class 8: Halloween project

AUTHOR
Torrey Rhyne (A14397504)

Import 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
```

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

```
nrow(candy)
```

```
[1] 85
```

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

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

```
[1] 38
```

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

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

```
[1] 81.64291
```

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",]$winpercent
```

```
[1] 49.6535
```

```
# install.packages("skimr")
library("skimr")
skim(candy)
```

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	▇▁▁▁▁

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
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	▃▇▆▅▂

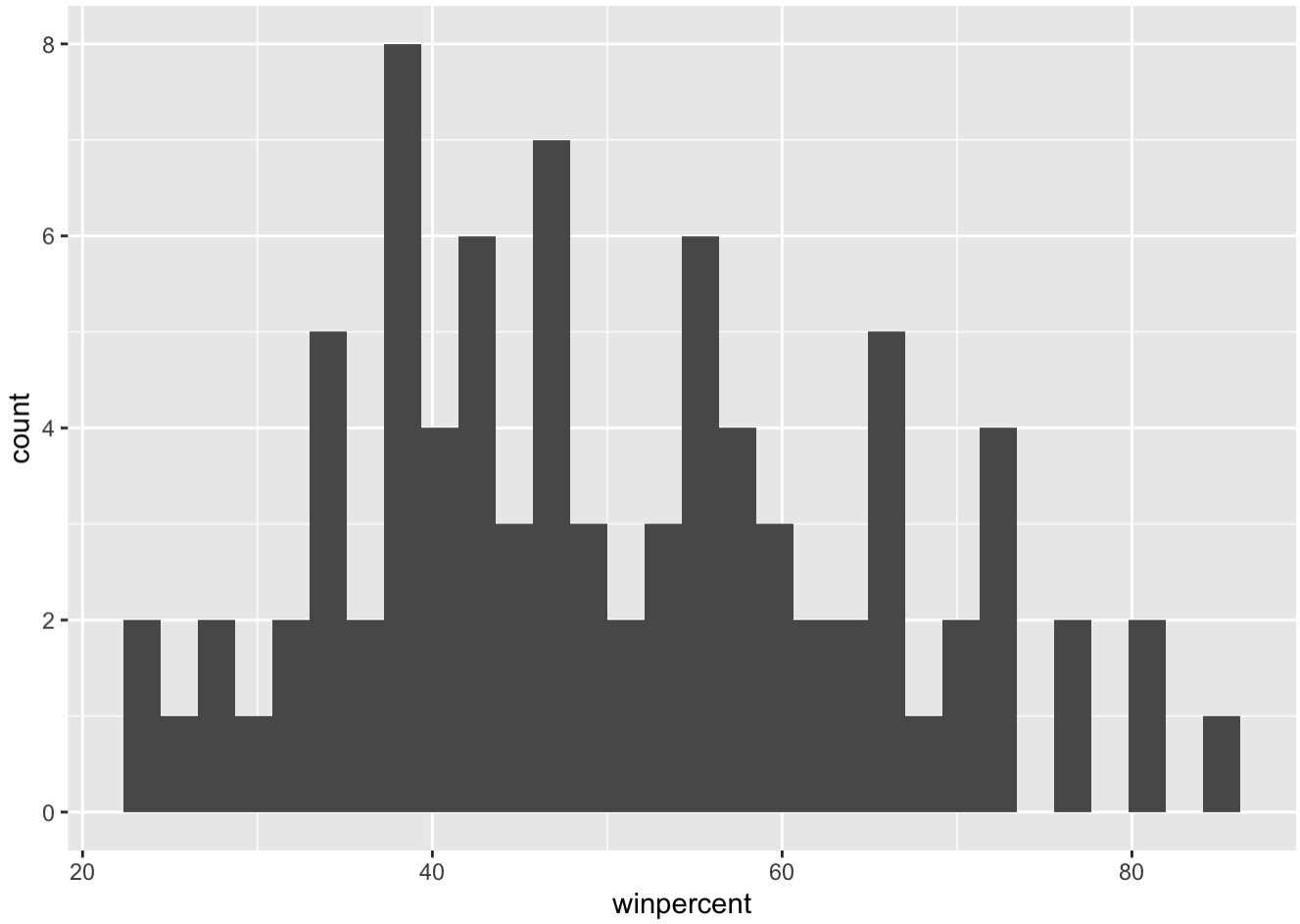
Q6. Is there any variable/column that looks to be on a different scale to the majority of the other columns in the dataset? Yes, winpercent is on a different scale.

Q7. What do you think a zero and one represent for the candy$chocolate column? 1 = it is a chocolatey candy (TRUE), 0 = it's not a chocolatey candy (FALSE).

Q8. Plot a histogram of winpercent values

```
library(ggplot2)
ggplot(candy, aes(x=winpercent)) + geom_histogram()
```

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



Q9. Is the distribution of winpercent values symmetrical? No.

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?

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

```
[1] 60.05188
```

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

```
[1] 60.92153
```

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

```
[1] 44.11974
```

Chocolate candy is ranked higher.

Q12. Is this difference statistically significant?

```
choc <- candy$winpercent[as.logical(candy$chocolate)]
fruit <- candy$winpercent[as.logical(candy$fruity)]
t.test(choc,fruit)
```

```
    Welch Two Sample t-test

data:  choc and fruit
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
```

Yes, the difference is ranked higher.

