Class 9: Halloween Mini Project

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```
candy <- read.csv("candy-data.csv", 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
```

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

```
 0  1
47 38
```

Q1: There are 85 different types of candy (rows)

Q2: There are 38 “fruity” candies.

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

```
[1] 76.7686
```

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

```
[1] 49.6535
```

Q3: I like kit kats and their win percentage is 76.77%

Q4: Kit kat has a win percentage of 76.77%

Q5: Tootsie roll snack bars have a win percentage of 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
_____	
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	

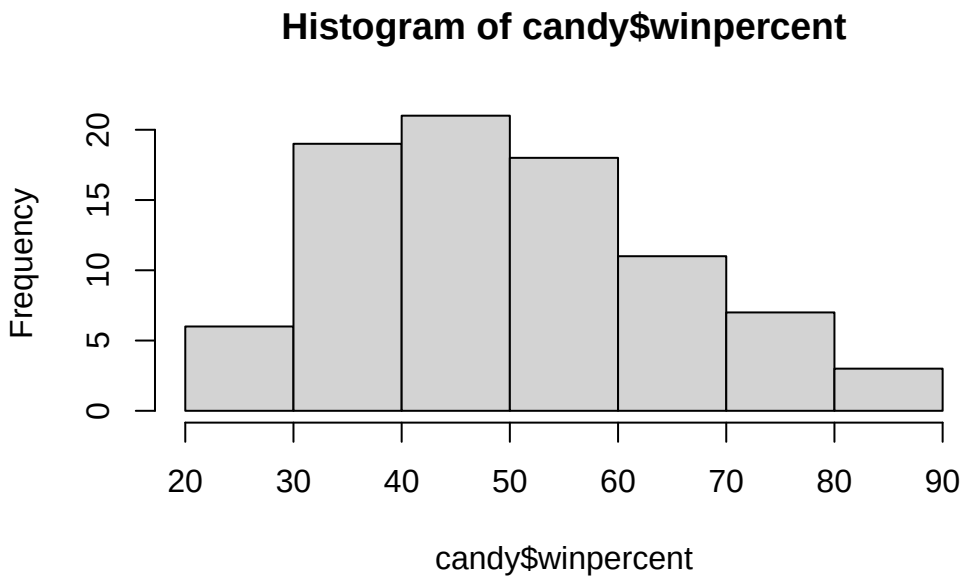
skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
hard	0	1	0.18	0.38	0.00	0.00	0.00	0.00	1.00	
bar	0	1	0.25	0.43	0.00	0.00	0.00	0.00	1.00	
pluribus	0	1	0.52	0.50	0.00	0.00	1.00	1.00	1.00	
sugarpercent	0	1	0.48	0.28	0.01	0.22	0.47	0.73	0.99	
pricepercent	0	1	0.47	0.29	0.01	0.26	0.47	0.65	0.98	
winpercent	0	1	50.32	14.71	22.45	39.14	47.83	59.86	84.18	

Q6: Win percentage seems to be on a different scale because its standard deviation is about 14, but all of the others are less than one.

Q7: The "0" in the chocolate column means there is no chocolate in the candy and the "1" means it contains chocolate.

Q8:

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



Q9: The distribution of the win percentage is not symmetrical.

Q10: The center of the distribution is below 50%.

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

```
[1] 60.92153
```

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

```
[1] 44.11974
```

Q11: On average the chocolate win percentage is higher than the fruity.

```
t.test(chocolate_winperc, fruity_winperc)
```

```
    Welch Two Sample t-test

data:  chocolate_winperc and fruity_winperc
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
```

Q12: According to a basic, two sample t-test, they are statistically significant with a p-value of 2.87e-8.

