

# Class 10: Mini Project

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Today we will be looking at some data regarding Candy Stats.

```
#read candy-data file

candy_file <- "candy-data.csv"

#omit the first row
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?**

```
#use `nrow` to count the rows of candy  
nrow(candy)
```

```
[1] 85
```

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

```
#use sum to count the number of candy types (columns)  
sum(candy$fruity)
```

```
[1] 38
```

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

```
candy["Almond Joy", ]$winpercent
```

```
[1] 50.34755
```

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

```
candy["Almond Joy", ]$winpercent
```

```
[1] 50.34755
```

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

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

```
[1] 49.6535
```

```
#load skimr
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  |      |
| 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 |      |

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

Winpercent seems to be on a different scale to the majority of the other columns in the dataset.

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

```
candy[as.logical(candy$chocolate), ]
```

|                             | chocolate | fruity | caramel | peanutyalmondy | nougat |
|-----------------------------|-----------|--------|---------|----------------|--------|
| 100 Grand                   | 1         | 0      | 1       | 0              | 0      |
| 3 Musketeers                | 1         | 0      | 0       | 0              | 1      |
| Almond Joy                  | 1         | 0      | 0       | 1              | 0      |
| Baby Ruth                   | 1         | 0      | 1       | 1              | 1      |
| Charleston Chew             | 1         | 0      | 0       | 0              | 1      |
| Hershey's Kisses            | 1         | 0      | 0       | 0              | 0      |
| 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      |
| Junior Mints                | 1         | 0      | 0       | 0              | 0      |
| Kit Kat                     | 1         | 0      | 0       | 0              | 0      |
| Peanut butter M&M's         | 1         | 0      | 0       | 1              | 0      |
| M&M's                       | 1         | 0      | 0       | 0              | 0      |
| Milk Duds                   | 1         | 0      | 1       | 0              | 0      |
| Milky Way                   | 1         | 0      | 1       | 0              | 1      |
| Milky Way Midnight          | 1         | 0      | 1       | 0              | 1      |
| Milky Way Simply Caramel    | 1         | 0      | 1       | 0              | 0      |
| Mounds                      | 1         | 0      | 0       | 0              | 0      |
| Mr Good Bar                 | 1         | 0      | 0       | 1              | 0      |
| Nestle Butterfinger         | 1         | 0      | 0       | 1              | 0      |
| Nestle Crunch               | 1         | 0      | 0       | 0              | 0      |
| Peanut M&Ms                 | 1         | 0      | 0       | 1              | 0      |
| Reese's Miniatures          | 1         | 0      | 0       | 1              | 0      |
| Reese's Peanut Butter cup   | 1         | 0      | 0       | 1              | 0      |
| Reese's pieces              | 1         | 0      | 0       | 1              | 0      |
| Reese's stuffed with pieces | 1         | 0      | 0       | 1              | 0      |
| Rolo                        | 1         | 0      | 1       | 0              | 0      |
| Sixlets                     | 1         | 0      | 0       | 0              | 0      |
| Nestle Smarties             | 1         | 0      | 0       | 0              | 0      |
| Snickers                    | 1         | 0      | 1       | 1              | 1      |
| Snickers Crisper            | 1         | 0      | 1       | 1              | 0      |
| Tootsie Pop                 | 1         | 1      | 0       | 0              | 0      |
| Tootsie Roll Juniors        | 1         | 0      | 0       | 0              | 0      |
| Tootsie Roll Midgies        | 1         | 0      | 0       | 0              | 0      |
| Tootsie Roll Snack Bars     | 1         | 0      | 0       | 0              | 0      |