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

```
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
```

Nik L Nip, Boston Baked Beans, Chiclets, Super Bubble, Jawbusters

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

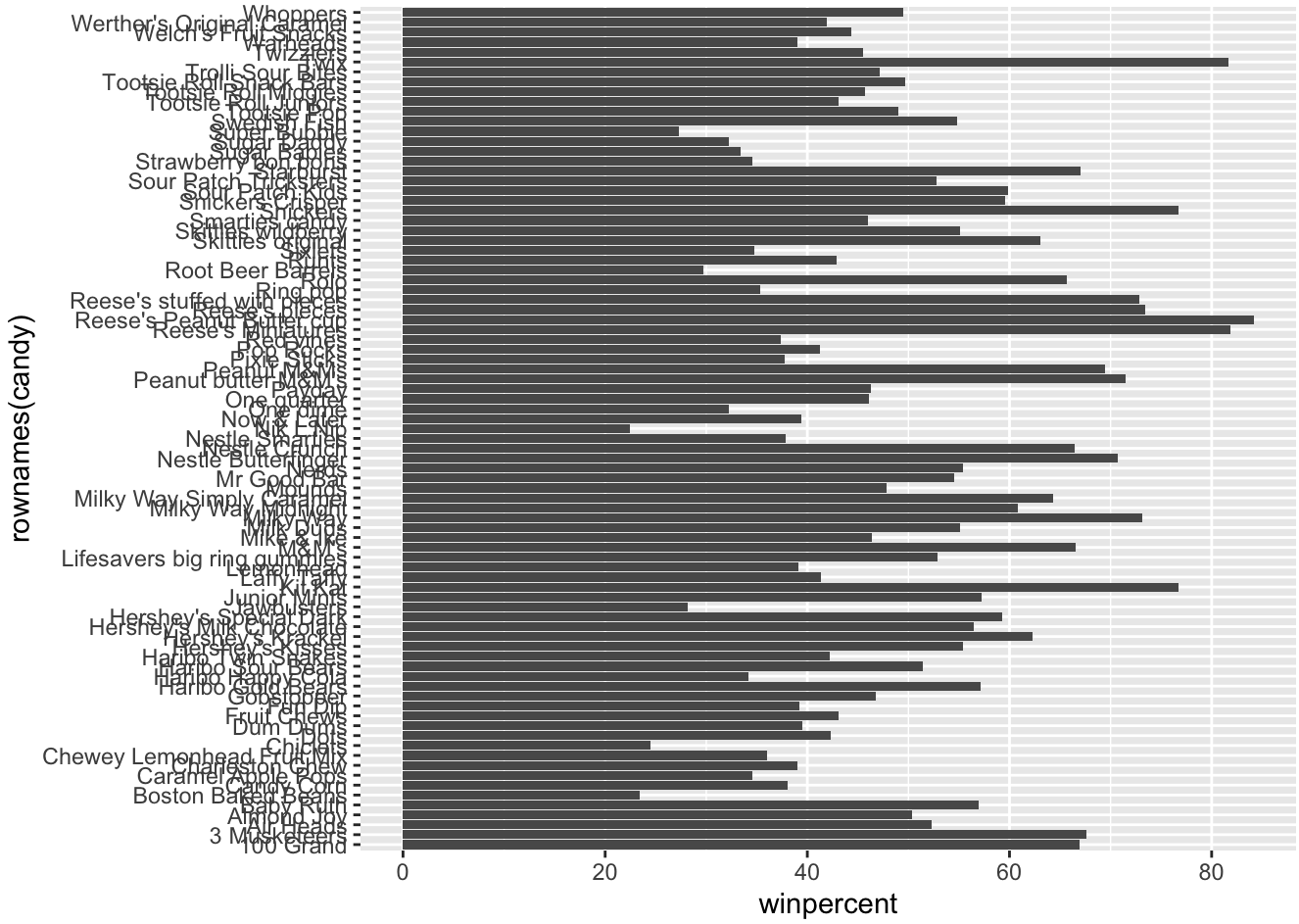
```
head(candy[order(candy$winpercent, decreasing = T), ], n =5)
```

```
                        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
```

Reese's PB cups, Reese's miniatures, Twix, Kit Kat, Snickers.

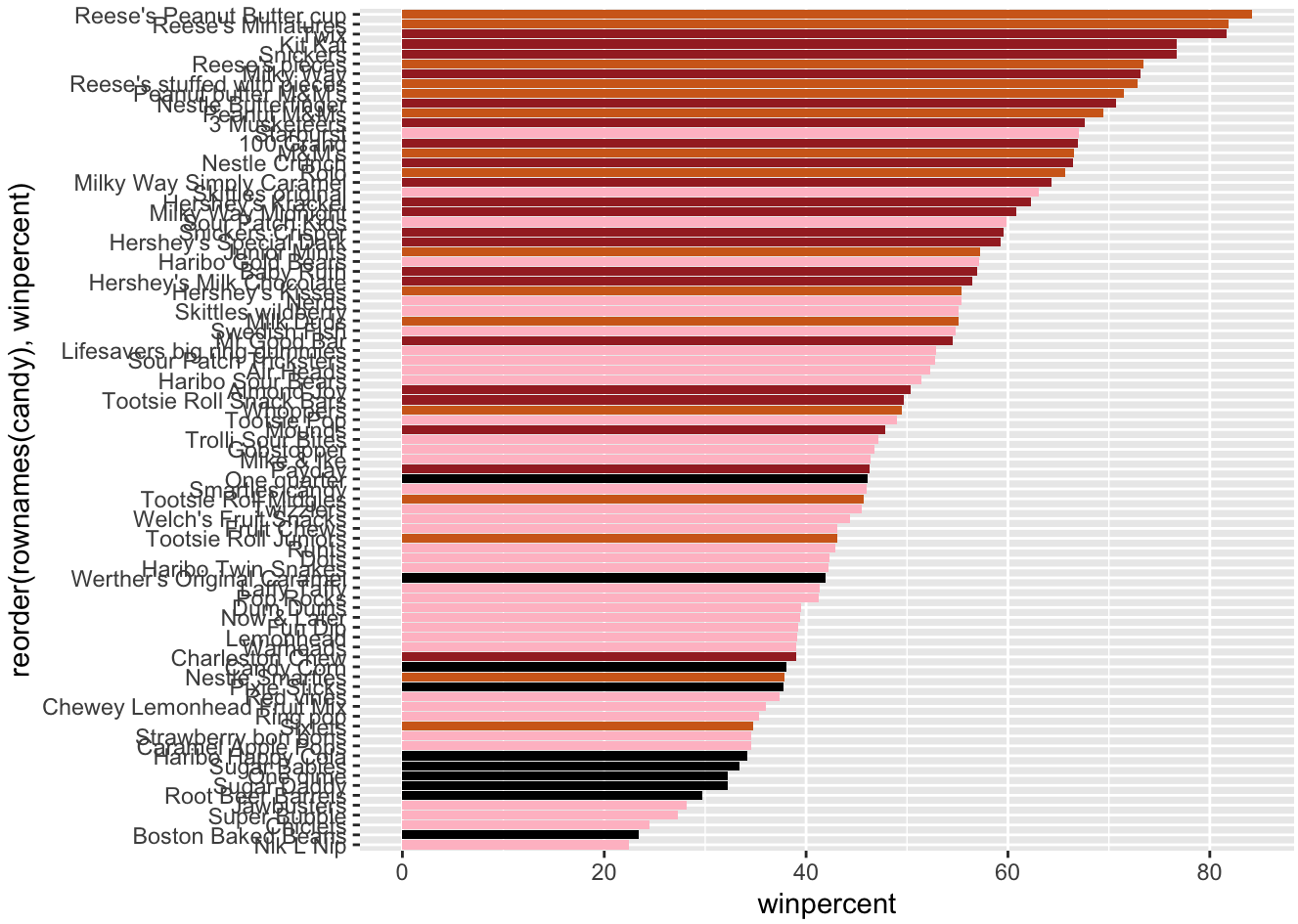
Q15. Make a first barplot of candy ranking based on winpercent values.

```
ggplot(candy) + aes(x=winpercent, y=rownames(candy)) + geom_col()
```