```
#lets try dplyr for this one
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
```

```
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
```

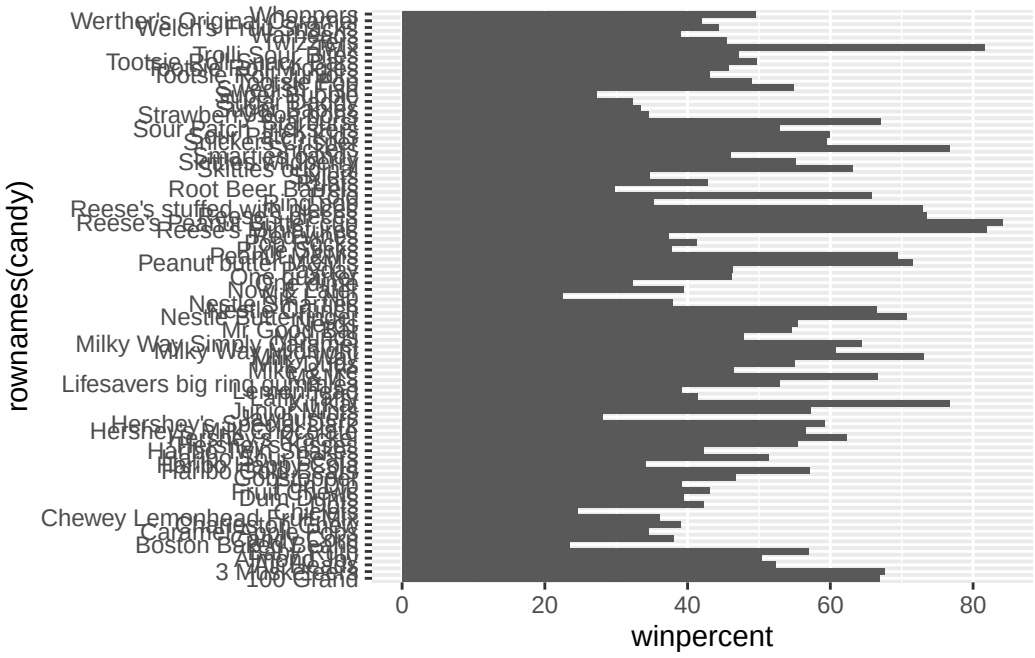
Q13: The bottom 5 are: jawbusters, super bubble, chiclets, boston baked beans, and nik l nip

Q14: The top 5 are: reese's peanut butter cups, reese's miniatures, twix, kit kat, and snickers

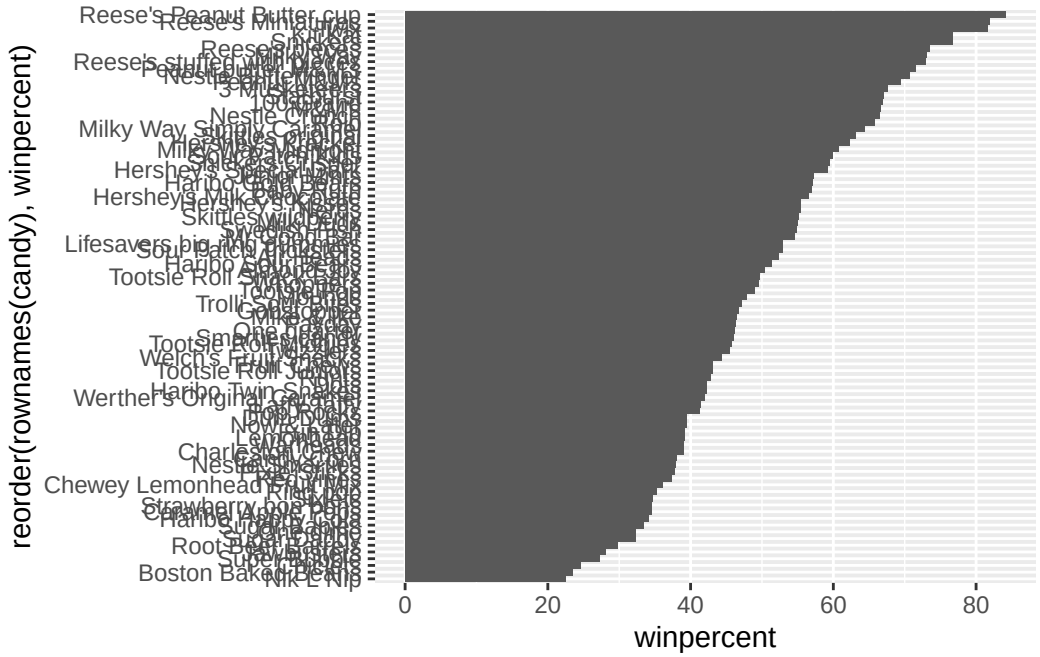
Q15:

```
library(ggplot2)
```

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

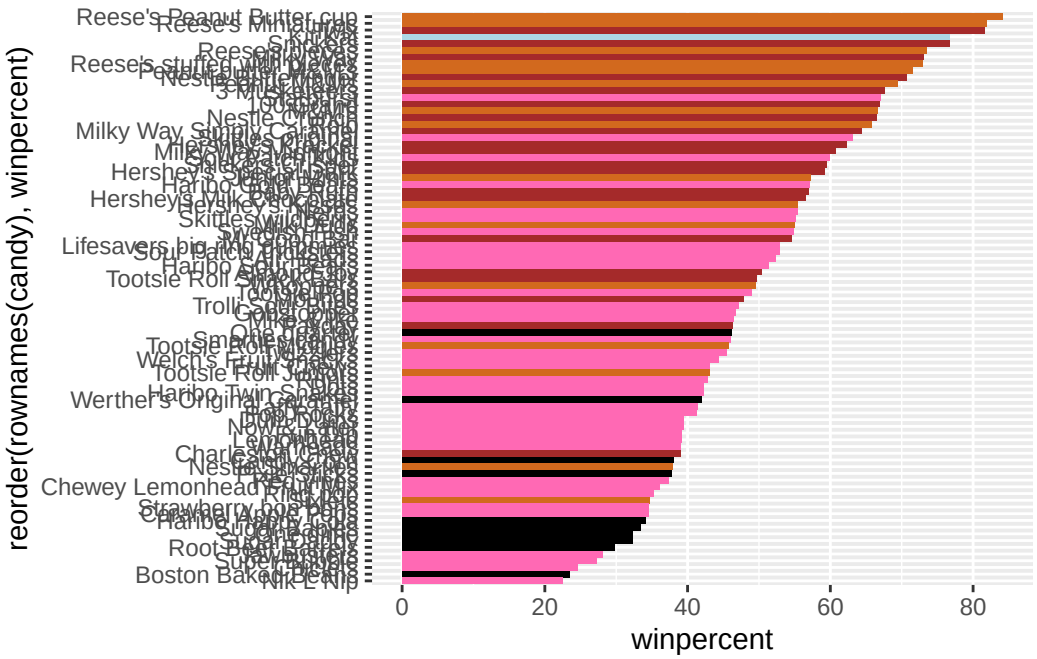


```
ggplot(candy) +
  aes(winpercent, reorder(rownames(candy), winpercent)) +
  geom_col()
```




```
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)] = "hotpink"
my_cols[rownames(candy)=="Kit Kat"] = "lightblue"
```

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



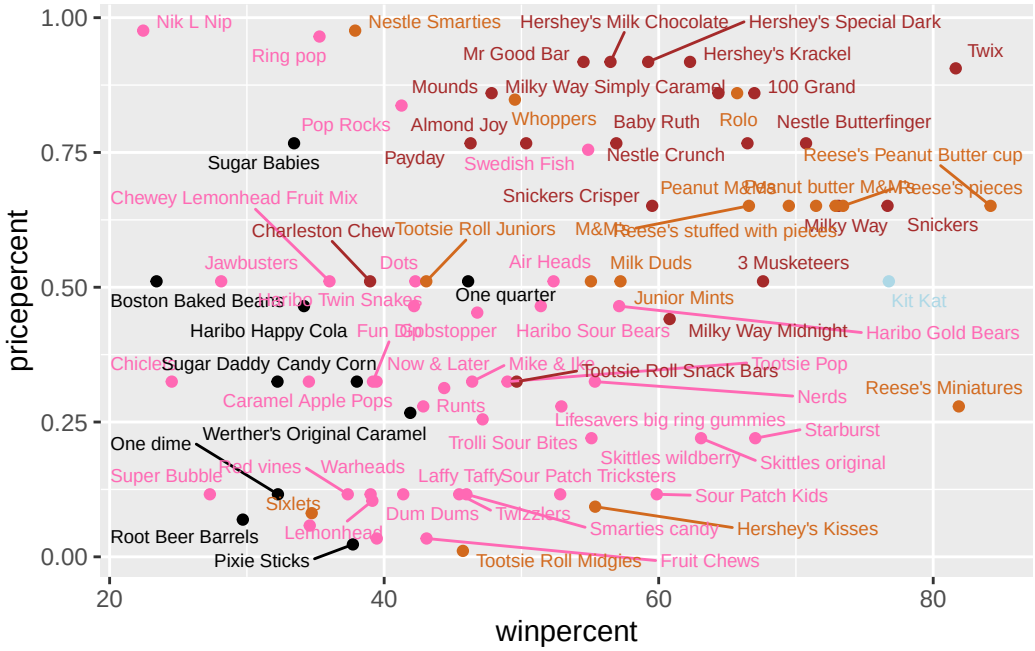
Q17: The worst ranked chocolate candy is Sixlets.

Q18: The best ranked fruity candy is Starbursts.

