class_10_lab

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Importing candy data

```r
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
```

```r
flextable::flextable(head(candy))
```

chocolate	fruity	caramel	peanutyalmondy	nougat	crispedricewafer	hard	bar	pluribus	s
1	0	1	0	0	1	0	1	0	
1	0	0	0	1	0	0	1	0	
0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	
0	1	0	0	0	0	0	0	0	
1	0	0	1	0	0	0	1	0	

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

There are 85 types of candy in this dataset.

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

There are 38 types of fruity candy in this dataset.

Overall Candy Rankings

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

My favorite candy in this dataset is Milkyway Midnight with a win percent of 60.800701.

> Q4. What is the winpercent value for "Kit Kat"?

Kit Kat has a winpercent of 76.7686.

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

Tootsie Roll Snack Bars has a win percent of 49.653503.

```r
skimr::skim(candy)
```

Table 2: 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?

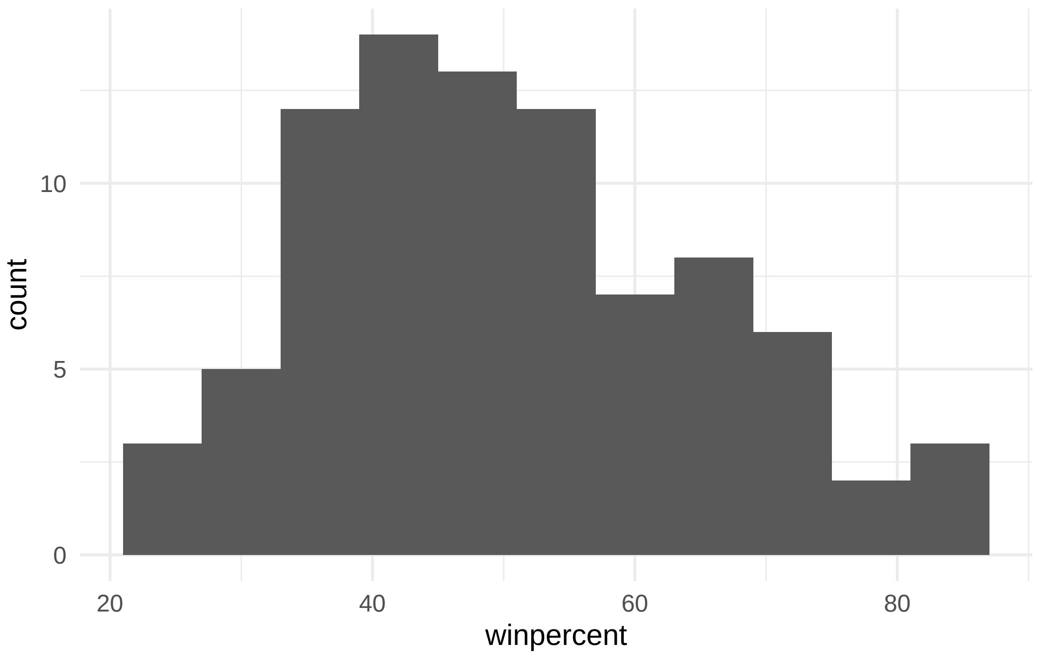
Yes the win percent column is in a whole number percent(ie 65.4%) whereas the other columns like percent sugar are in a decimal point percent (ie 0.923).

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

They are the binary representation of T/F 1 would be true/ has chocolate, and 0 would be false/no chocolate.

> Q8. Plot a histogram of winpercent values

```r
library(ggplot2)

ggplot(candy) +
aes(x = winpercent) +
  geom_histogram(binwidth = 6) +
  theme_minimal()
```



Q9. Is the distribution of winpercent values symmetrical?

No it it slightly right skewed with the normal distribution being centered closer to 40%.

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

Below 50% it is around 40%. 22.445341, 39.141056, 47.829754, 50.3167638, 59.863998, 84.18029

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

```r
library(tidyverse)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.1     v stringr   1.5.2
v lubridate 1.9.4     v tibble    3.3.0
v purrr     1.1.0     v tidyr     1.3.1
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to becom
```

```r
j.choc <- candy %>%
  filter(chocolate == 1)
mean(j.choc$winpercent)
```

```
[1] 60.92153
```

```r
j.fruit <- candy %>%
  filter(fruity == 1)
mean(j.fruit$winpercent)
```

```
[1] 44.11974
```

Chocolate has a higher average win percent 60.9215294 than fruity candy 44.1197414.