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

```
colors = rep("black", nrow(candy))
colors[as.logical(candy$chocolate)] = "chocolate"
colors[as.logical(candy$bar)] = "brown"
colors[as.logical(candy$fruity)] = "pink"

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

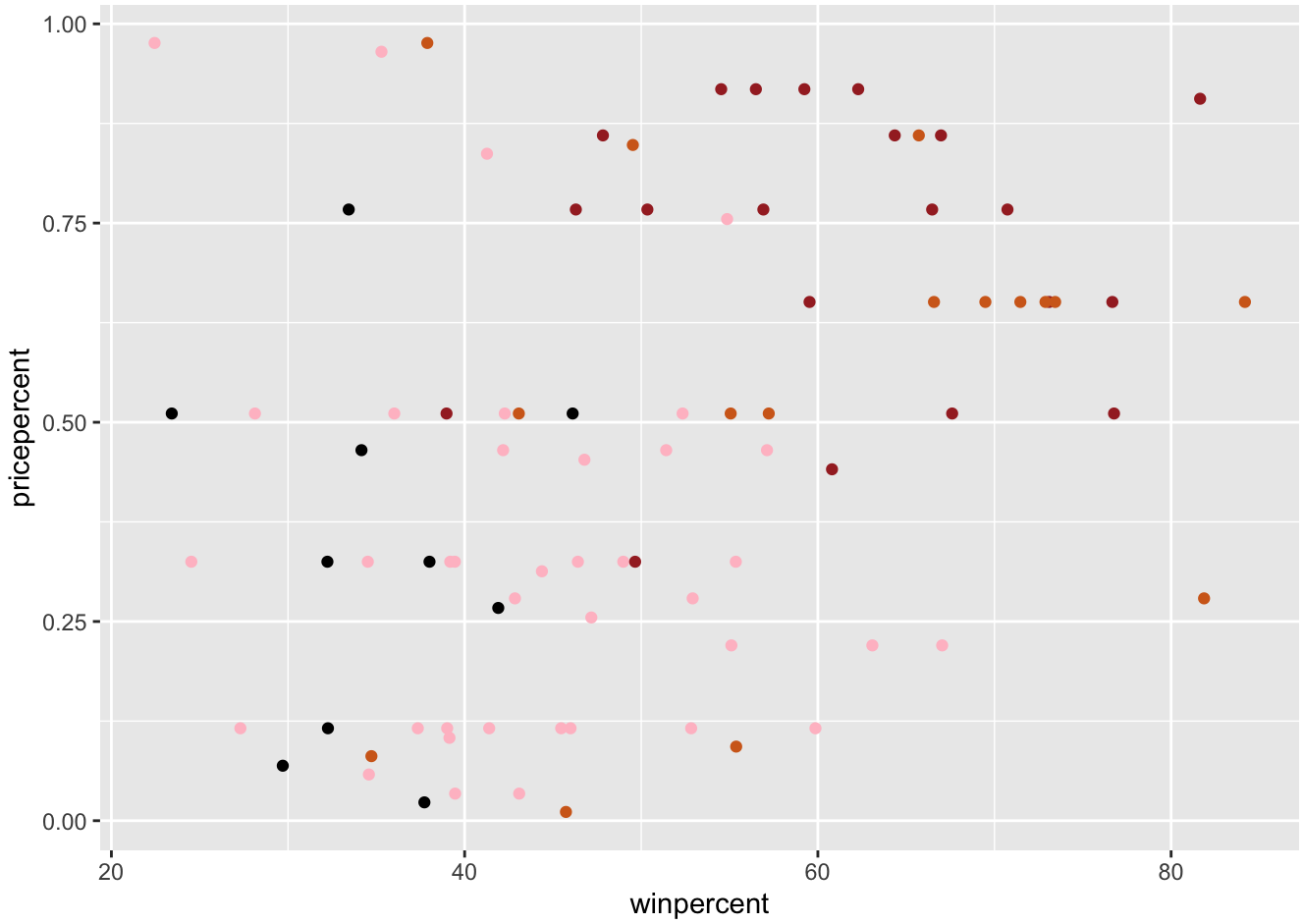


Now, for the first time, using this plot we can answer questions like: Q17. What is the worst ranked chocolate candy? Boston Baked Beans Q18. What is the best ranked fruity candy? Starburst

```
# install.packages("ggrepel")
library(ggrepel)
```

Plot price vs. winpercent:

```
ggplot(candy) + aes(winpercent, pricepercent, label = rownames(candy)) + geom_point(col=
```