```
library(ggrepel)
```

```
ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols, size=2.5, max.overlaps = 16)
```

```
Warning: ggrepel: 2 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```




```
#changed the size and overlaps so that all could be included with labels
#geom_text_repel is better than geom_text for lots of points because it reduces overlaps of w
```

Q19: The highest win percentage for the lowest price is probably reese's minis because it has a win percent over 80%, but is close to the 25% price percentage, which is fairly low.

Q20: The top 5 most expensive are: Nik l nip, ring pops, smarties, hershey krackel and hershey milk chocolate. The nik l nip is the least popular.

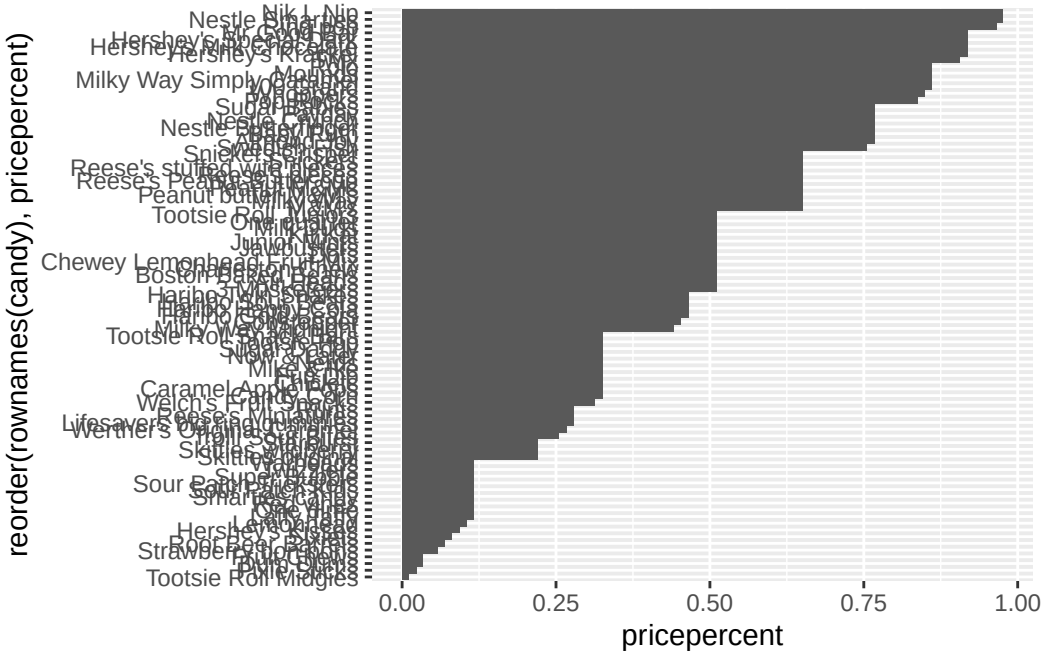
```
candy |>
  arrange(desc(pricepercent)) |>
  head(5)
```

```
                      chocolate fruity caramel peanutyalmondy nougat
Nik L Nip                     0      1       0              0      0
Nestle Smarties               1      0       0              0      0
Ring pop                      0      1       0              0      0
Hershey's Krackel             1      0       0              0      0
Hershey's Milk Chocolate      1      0       0              0      0
                      crispedricewafer hard bar pluribus sugarpercent
Nik L Nip                            0    0   0        1        0.197
Nestle Smarties                      0    0   0        1        0.267
```