|                             |              |            |          |          |              |       |
|-----------------------------|--------------|------------|----------|----------|--------------|-------|
| Twix                        | 1            | 0          | 1        | 0        | 0            |       |
| Whoppers                    | 1            | 0          | 0        | 0        | 0            |       |
|                             | crisped      | ricewafer  | hard bar | pluribus | sugarpercent |       |
| 100 Grand                   |              | 1          | 0        | 1        | 0            | 0.732 |
| 3 Musketeers                |              | 0          | 0        | 1        | 0            | 0.604 |
| Almond Joy                  |              | 0          | 0        | 1        | 0            | 0.465 |
| Baby Ruth                   |              | 0          | 0        | 1        | 0            | 0.604 |
| Charleston Chew             |              | 0          | 0        | 1        | 0            | 0.604 |
| Hershey's Kisses            |              | 0          | 0        | 0        | 1            | 0.127 |
| 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 |
| Junior Mints                |              | 0          | 0        | 0        | 1            | 0.197 |
| Kit Kat                     |              | 1          | 0        | 1        | 0            | 0.313 |
| Peanut butter M&M's         |              | 0          | 0        | 0        | 1            | 0.825 |
| M&M's                       |              | 0          | 0        | 0        | 1            | 0.825 |
| Milk Duds                   |              | 0          | 0        | 0        | 1            | 0.302 |
| Milky Way                   |              | 0          | 0        | 1        | 0            | 0.604 |
| Milky Way Midnight          |              | 0          | 0        | 1        | 0            | 0.732 |
| Milky Way Simply Caramel    |              | 0          | 0        | 1        | 0            | 0.965 |
| Mounds                      |              | 0          | 0        | 1        | 0            | 0.313 |
| Mr Good Bar                 |              | 0          | 0        | 1        | 0            | 0.313 |
| Nestle Butterfinger         |              | 0          | 0        | 1        | 0            | 0.604 |
| Nestle Crunch               |              | 1          | 0        | 1        | 0            | 0.313 |
| Peanut M&Ms                 |              | 0          | 0        | 0        | 1            | 0.593 |
| Reese's Miniatures          |              | 0          | 0        | 0        | 0            | 0.034 |
| Reese's Peanut Butter cup   |              | 0          | 0        | 0        | 0            | 0.720 |
| Reese's pieces              |              | 0          | 0        | 0        | 1            | 0.406 |
| Reese's stuffed with pieces |              | 0          | 0        | 0        | 0            | 0.988 |
| Rolo                        |              | 0          | 0        | 0        | 1            | 0.860 |
| Sixlets                     |              | 0          | 0        | 0        | 1            | 0.220 |
| Nestle Smarties             |              | 0          | 0        | 0        | 1            | 0.267 |
| Snickers                    |              | 0          | 0        | 1        | 0            | 0.546 |
| Snickers Crisper            |              | 1          | 0        | 1        | 0            | 0.604 |
| Tootsie Pop                 |              | 0          | 1        | 0        | 0            | 0.604 |
| Tootsie Roll Juniors        |              | 0          | 0        | 0        | 0            | 0.313 |
| Tootsie Roll Midgies        |              | 0          | 0        | 0        | 1            | 0.174 |
| Tootsie Roll Snack Bars     |              | 0          | 0        | 1        | 0            | 0.465 |
| Twix                        |              | 1          | 0        | 1        | 0            | 0.546 |
| Whoppers                    |              | 1          | 0        | 0        | 1            | 0.872 |
|                             | pricepercent | winpercent |          |          |              |       |
| 100 Grand                   | 0.860        | 66.97173   |          |          |              |       |
| 3 Musketeers                | 0.511        | 67.60294   |          |          |              |       |