```
  # + geom_text_repel(col=colors, size=3.3, max.overlaps = 5)
```

```
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

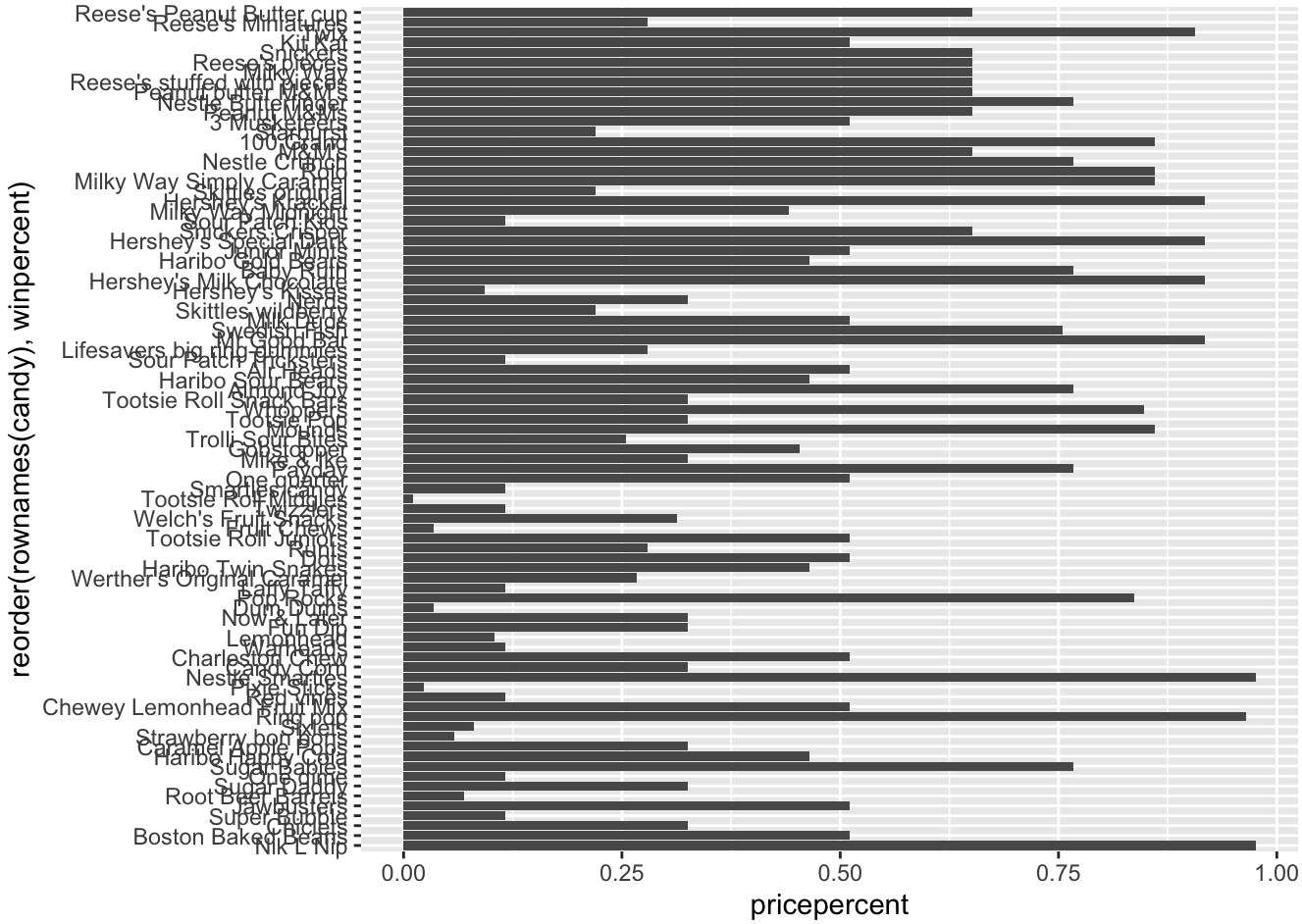
Q19. Which candy type is the highest ranked in terms of winpercent for the least money - i.e. offers the most bang for your buck? Tootsie Roll Midgies

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

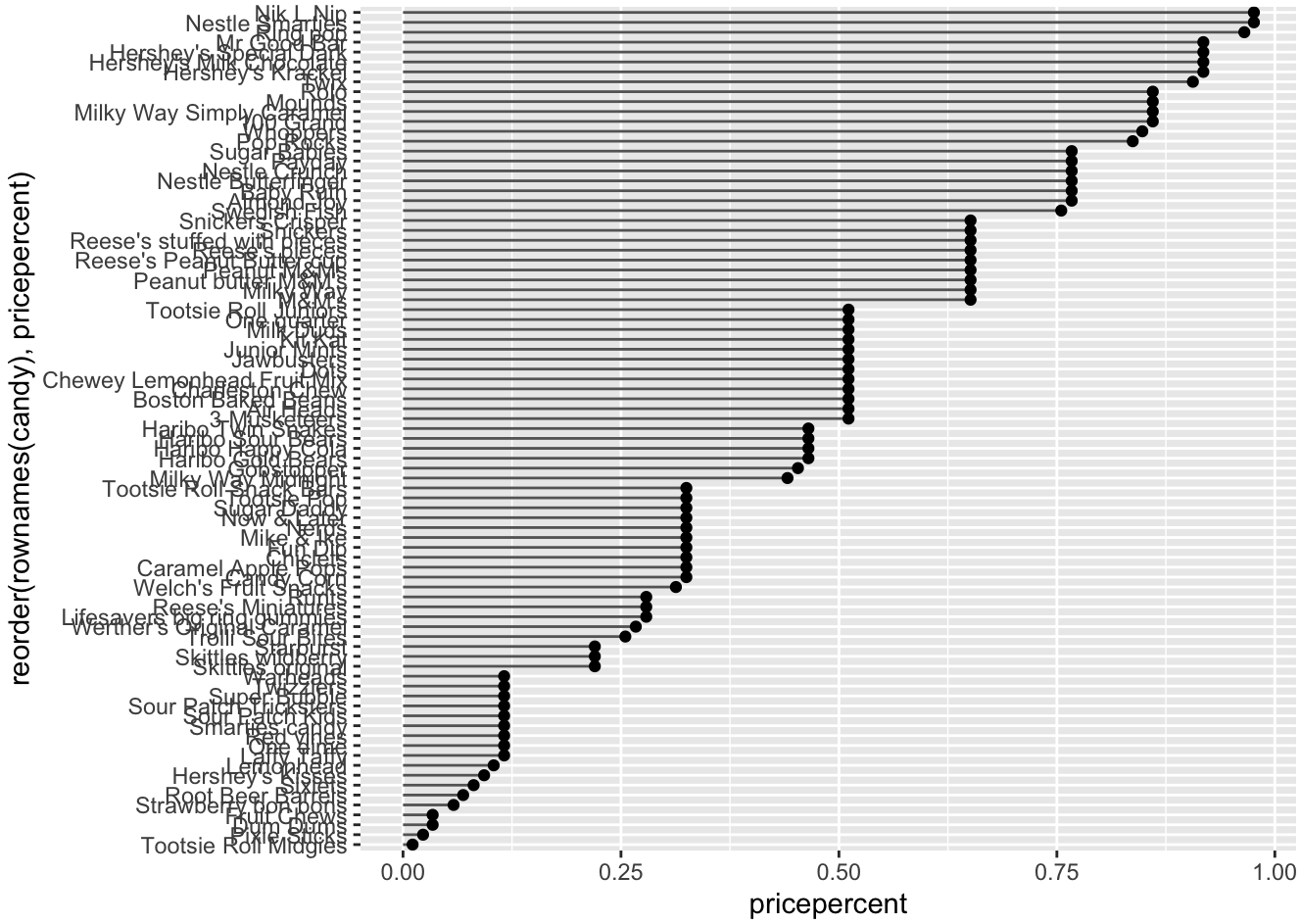
Q21. Make a barplot again with geom_col() this time using pricepercent and then improve this step by step, first ordering the x-axis by value and finally making a so called "dot chat" or "lollipop" chart by