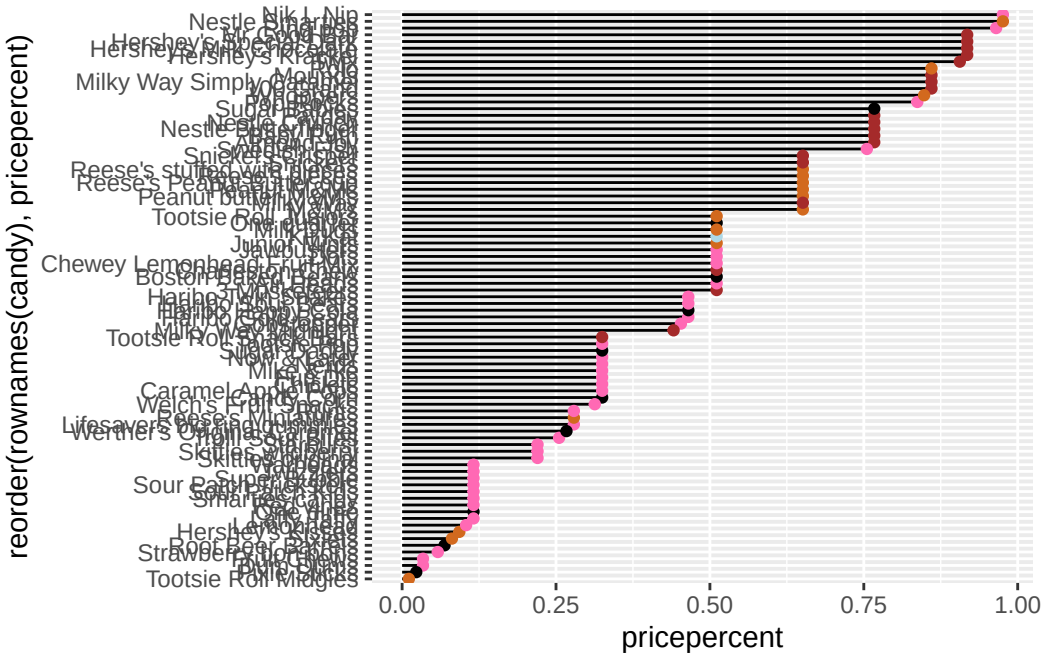
```
Ring pop                            0    1   0        0        0.732
Hershey's Krackel                   1    0   1        0        0.430
Hershey's Milk Chocolate            0    0   1        0        0.430
                          pricepercent winpercent
Nik L Nip                        0.976   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
```

Q21:

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



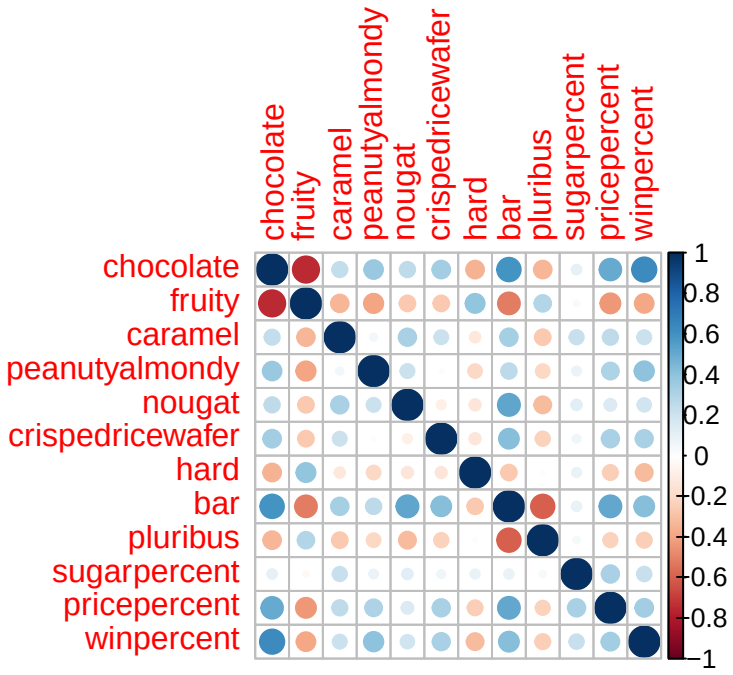

```
ggplot(candy) +
  aes(pricepercent, reorder(rownames(candy), pricepercent)) +
  geom_segment(aes(yend=reorder(rownames(candy), pricepercent),
                   xend=0)) +
  geom_point(col=my_cols)
```




```
library(corrplot)
```

```
corrplot 0.95 loaded
```

