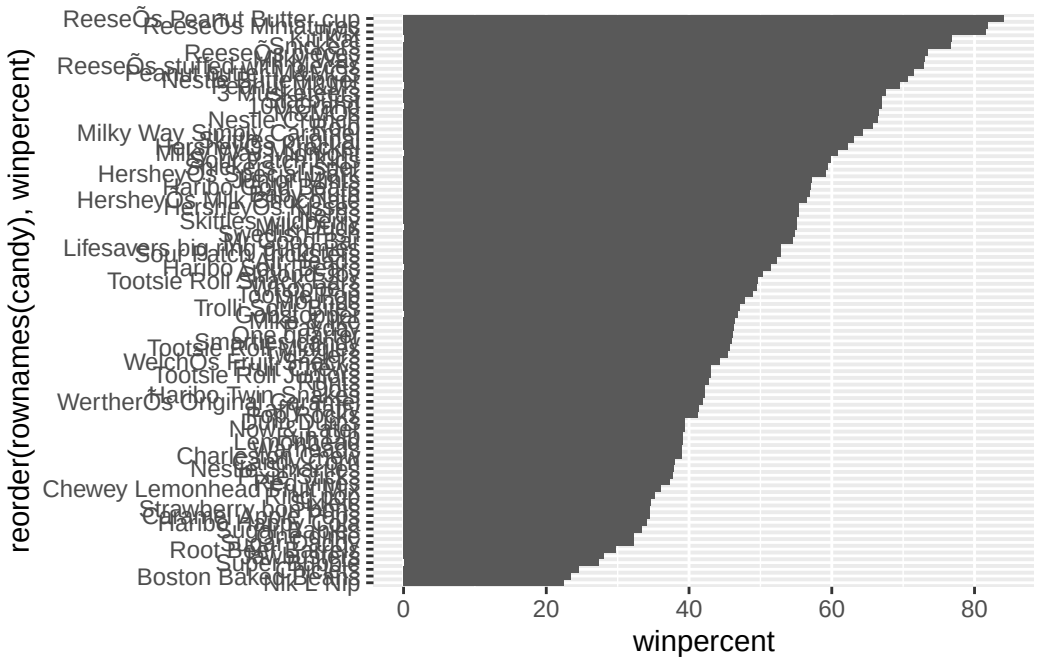
```
library(ggplot2)

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



Q.16 This is quite ugly, use the reorder() function to get the bars sorted by winpercent?

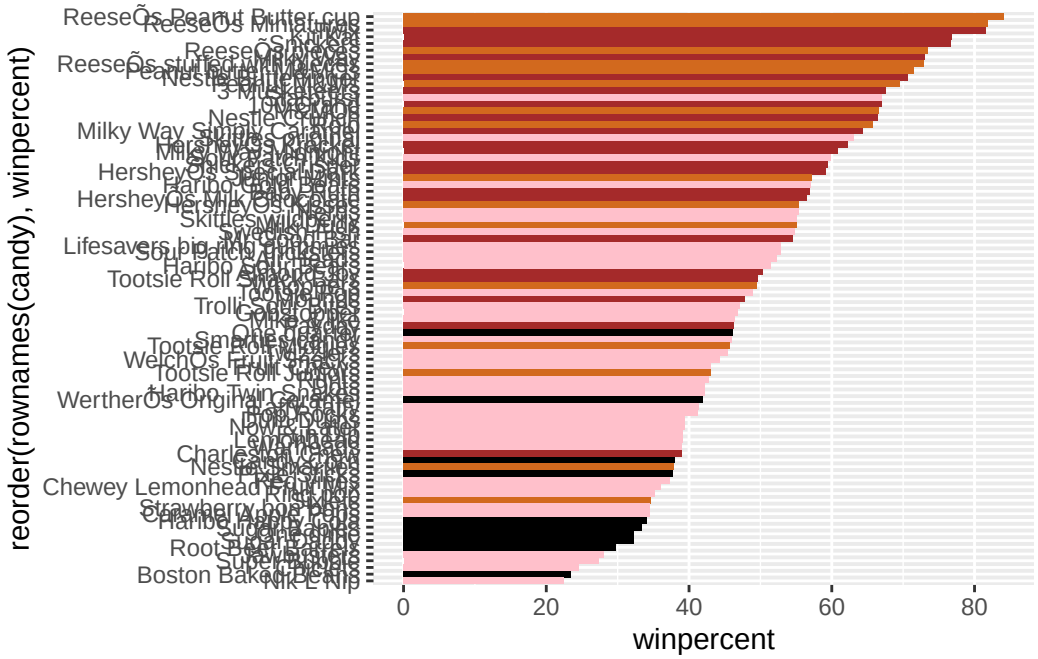
```
library(ggplot2)
```

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



Color