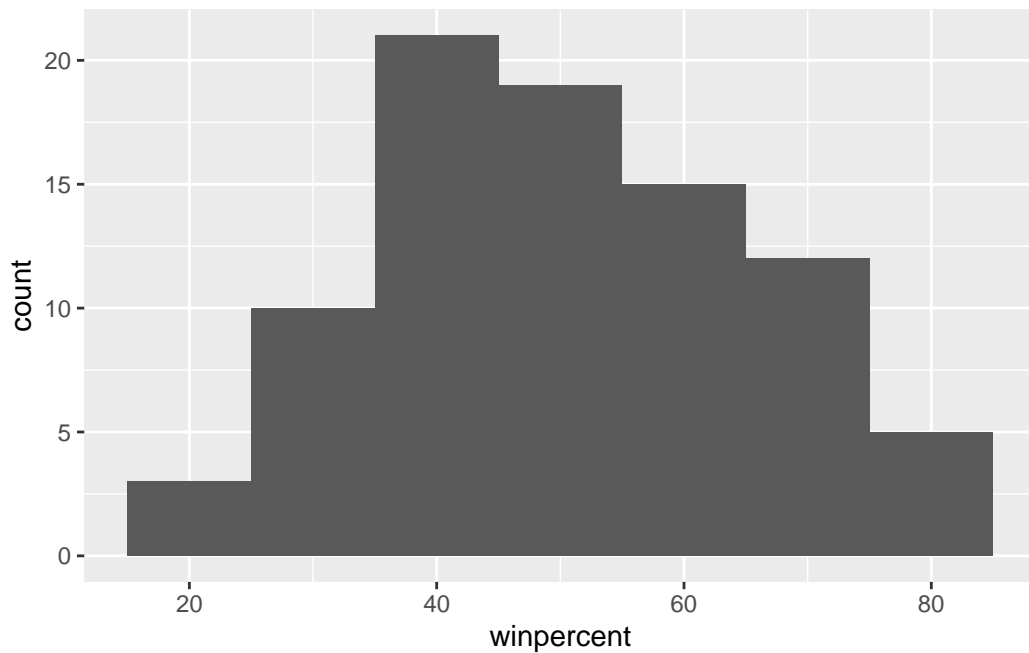
|                             |       |          |
|-----------------------------|-------|----------|
| Almond Joy                  | 0.767 | 50.34755 |
| Baby Ruth                   | 0.767 | 56.91455 |
| Charleston Chew             | 0.511 | 38.97504 |
| Hershey's Kisses            | 0.093 | 55.37545 |
| Hershey's Krackel           | 0.918 | 62.28448 |
| Hershey's Milk Chocolate    | 0.918 | 56.49050 |
| Hershey's Special Dark      | 0.918 | 59.23612 |
| Junior Mints                | 0.511 | 57.21925 |
| Kit Kat                     | 0.511 | 76.76860 |
| Peanut butter M&M's         | 0.651 | 71.46505 |
| M&M's                       | 0.651 | 66.57458 |
| Milk Duds                   | 0.511 | 55.06407 |
| Milky Way                   | 0.651 | 73.09956 |
| Milky Way Midnight          | 0.441 | 60.80070 |
| Milky Way Simply Caramel    | 0.860 | 64.35334 |
| Mounds                      | 0.860 | 47.82975 |
| Mr Good Bar                 | 0.918 | 54.52645 |
| Nestle Butterfinger         | 0.767 | 70.73564 |
| Nestle Crunch               | 0.767 | 66.47068 |
| Peanut M&Ms                 | 0.651 | 69.48379 |
| Reese's Miniatures          | 0.279 | 81.86626 |
| Reese's Peanut Butter cup   | 0.651 | 84.18029 |
| Reese's pieces              | 0.651 | 73.43499 |
| Reese's stuffed with pieces | 0.651 | 72.88790 |
| Rolo                        | 0.860 | 65.71629 |
| Sixlets                     | 0.081 | 34.72200 |
| Nestle Smarties             | 0.976 | 37.88719 |
| Snickers                    | 0.651 | 76.67378 |
| Snickers Crisper            | 0.651 | 59.52925 |
| Tootsie Pop                 | 0.325 | 48.98265 |
| Tootsie Roll Juniors        | 0.511 | 43.06890 |
| Tootsie Roll Midgies        | 0.011 | 45.73675 |
| Tootsie Roll Snack Bars     | 0.325 | 49.65350 |
| Twix                        | 0.906 | 81.64291 |
| Whoppers                    | 0.848 | 49.52411 |

1 means that there is chocolate in the candy and 0 means there is no chocolate.

**Question Q8. Plot a histogram of winpercent values**

```
#load ggplot
library(ggplot2)

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



**Question Q9. Is the distribution of winpercent values symmetrical?**

The distribution seems to be right skewed, not symmetrical.

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

The center of distribution is below 50%.

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

```
choc_candy <- candy[which(candy$chocolate == TRUE), ]  
fruit_candy <- candy[which(candy$fruity == TRUE), ]  
  
mean(choc_candy$winpercent) > mean(fruit_candy$winpercent)
```

[1] TRUE

OR

```
choc.inds <- as.logical(candy$chocolate)  
choc.win <- candy[choc.inds, "winpercent"]  
  
fruit.inds <- as.logical(candy$fruity)  
fruit.win <- candy[fruit.inds, "winpercent"]  
  
mean(choc.win) > mean(fruit.win)
```

[1] TRUE

On average, chocolate candy is higher ranked than fruity candy.

**Question Q12. Is this difference statistically significant?**

```
#use t.test to find significance  
t.test(choc_candy$winpercent, fruit_candy$winpercent )
```

Welch Two Sample t-test

```
data: choc_candy$winpercent and fruit_candy$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
```

The difference is statistically significant.

### Question 13. What are the five least liked candy types in this set?

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

|                    | chocolate | fruity | caramel | peanut | almond | 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      |

|                    | crisped | rice | wafer | hard | bar | pluribus | sugar | percent | price | percent |
|--------------------|---------|------|-------|------|-----|----------|-------|---------|-------|---------|
| 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 5 least liked candy types in this set are Nik L Nip, Boston Baked Beans, Chiclets, Super Bubble, and Jawbusters.

### Question 14. What are the top 5 all time favorite candy types out of this set?