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



Q22: The most anti-correlated would be chocolate and fruity (not a lot of candy is both). The pluribus and bar are also anti-correlated (which makes sense because most of the time you don't get more than one bar of candy per serving). I can tell by the size and redness of the dots.

Q23: Chocolate and winpercent are very correlated. Chocolate and bar are also very correlated. Same with chocolate and pricepercent, as well as bar and pricepercent.

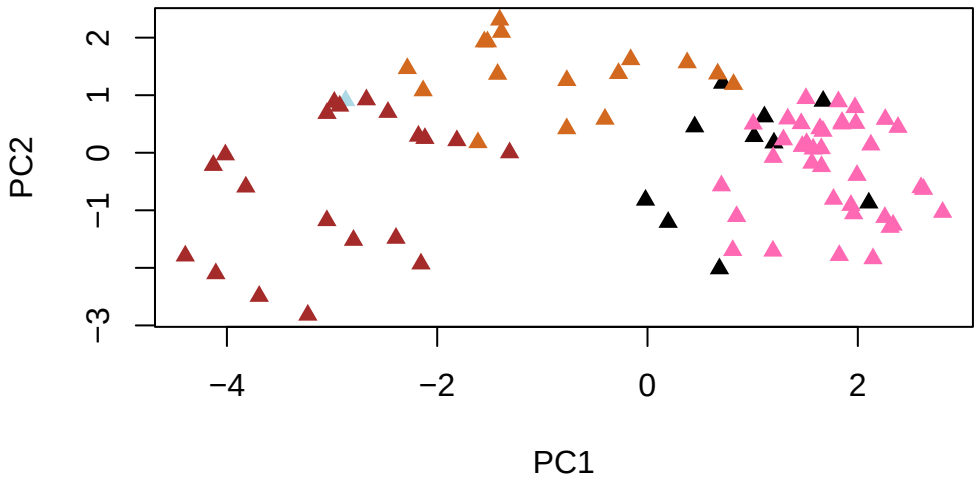
```
noscale_pca <- prcomp(candy, scale=FALSE)
pca <- prcomp(candy, scale=TRUE)

summary(noscale_pca)
```

```
Importance of components:
                            PC1     PC2     PC3     PC4     PC5     PC6     PC7
Standard deviation     14.7231 0.70241 0.47762 0.37292 0.34641 0.33614 0.30748
Proportion of Variance  0.9935 0.00226 0.00105 0.00064 0.00055 0.00052 0.00043
Cumulative Proportion   0.9935 0.99574 0.99678 0.99742 0.99797 0.99849 0.99892
                           PC8     PC9    PC10    PC11    PC12
Standard deviation     0.27417 0.23826 0.21435 0.18434 0.15331
Proportion of Variance 0.00034 0.00026 0.00021 0.00016 0.00011
Cumulative Proportion  0.99927 0.99953 0.99974 0.99989 1.00000
```

```
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
```

```
#change shape and colors
plot(pca$x[,1:2], col=my_cols, pch=17)
```