```
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"

library(ggplot2)
ggplot(candy) +
  aes(winpercent, reorder(rownames(candy),winpercent)) +
  geom_col(fill=my_cols)
```



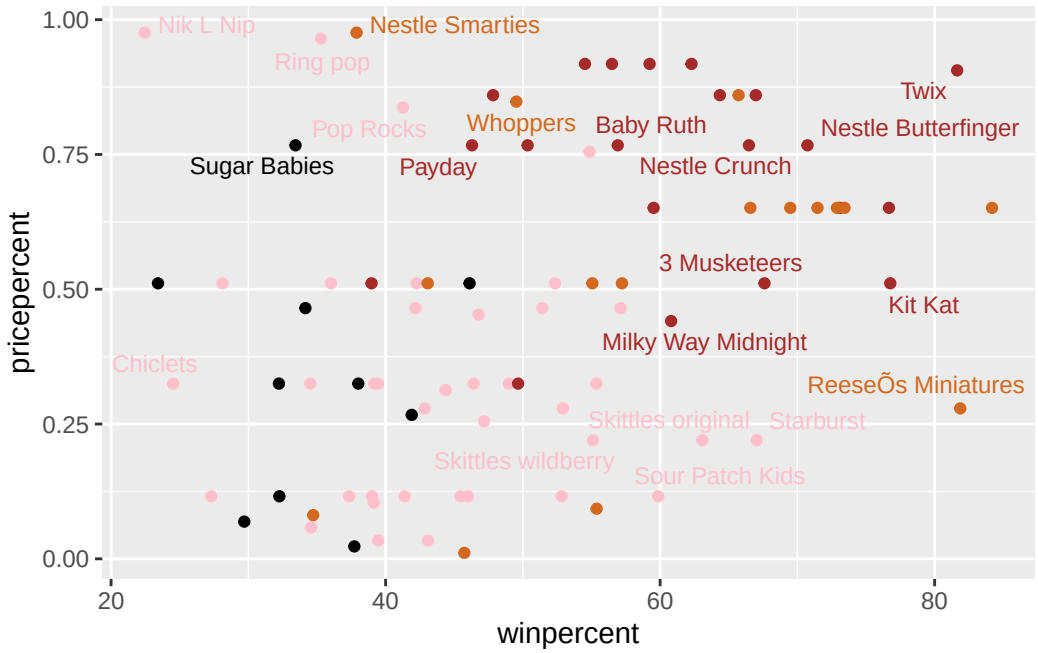
Now, for the first time, using this plot we can answer questions like: > Q17. What is the worst ranked chocolate candy?

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 )
```

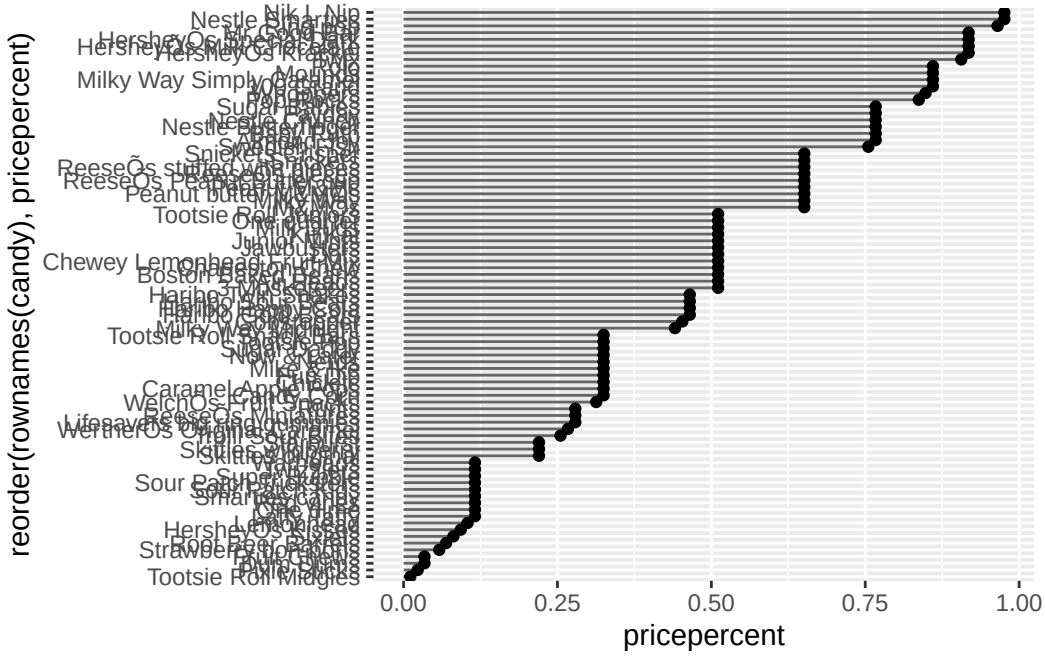
```
                        pricepercent winpercent
Nik L Nip                      0.976   22.44534
Nestle Smarties                0.976   37.88719
Ring pop                       0.965   35.29076
HersheyÕs Krackel              0.918   62.28448
HersheyÕs Milk Chocolate       0.918   56.49050
```