```
#load dplyr
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
```

```
tail(candy[order(candy$winpercent),], n=5)
```

|                           | chocolate | fruity | caramel | peanut | almondy | 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      |

|                           | crisped | rice | wafer | hard | bar | pluribus | sugar | percent |
|---------------------------|---------|------|-------|------|-----|----------|-------|---------|
| 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   |

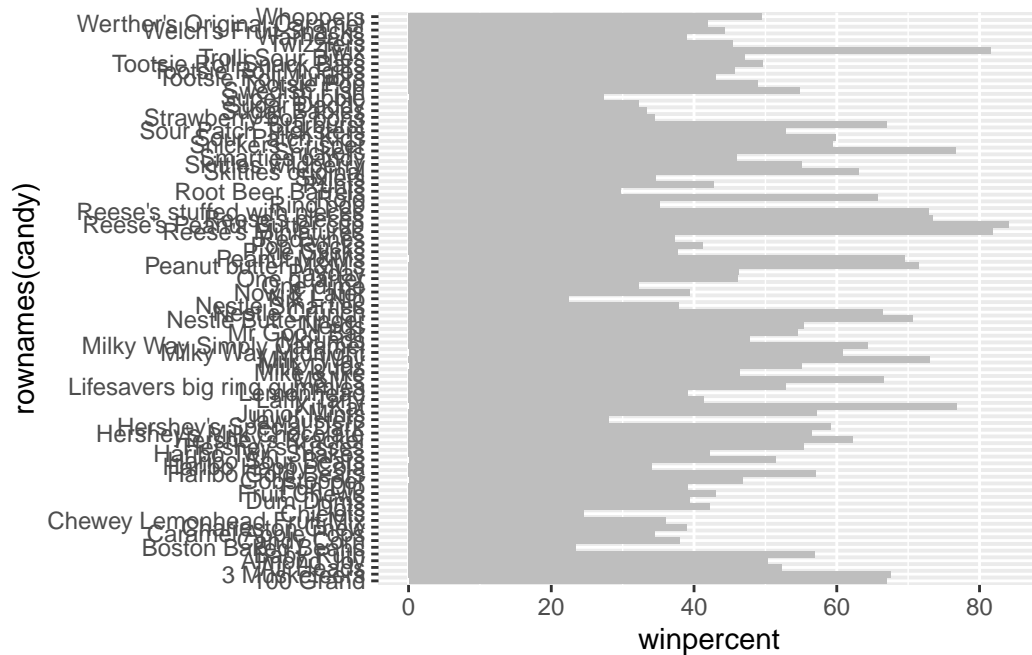
  

|                           | price | percent | winpercent |
|---------------------------|-------|---------|------------|
| Snickers                  | 0.651 |         | 76.67378   |
| Kit Kat                   | 0.511 |         | 76.76860   |
| Twix                      | 0.906 |         | 81.64291   |
| Reese's Miniatures        | 0.279 |         | 81.86626   |
| Reese's Peanut Butter cup | 0.651 |         | 84.18029   |

The top 5 are Snickers, Kit Kat, Twix, Reese's Miniatures, and Reese's Peanut Butter Cups

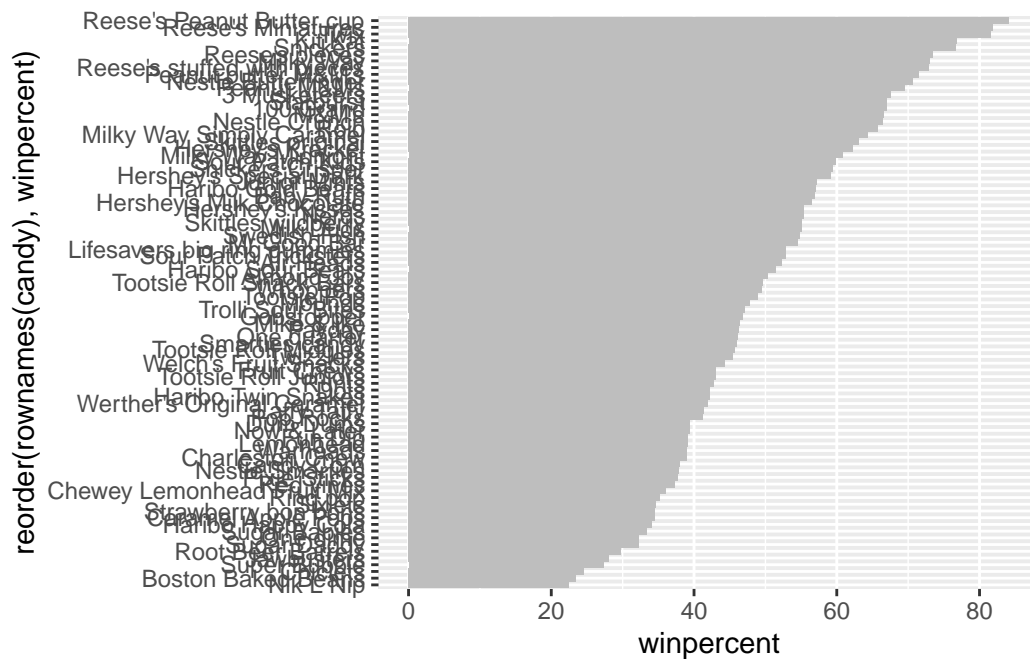
**Question 15. Make a first barplot of candy ranking based on winpercent values.**