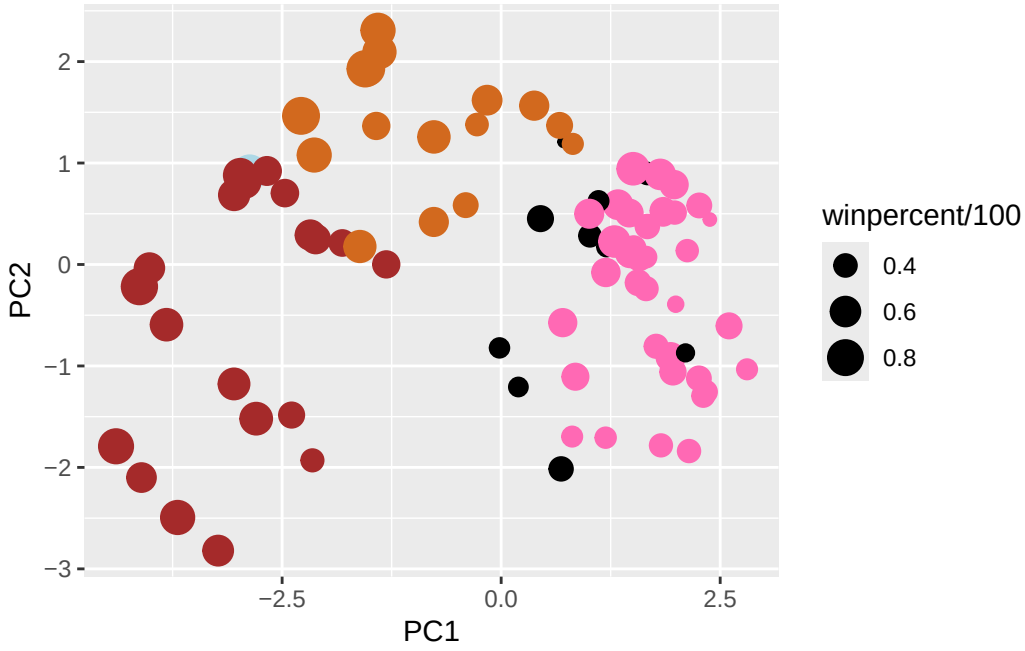



```
candy_data <- cbind(candy, pca$x[,1:3])
head(candy_data)
```

```
             chocolate fruity caramel peanutyalmondy nougat crispedricewafer
100 Grand            1      0       1              0      0                 1
3 Musketeers         1      0       0              0      1                 0
```

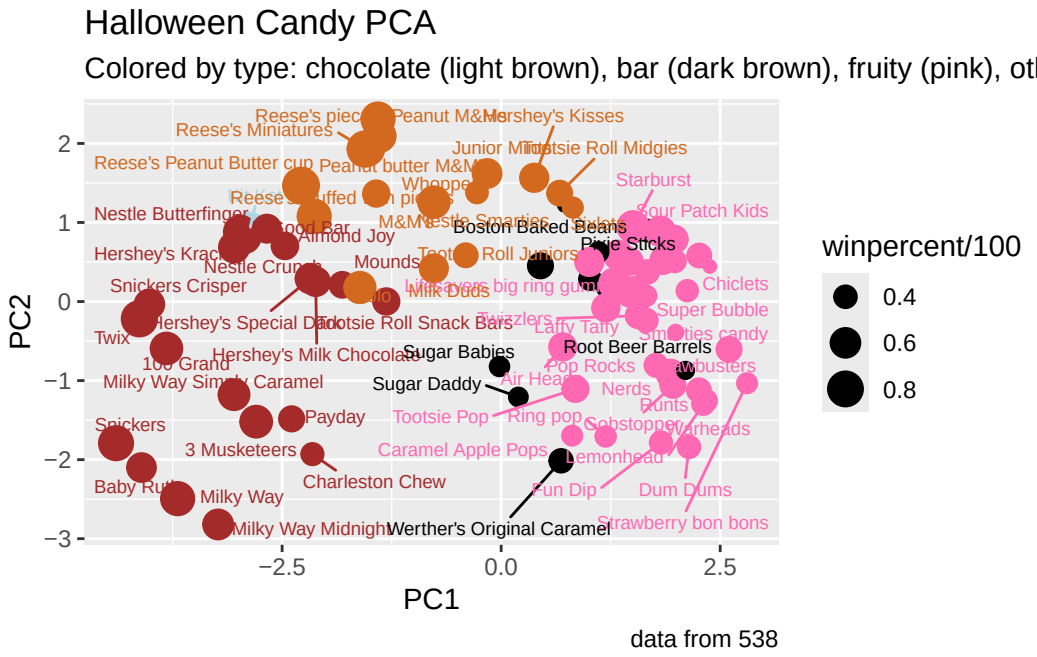
```
One dime              0      0       0              0      0                0
One quarter           0      0       0              0      0                0
Air Heads             0      1       0              0      0                0
Almond Joy            1      0       0              1      0                0
             hard bar pluribus sugarpercent pricepercent winpercent        PC1
100 Grand       0   1        0        0.732        0.860   66.97173 -3.8198617
3 Musketeers    0   1        0        0.604        0.511   67.60294 -2.7960236
One dime        0   0        0        0.011        0.116   32.26109  1.2025836
One quarter     0   0        0        0.011        0.511   46.11650  0.4486538
Air Heads       0   0        0        0.906        0.511   52.34146  0.7028992
Almond Joy      0   1        0        0.465        0.767   50.34755 -2.4683383
                    PC2        PC3
100 Grand    -0.5935788 -2.1863087
3 Musketeers -1.5196062  1.4121986
One dime      0.1718121  2.0607712
One quarter   0.4519736  1.4764928
Air Heads    -0.5731343 -0.9293893
Almond Joy    0.7035501  0.8581089
```

```
ggplot(candy_data) +
  aes(PC1, PC2, size=winpercent/100, text=rownames(candy_data),
      label=rownames(candy_data)) +
  geom_point(col=my_cols)
```