Nik L Nip is in the top 5 most expensive and is the least liked at about 22.45%.

Q21. Make a barplot again with geom_col() this time using pricepercent and then improve this step by step, first ordering the x-axis by value and finally making a

so called “dot chat” or “lollipop” chart by swapping geom_col() for geom_point() + geom_segment().

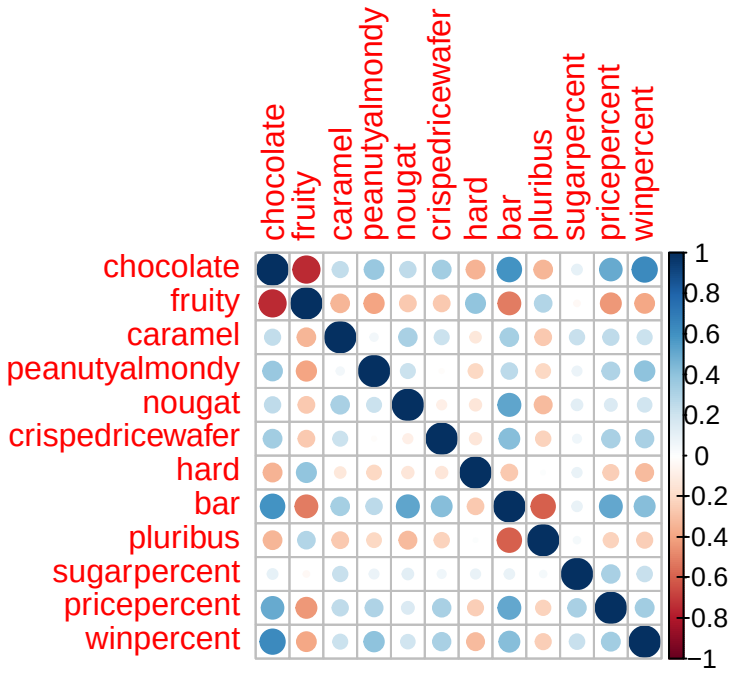
```
# Make a lollipop chart of pricepercent
ggplot(candy) +
  aes(pricepercent, reorder(rownames(candy), pricepercent)) +
  geom_segment(aes(yend = reorder(rownames(candy), pricepercent),
                   xend = 0), col="gray40") +
    geom_point()
```




```
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)?

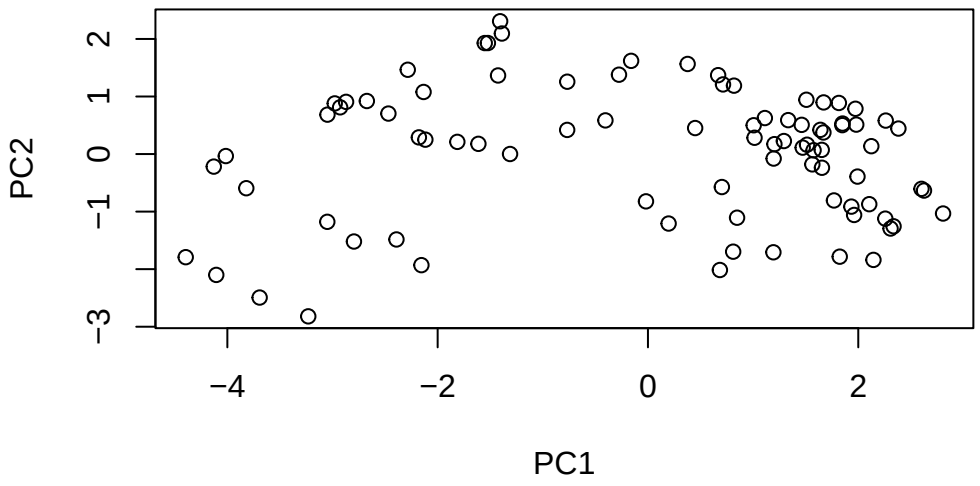
Fruity and chocolate, pluribus and bar, fruity and bar, etc. >Q23. Similarly, what two variables are most positively correlated?

Chocalate and winpercent.

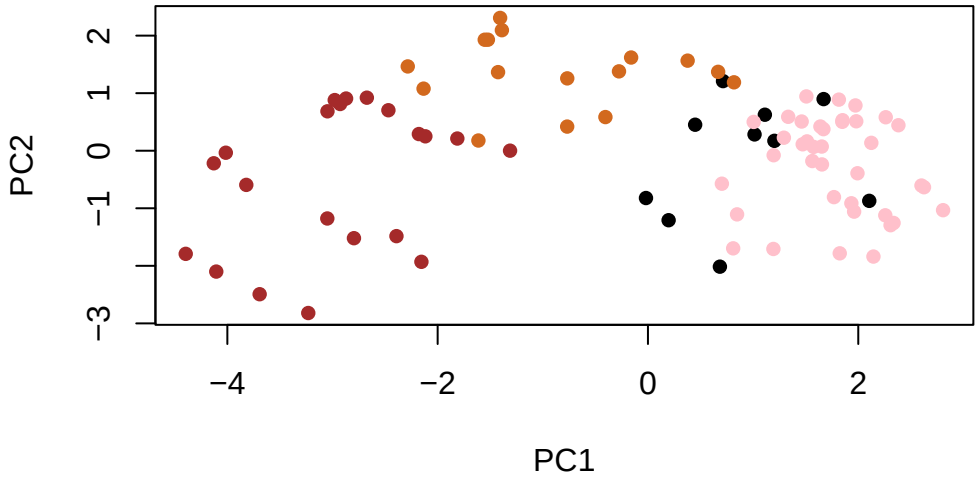
```
pca <- prcomp(candy, scale = TRUE)
summary(pca)
```