```
ggplot(candy) +  
  aes(winpercent, rownames(candy), winpercent) +  
  geom_col(fill="grey")
```



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

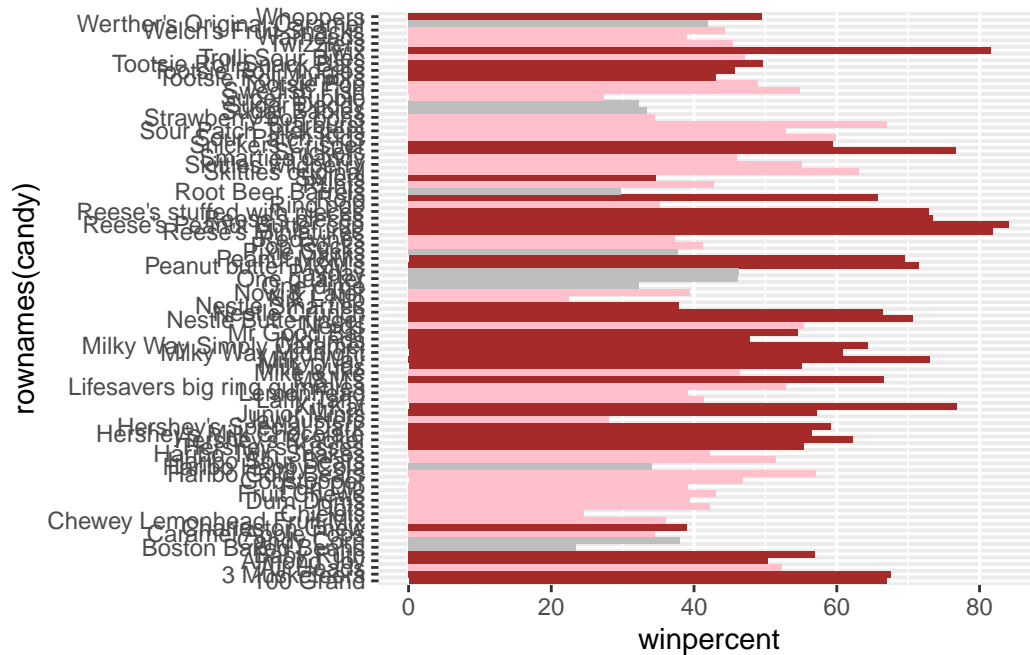
```
ggplot(candy) +
  aes(winpercent, reorder(rownames(candy), winpercent)) +
  geom_col(fill="grey")
```



```
#rename so that we can see colors
mycols <- rep("grey", nrow(candy))

mycols[as.logical(candy$chocolate)] <- "brown"
mycols[as.logical(candy$fruity)] <- "pink"