swapping geom_col() for geom_point() + geom_segment().

```
# base plot
ggplot(candy, aes(pricepercent, reorder(rownames(candy), winpercent))) + geom_col()
```



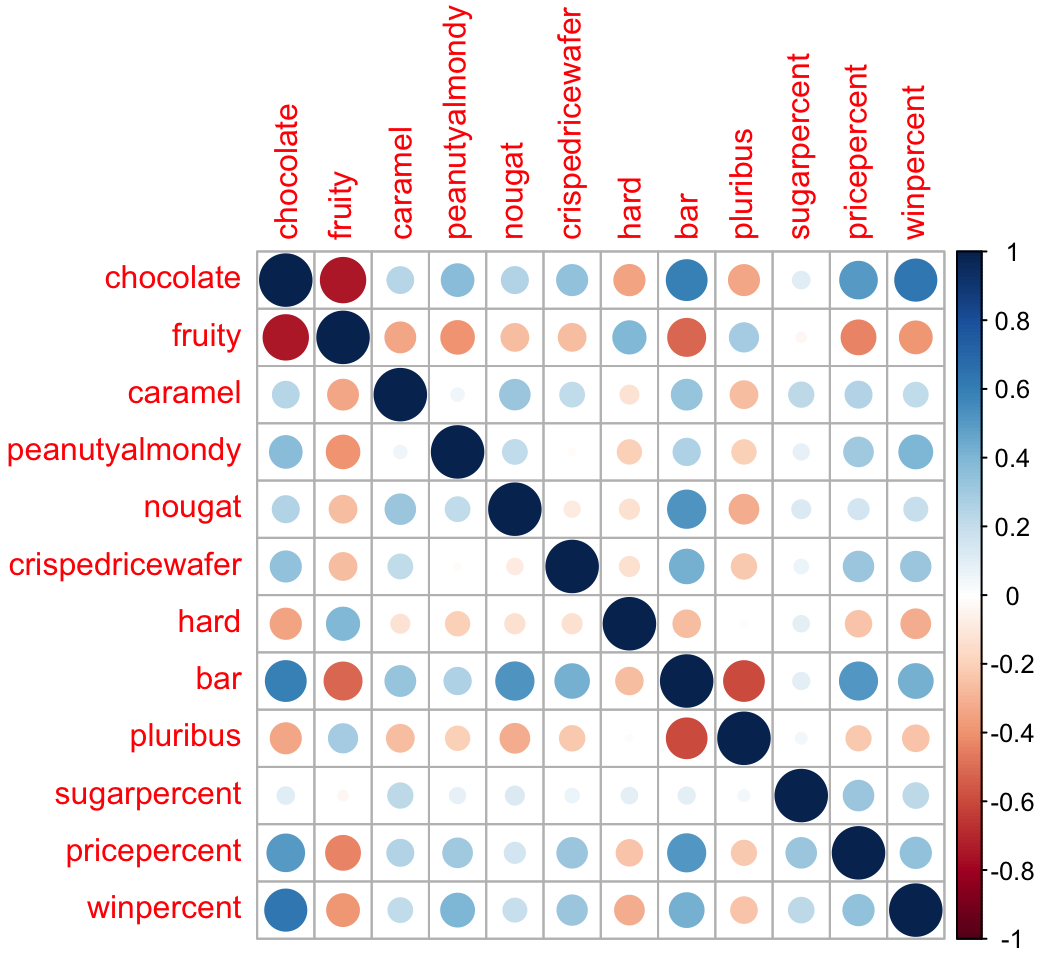

```
# make a lollipop chart
ggplot(candy, aes(pricepercent, reorder(rownames(candy), pricepercent))) + geom_segment(
```




```
# install.packages("corrplot)
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)? chocolate and fruity

Q23. Similarly, what two variables are most positively correlated?