```
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
```

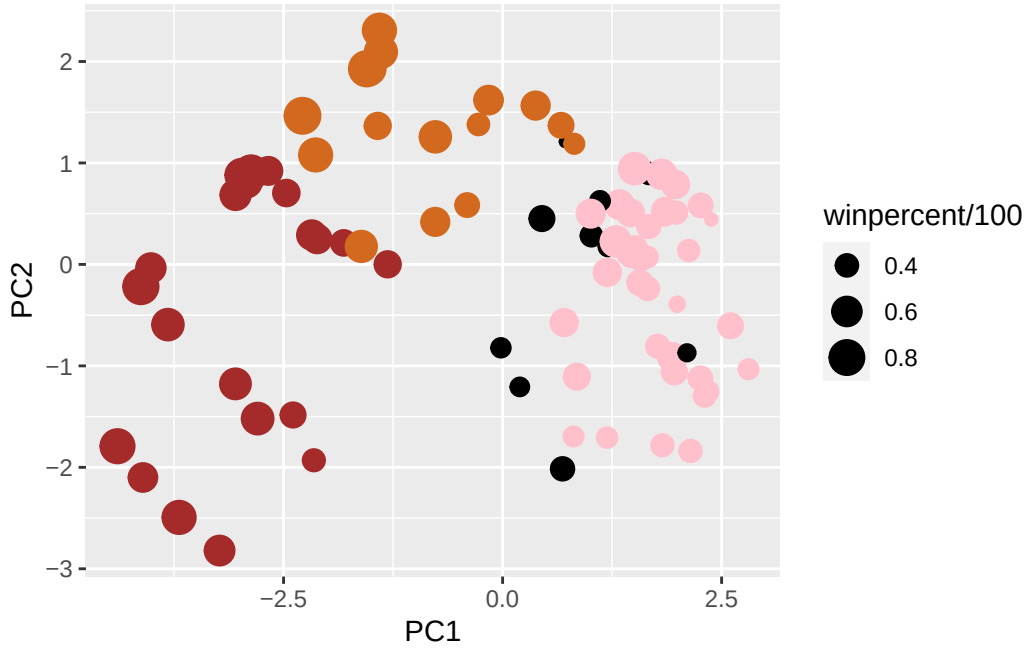
```
plot(pca$x[,c(1,2)])
```




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

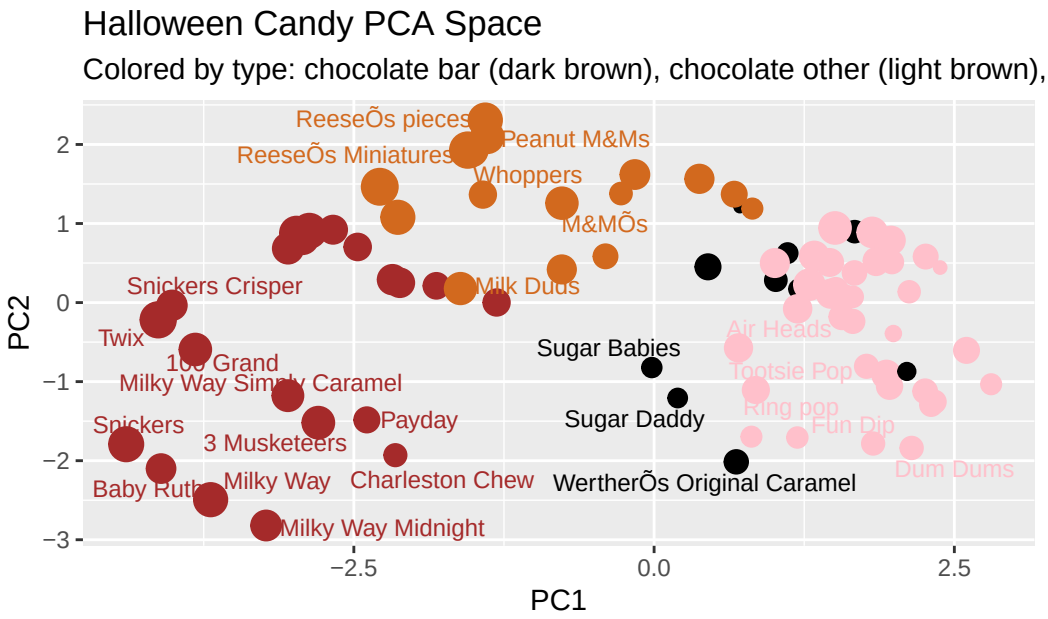