> Q12. Is this difference statistically significant?

```r
t.test(x = j.choc$winpercent,
  y = j.fruit$winpercent)
```

```

	Welch Two Sample t-test

data:  j.choc$winpercent and j.fruit$winpercent
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 
```

With a p-value of 2.871e-08 we accept the null hypothesis of the two-sample ttest. This indicates that there is a statistical difference between chocolate and fruity candy with chocolate being more popular.

Overall Candy Rankings

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

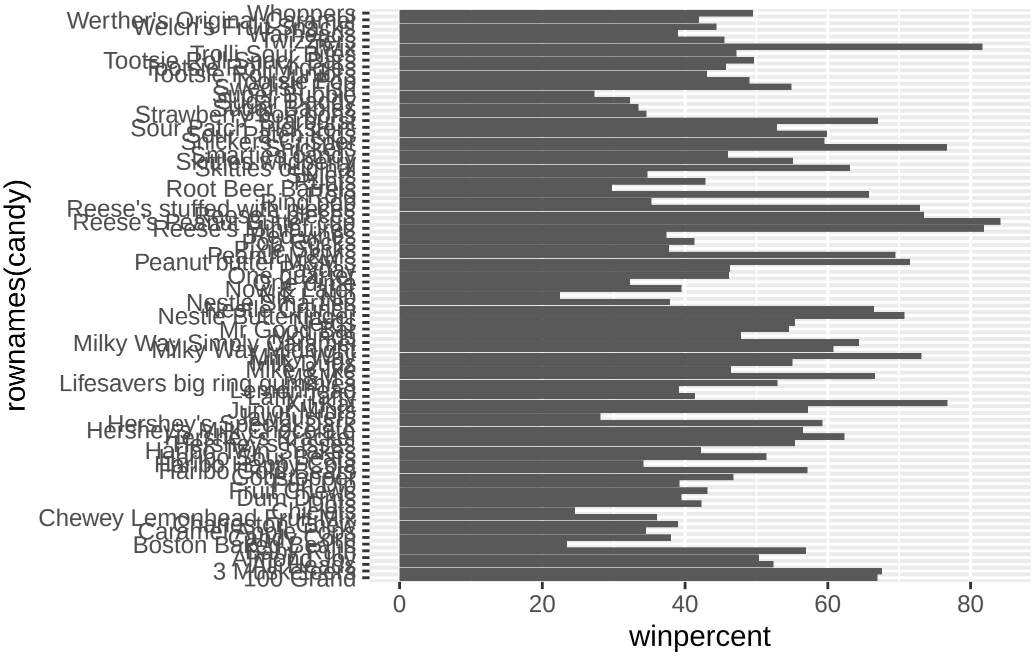
The five least liked candies are; Nik L Nip, Boston Baked Beans, Chiclets, Super Bubble, Jawbusters.

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

The top five most liked candies are; Snickers, Kit Kat, Twix, Reese's Miniatures, Reese's Peanut Butter cup.

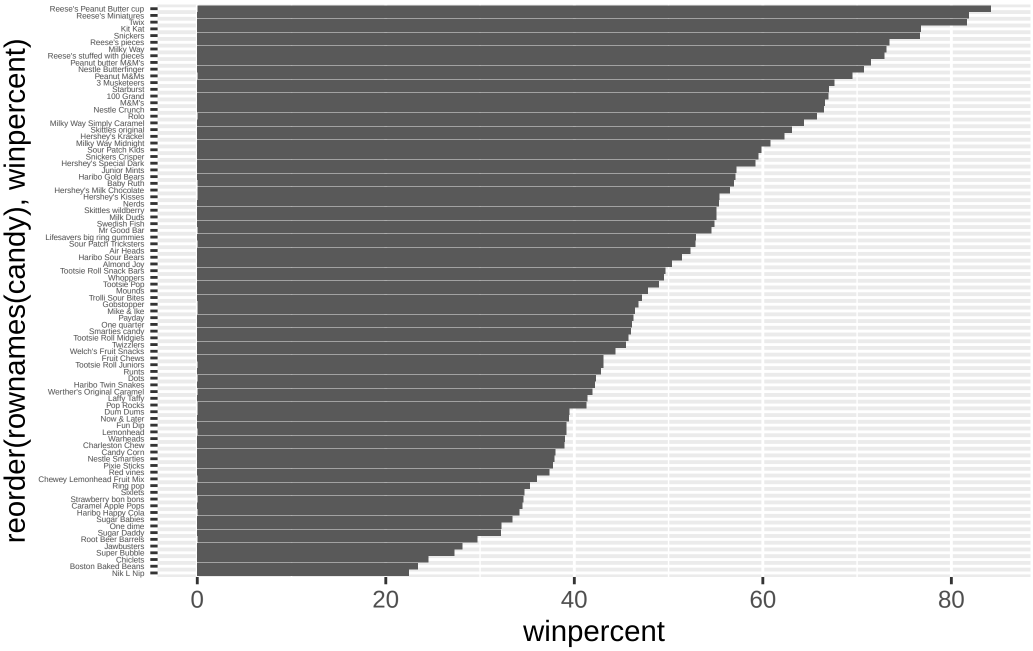
Q15. Make a first barplot of candy ranking based on winpercent values.