#generate plot
ggplot(candy) +
  aes(winpercent, rownames(candy), winpercent) +
  geom_col(fill=mycols)
```



Now, for the first time, using this plot we can answer questions like: ## Question 17. What is the worst ranked chocolate candy? The worst ranked chocolate candy is Sixlets.

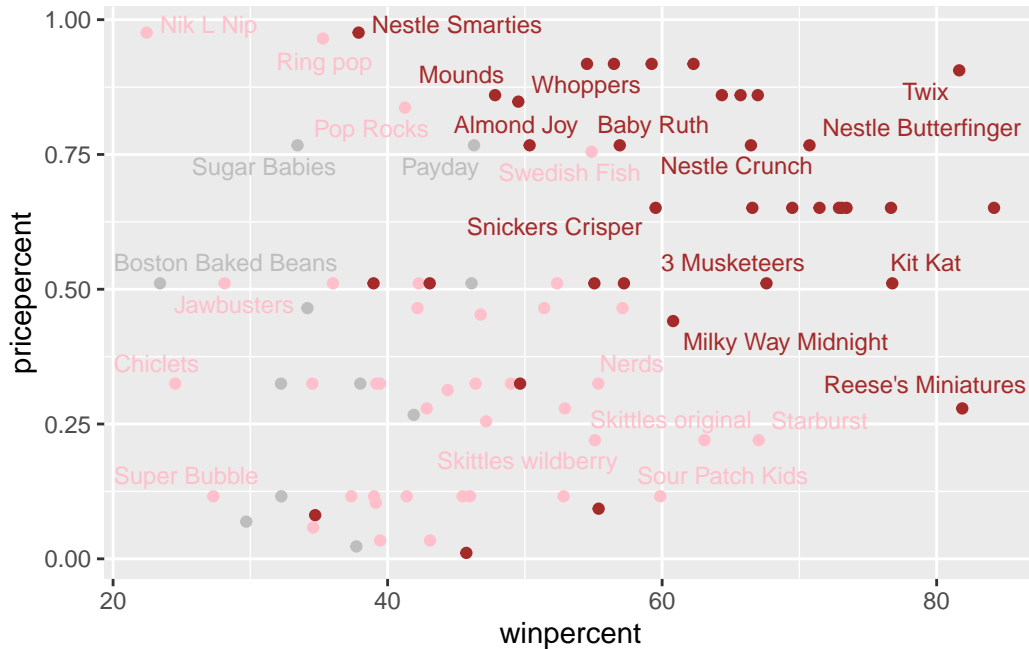
**Question 18. What is the best ranked fruity candy?**

The best ranked fruit candy is Starburst.

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

ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=mycols) +
  geom_text_repel(col=mycols, size=3.3, max.overlaps = 7)
```

Warning: ggrepel: 57 unlabeled data points (too many overlaps). Consider increasing max.overlaps



**Question 19. Which candy type is the highest ranked in terms of winpercent for the least money - i.e. offers the most bang for your buck?**

```
#using order, find the price and most ranked
ord <- order(candy$pricepercent, decreasing = TRUE)
tail( candy[ord,c(11,12)], n=5 )
```

|                      | pricepercent | winpercent |
|----------------------|--------------|------------|
| Strawberry bon bons  | 0.058        | 34.57899   |
| Dum Dums             | 0.034        | 39.46056   |
| Fruit Chews          | 0.034        | 43.08892   |
| Pixie Sticks         | 0.023        | 37.72234   |
| Tootsie Roll Midgies | 0.011        | 45.73675   |

The most liked and least expensive is Tootsie Roll Midgies.

**Question 20. 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 )
```

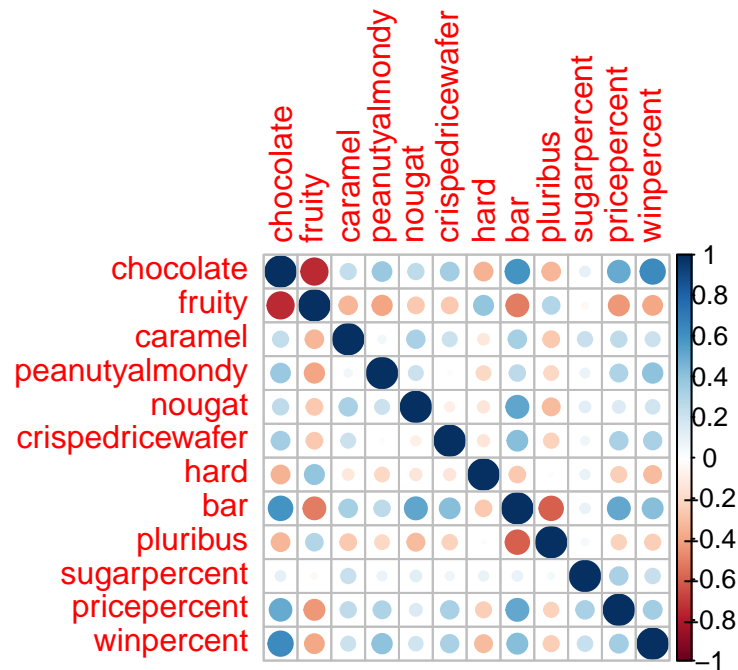
|                          | pricepercent | winpercent |
|--------------------------|--------------|------------|
| Nik L Nip                | 0.976        | 22.44534   |
| Nestle Smarties          | 0.976        | 37.88719   |
| Ring pop                 | 0.965        | 35.29076   |
| Hershey's Krackel        | 0.918        | 62.28448   |
| Hershey's Milk Chocolate | 0.918        | 56.49050   |

The most expensive candies are Nik L Nip, Nestle Smarties, Ring Pop, Hersheys Krackel, and Hersheys Milk Chocolate. Of these, Hersheys Milk Chocolate is the most expensive.