```
# Make a new data-frame with our PCA results and candy data
my_data <- cbind(candy, pca$x[,1:3])
p <- ggplot(my_data) +
        aes(x=PC1, y=PC2,
            size=winpercent/100,
            text=rownames(my_data),
            label=rownames(my_data)) +
        geom_point(col=my_cols)

p
```




```
library(ggrepel)

p + geom_text_repel(size=3.3, col=my_cols, max.overlaps = 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: 60 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```




```
library(plotly)
```

```
Attaching package: 'plotly'
```

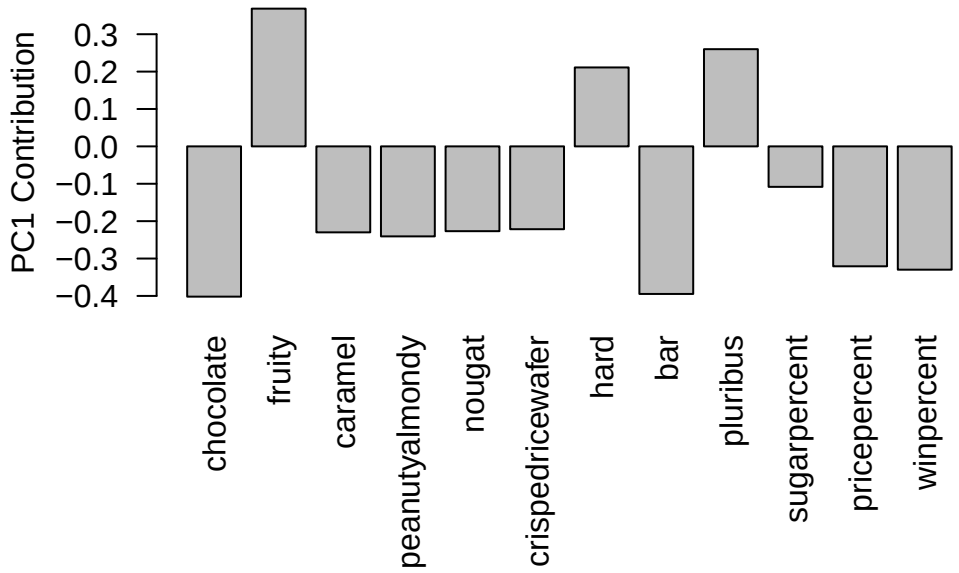
```
The following object is masked from 'package:ggplot2':

    last_plot
```

```
The following object is masked from 'package:stats':

    filter
```

```
The following object is masked from 'package:graphics':

    layout
```

```
#ggplotly was not rendering properly in pdf format, only works in html format
#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?

Fruity, Hard, and Pluribus. These make sense since these groups are the most unique in comparison to the other groups. Fruity, hard, and pluribus don't share as much with the other groups as others do for example chocolate which shares a lot with many groups.