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

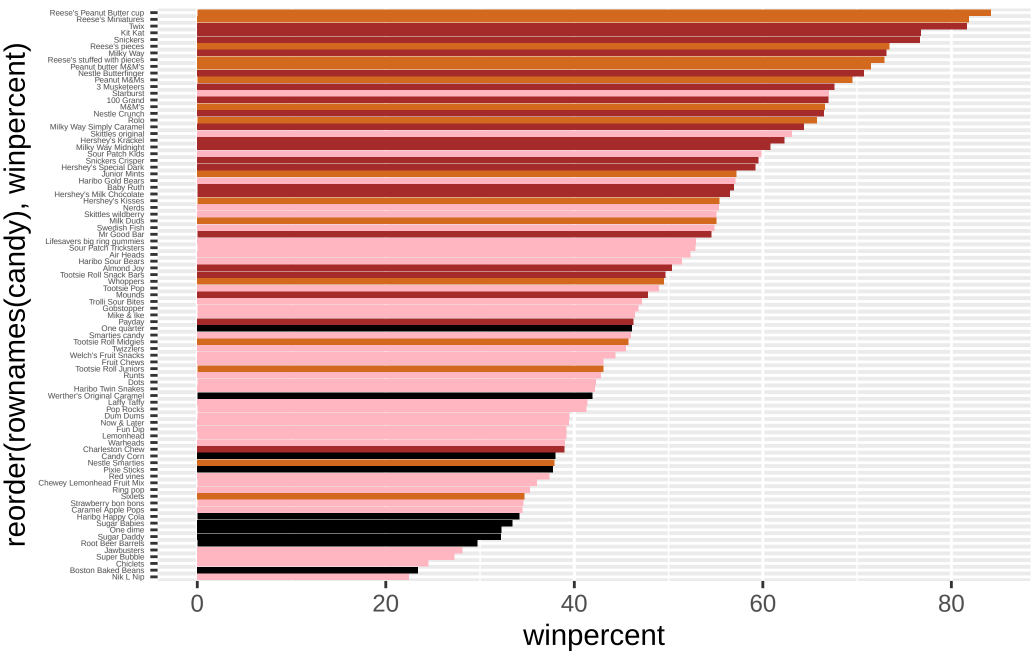


Q16. This is quite ugly, use the reorder() function to get the bars sorted by winpercent?

```
ggplot(candy) +
  aes(x= winpercent, y= reorder(rownames(candy), winpercent)) +
  geom_col() +
  theme(axis.text.y = element_text(size = 3))
```



```
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)] = "lightpink"

ggplot(candy) +
  aes(winpercent, reorder(rownames(candy),winpercent)) +
  geom_col(fill=my_cols) +
   theme(axis.text.y = element_text(size = 3))
```



Q17. What is the worst ranked chocolate candy?