```
cor(candy$chocolate, candy$winpercent)
```

```
[1] 0.6365167
```

```
cor(candy$chocolate, candy$bar)
```

```
[1] 0.5974211
```

winpercent and chocolate

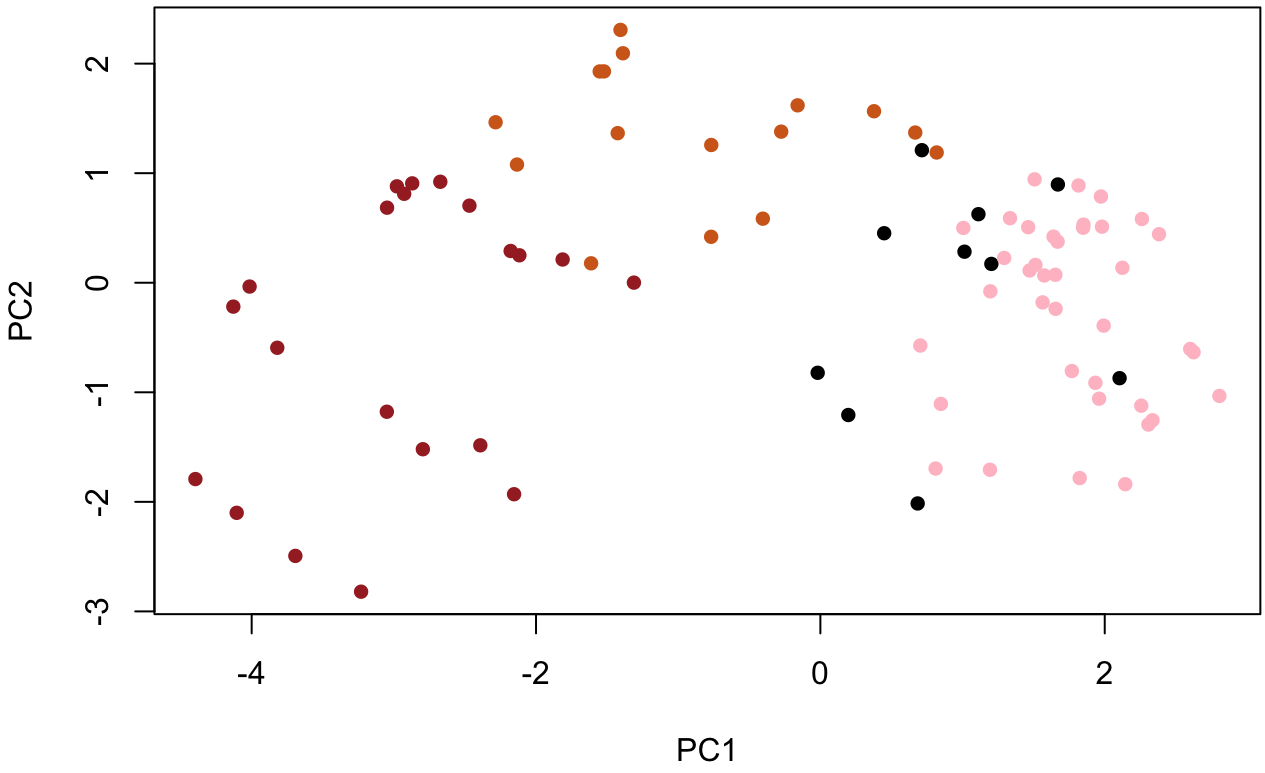
PCA:

```
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
```

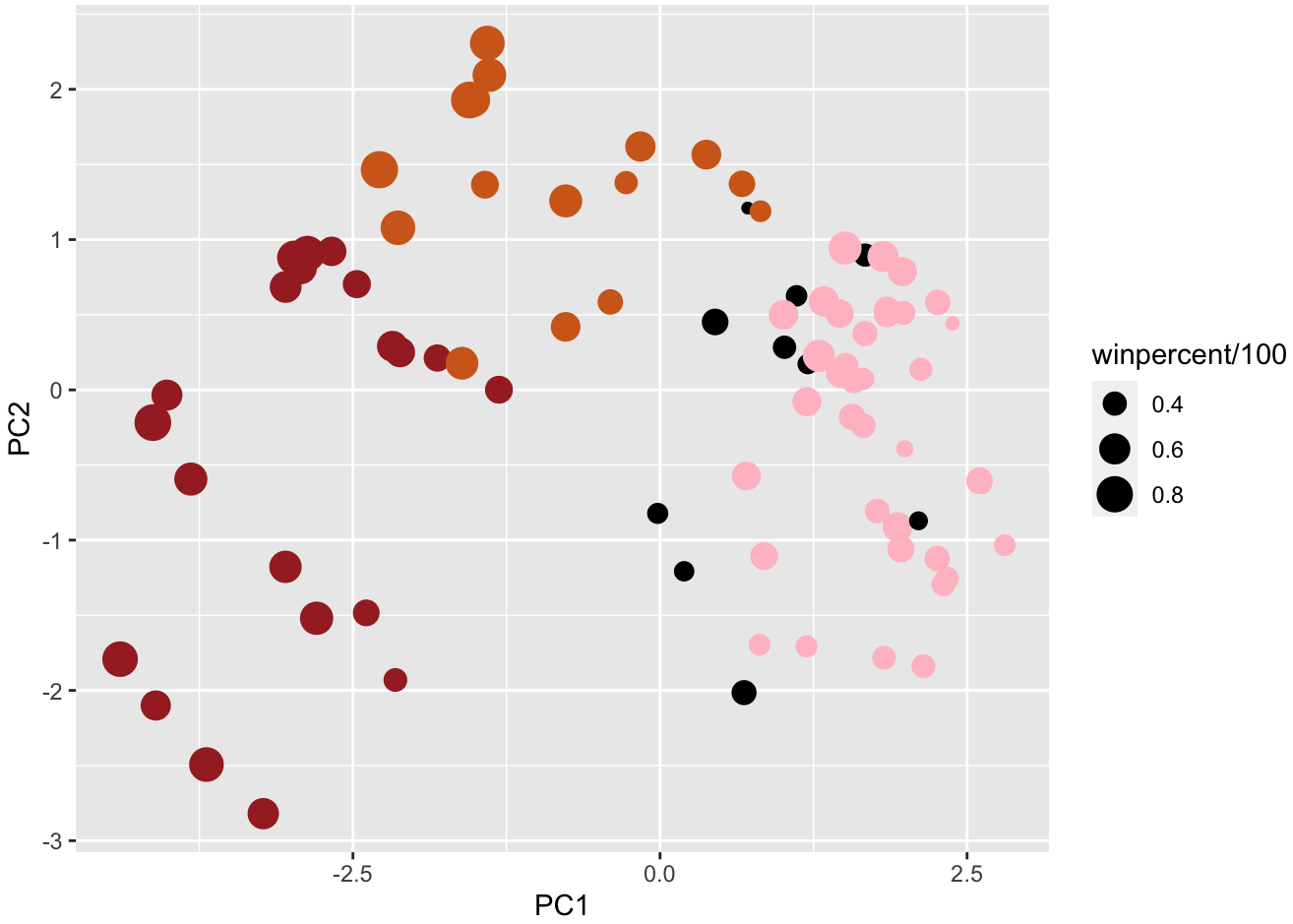
Plot:

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

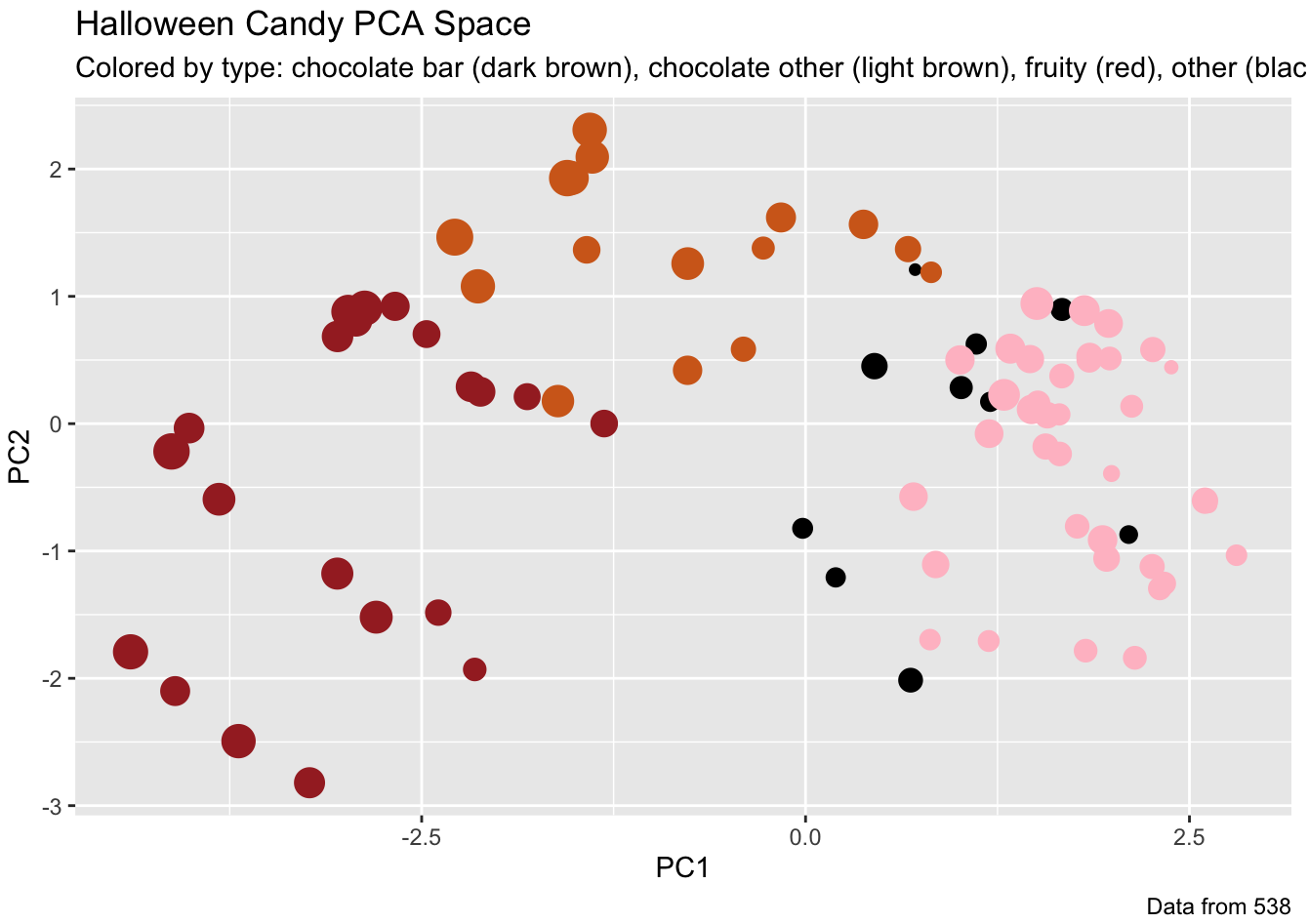


Combine data and plot:

```
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_d
p
```



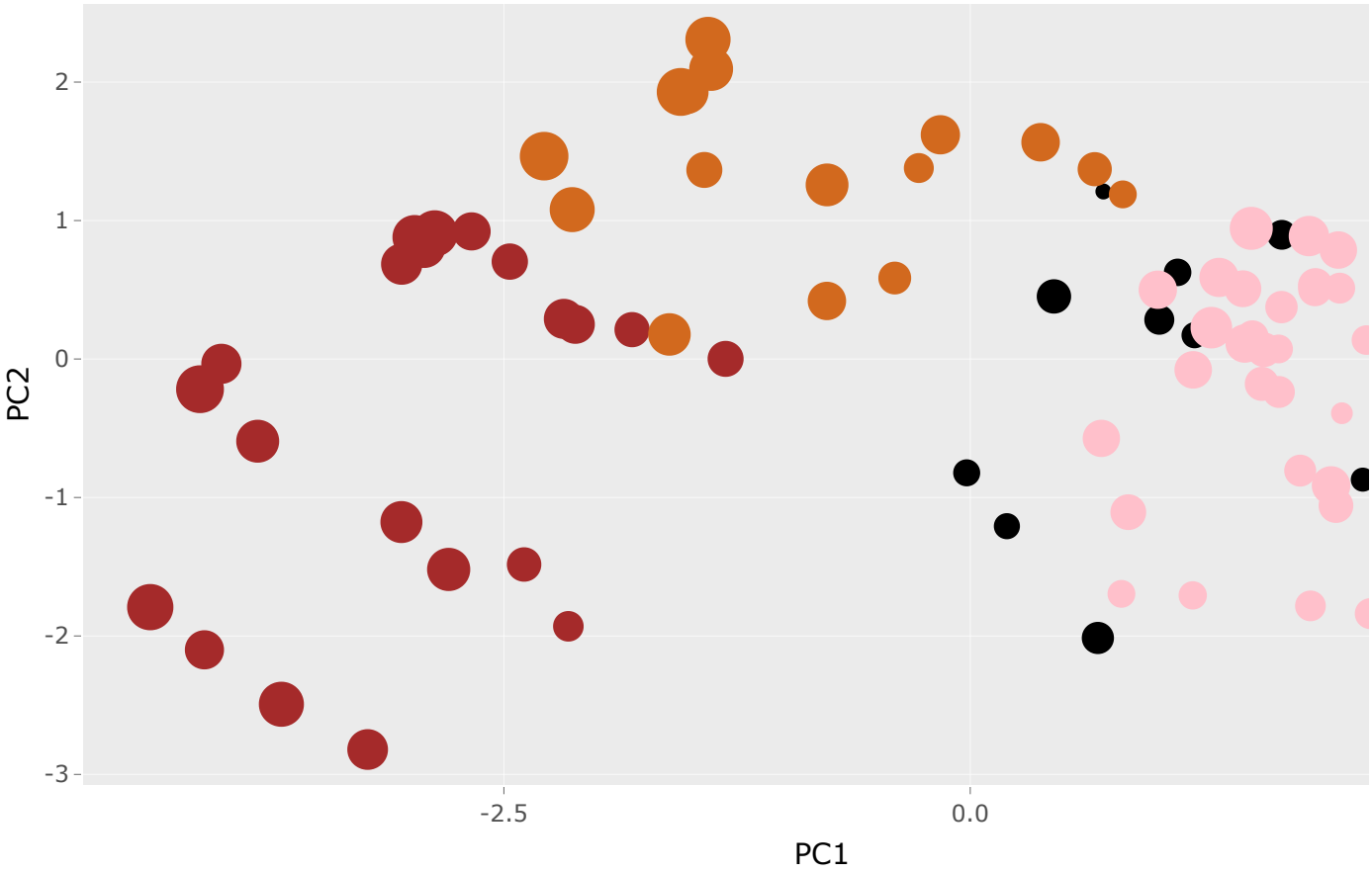

```
p + # + geom_text_repel(size=3.3, col=colors, max.overlaps = 7)
 theme(legend.position = "none") +
  labs(title="Halloween Candy PCA Space",
       subtitle="Colored by type: chocolate bar (dark brown), chocolate other (light bro
       caption="Data from 538")
```



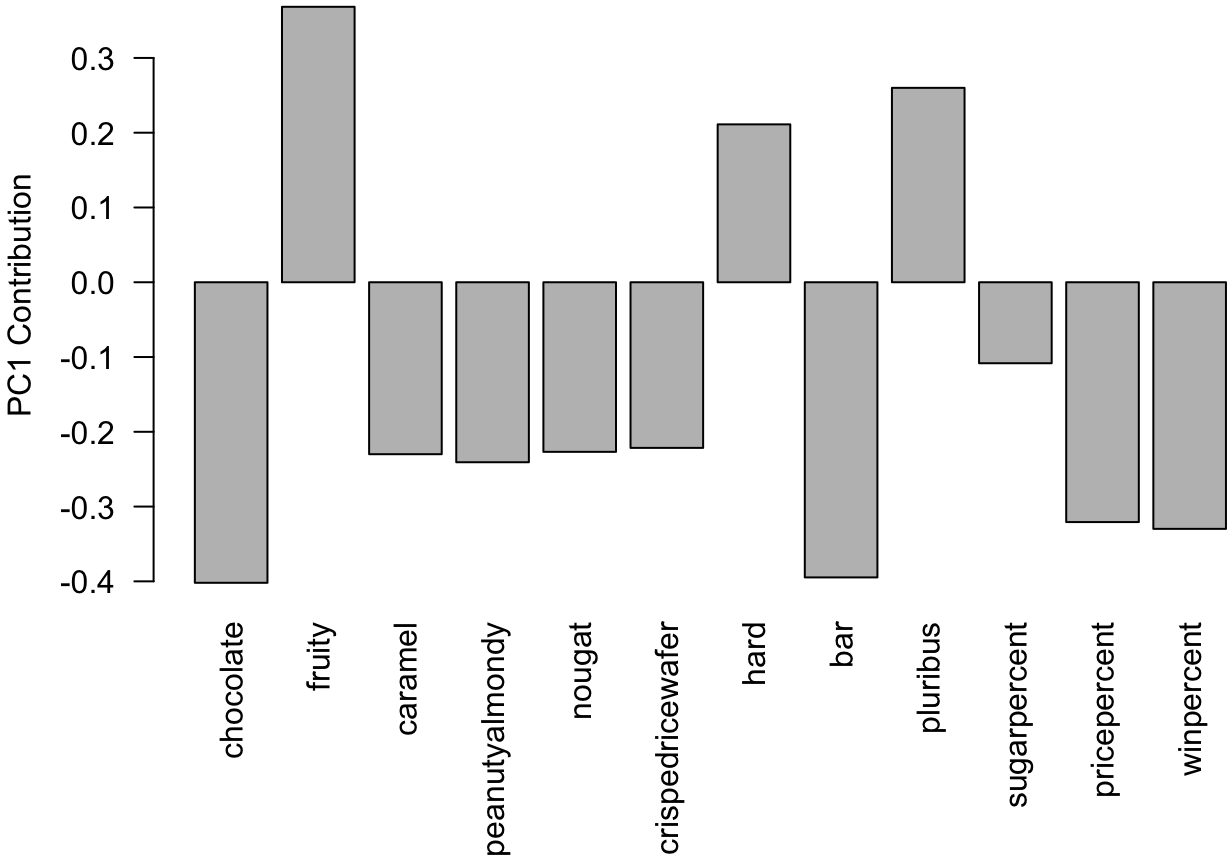

```
# install.packages("plotly")
library(plotly)
```

```
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? Pluribus and fruity. Yes, this makes sense. Most of the fruity candies are on the right side (positive PC1 value) of the previous plot. Fruity candies usually come in a bag or box of multiple (unlike chocolate bars).