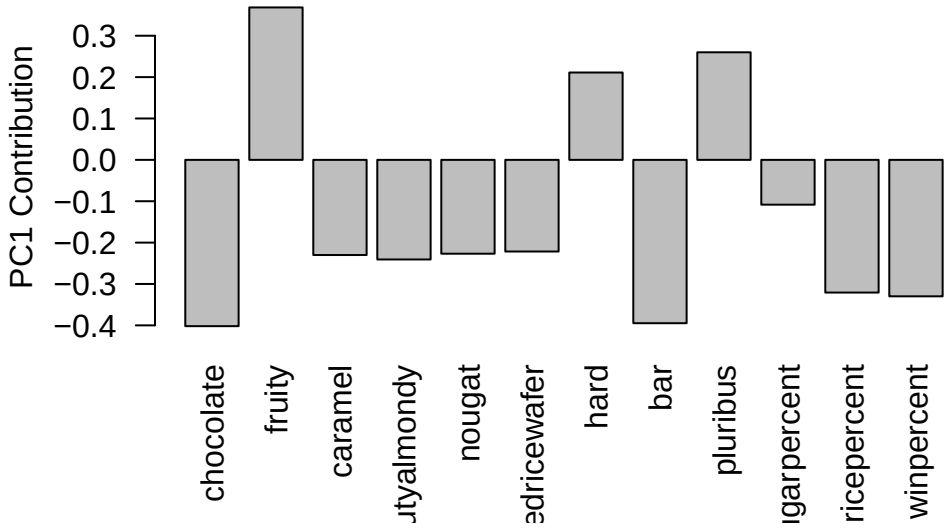
```
candy_plot <- ggplot(candy_data) +
  aes(PC1, PC2,
      size=winpercent/100,
      text=rownames(candy_data),
      label=rownames(candy_data)) +
  geom_point(col=my_cols) +
  geom_text_repel(size=2.5, col=my_cols, max.overlaps = 20) +
  labs(title="Halloween Candy PCA",
       subtitle = "Colored by type: chocolate (light brown), bar (dark brown), fruity (pink)",
       caption= "data from 538")

candy_plot
```

```
Warning: ggrepel: 20 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```




```
#library(plotly)
#ggplotly(candy_plot)
```

```
barplot(pca$rotation[,1], las = 2, ylab="PC1 Contribution")
```



Q24: chocolate, fruity, and bar are the most "picked up." This makes sense to me because those were the categories that showed the largest pos/neg correlations on the correlation graph. So, they it makes sense that they are strongly variable.