Sixlets

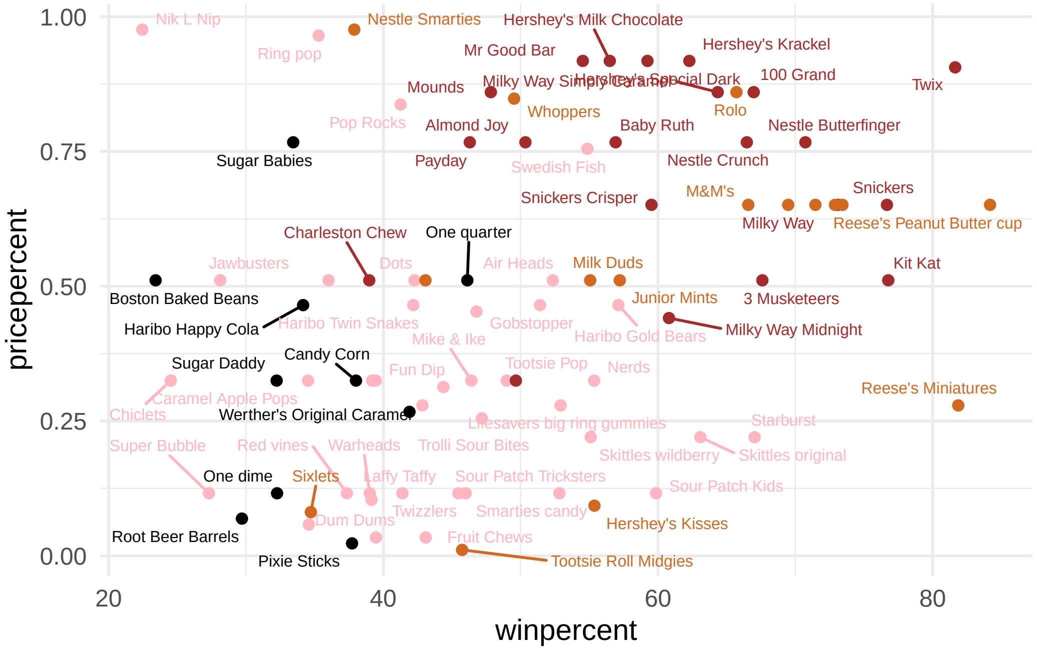
Q18. What is the best ranked fruity candy?

Starburst

Taking a look at pricepercent

```r
library(ggrepel)

ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols, size=2, max.overlaps = 10) +
  theme_minimal()
```

```
Warning: ggrepel: 13 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?

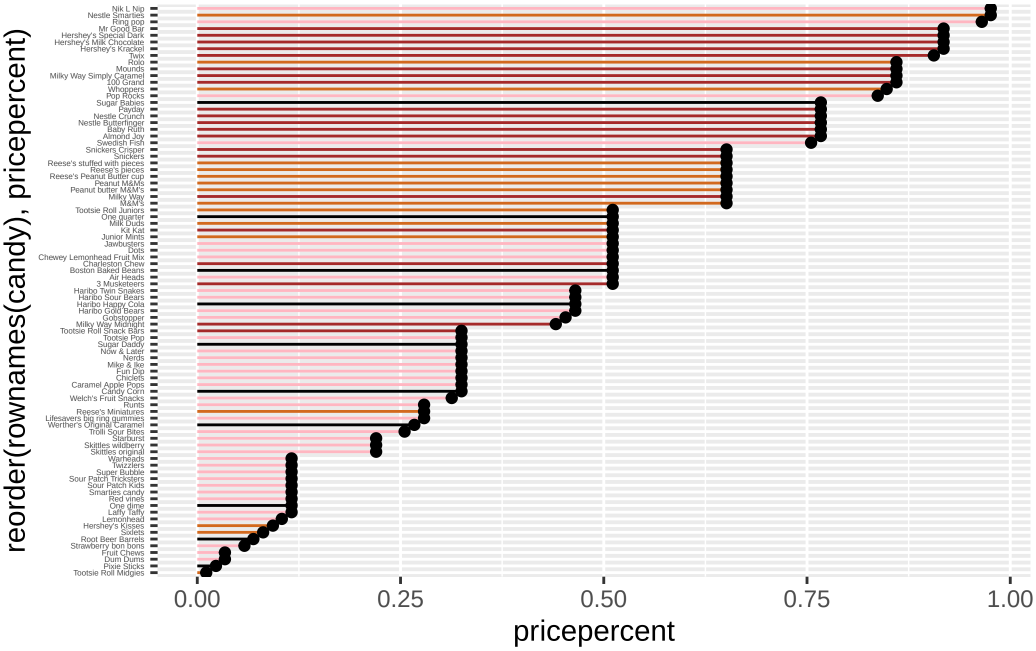
```
ord <- order(candy$pricepercent, decreasing = TRUE)
head( candy[ord,c(11,12)], n=5 )
```

```
                         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
```

The most expensive candies are Nik L Nip, Nestle Smarties, Ring pop, Hershey's Krackel, Hershey's Milk Chocolate and the least liked is Nik L Nip.

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().