```
#install.packages("corrplot")  
  
#load corrplot  
library(corrplot)
```

corrplot 0.92 loaded

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



**Question 22. Examining this plot what two variables are anti-correlated (i.e. have minus values)?**

Based on the plot, the two most anti-correlated variables are Fruit and Chocolate.

**Question 23. Similarly, what two variables are most positively correlated?**

Based on the plot above, the two variables most positively correlated are chocolate and win-percent.

```
#generate pca
pca <- prcomp(candy, scale=T)
summary(pca)
```

Importance of components:

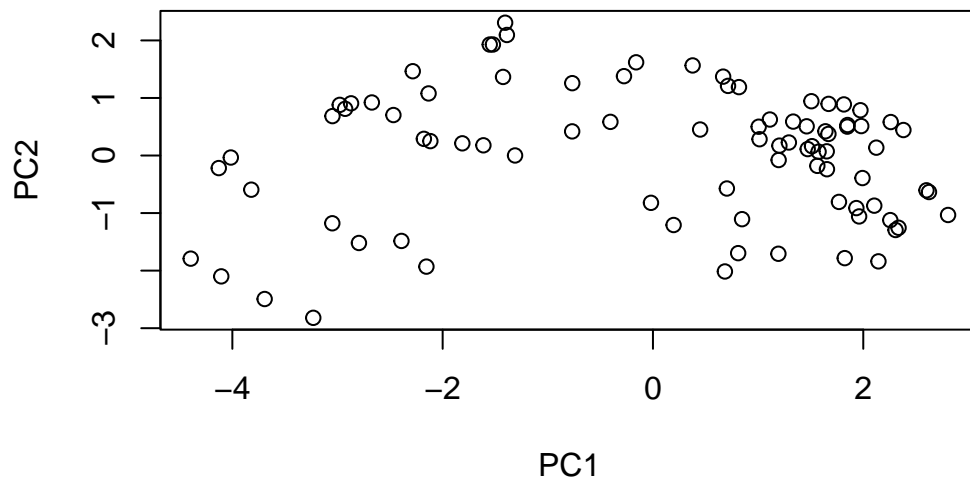
|                        | PC1     | PC2     | PC3     | PC4     | PC5     | PC6     | PC7     |
|------------------------|---------|---------|---------|---------|---------|---------|---------|
| Standard deviation     | 2.0788  | 1.1378  | 1.1092  | 1.07533 | 0.9518  | 0.81923 | 0.81530 |
| Proportion 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 |

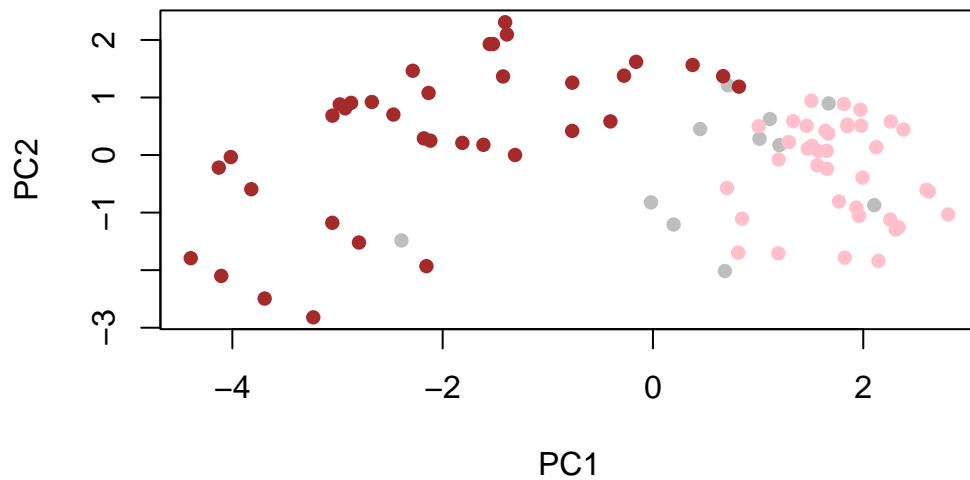
```
#plot PC1 vs PC2
```

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