```
ggplot(candy) +
  aes(pricepercent, reorder(rownames(candy),     pricepercent)) +
  geom_segment(aes(yend = reorder(rownames(candy), pricepercent),
  xend = 0), col=my_cols) +
    geom_point() +
  theme(axis.text.y = element_text(size = 3))
```

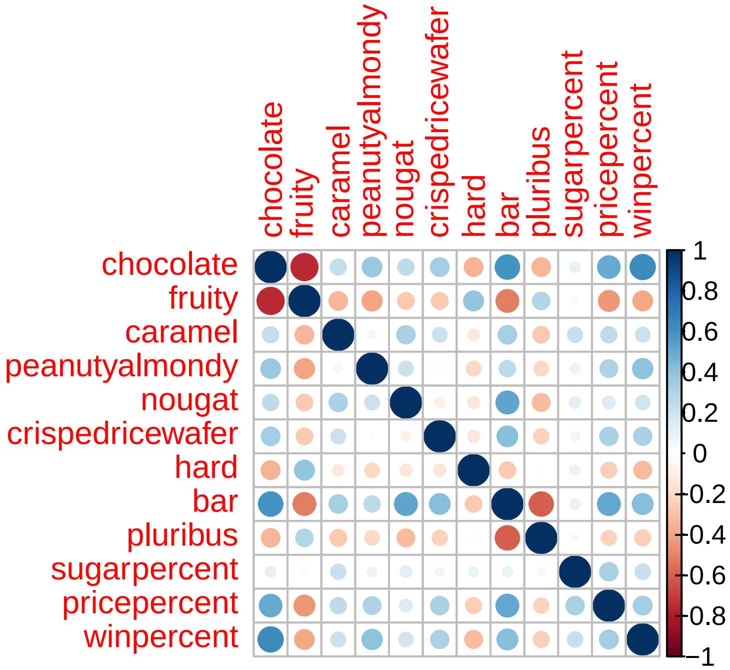


Exploring the correlation structure

```
library(corrplot)
```

```
corrplot 0.95 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?

chocolate and bar or chocolate and win percentage

Principal Component Analysis

```
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
```

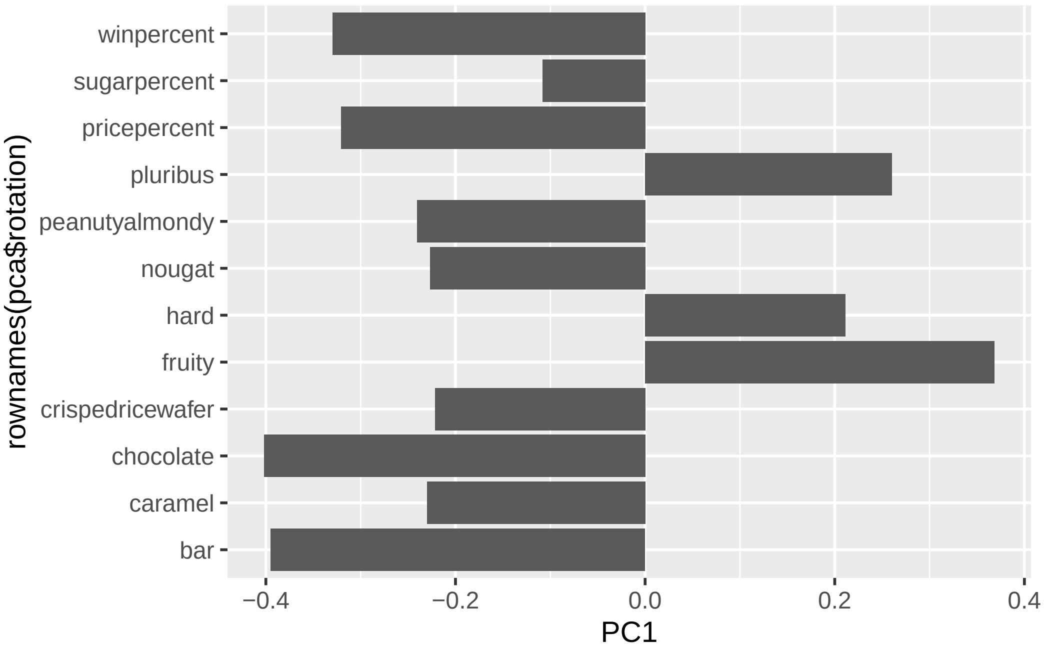
```r
library(plotly)
```

```


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
```

```r
## note plotly can make interactive plots but wont work for a pdf

p <- ggplot(pca$x) +
  aes(PC1, PC2, label = rownames(pca$x)) +
  geom_point(col = my_cols) +
  geom_text_repel(col = my_cols)
```

Examining variable “loadings” or contributions of original variables to new PCs

```r
ggplot(pca$rotation) +
  aes(PC1, rownames(pca$rotation)) +
  geom_col()
```



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

Fruity, hard, and pluribus. This makes sense the way many fruity candies are packaged like skittles or starburst you get a lot of little candies. Additionally things like lolipops and suckers are more often fruit flavored.