```
#add color
```

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



```
#load ggplot2
library(ggplot2)
my_data <- cbind(candy, pca$x[,1:3])
my_data
```

|                           | chocolate | fruity | caramel | peanut | almond | nougat |
|---------------------------|-----------|--------|---------|--------|--------|--------|
| 100 Grand                 | 1         | 0      | 1       |        | 0      | 0      |
| 3 Musketeers              | 1         | 0      | 0       |        | 0      | 1      |
| One dime                  | 0         | 0      | 0       |        | 0      | 0      |
| One quarter               | 0         | 0      | 0       |        | 0      | 0      |
| Air Heads                 | 0         | 1      | 0       |        | 0      | 0      |
| Almond Joy                | 1         | 0      | 0       |        | 1      | 0      |
| Baby Ruth                 | 1         | 0      | 1       |        | 1      | 1      |
| Boston Baked Beans        | 0         | 0      | 0       |        | 1      | 0      |
| Candy Corn                | 0         | 0      | 0       |        | 0      | 0      |
| Caramel Apple Pops        | 0         | 1      | 1       |        | 0      | 0      |
| Charleston Chew           | 1         | 0      | 0       |        | 0      | 1      |
| Chewy Lemonhead Fruit Mix | 0         | 1      | 0       |        | 0      | 0      |
| Chiclets                  | 0         | 1      | 0       |        | 0      | 0      |
| Dots                      | 0         | 1      | 0       |        | 0      | 0      |
| Dum Dums                  | 0         | 1      | 0       |        | 0      | 0      |
| Fruit Chews               | 0         | 1      | 0       |        | 0      | 0      |

|                             |   |   |   |   |   |
|-----------------------------|---|---|---|---|---|
| Fun Dip                     | 0 | 1 | 0 | 0 | 0 |
| Gobstopper                  | 0 | 1 | 0 | 0 | 0 |
| Haribo Gold Bears           | 0 | 1 | 0 | 0 | 0 |
| Haribo Happy Cola           | 0 | 0 | 0 | 0 | 0 |
| Haribo Sour Bears           | 0 | 1 | 0 | 0 | 0 |
| Haribo Twin Snakes          | 0 | 1 | 0 | 0 | 0 |
| Hershey's Kisses            | 1 | 0 | 0 | 0 | 0 |
| 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 |
| Jawbusters                  | 0 | 1 | 0 | 0 | 0 |
| Junior Mints                | 1 | 0 | 0 | 0 | 0 |
| Kit Kat                     | 1 | 0 | 0 | 0 | 0 |
| Laffy Taffy                 | 0 | 1 | 0 | 0 | 0 |
| Lemonhead                   | 0 | 1 | 0 | 0 | 0 |
| Lifesavers big ring gummies | 0 | 1 | 0 | 0 | 0 |
| Peanut butter M&M's         | 1 | 0 | 0 | 1 | 0 |
| M&M's                       | 1 | 0 | 0 | 0 | 0 |
| Mike & Ike                  | 0 | 1 | 0 | 0 | 0 |
| Milk Duds                   | 1 | 0 | 1 | 0 | 0 |
| Milky Way                   | 1 | 0 | 1 | 0 | 1 |
| Milky Way Midnight          | 1 | 0 | 1 | 0 | 1 |
| Milky Way Simply Caramel    | 1 | 0 | 1 | 0 | 0 |
| Mounds                      | 1 | 0 | 0 | 0 | 0 |
| Mr Good Bar                 | 1 | 0 | 0 | 1 | 0 |
| Nerds                       | 0 | 1 | 0 | 0 | 0 |
| Nestle Butterfinger         | 1 | 0 | 0 | 1 | 0 |
| Nestle Crunch               | 1 | 0 | 0 | 0 | 0 |
| Nik L Nip                   | 0 | 1 | 0 | 0 | 0 |
| Now & Later                 | 0 | 1 | 0 | 0 | 0 |
| Payday                      | 0 | 0 | 0 | 1 | 1 |
| Peanut M&Ms                 | 1 | 0 | 0 | 1 | 0 |
| Pixie Sticks                | 0 | 0 | 0 | 0 | 0 |
| Pop Rocks                   | 0 | 1 | 0 | 0 | 0 |
| Red vines                   | 0 | 1 | 0 | 0 | 0 |
| Reese's Miniatures          | 1 | 0 | 0 | 1 | 0 |
| Reese's Peanut Butter cup   | 1 | 0 | 0 | 1 | 0 |
| Reese's pieces              | 1 | 0 | 0 | 1 | 0 |
| Reese's stuffed with pieces | 1 | 0 | 0 | 1 | 0 |
| Ring pop                    | 0 | 1 | 0 | 0 | 0 |
| Rolo                        | 1 | 0 | 1 | 0 | 0 |
| Root Beer Barrels           | 0 | 0 | 0 | 0 | 0 |
| Runts                       | 0 | 1 | 0 | 0 | 0 |

|                            |         |      |       |          |                       |
|----------------------------|---------|------|-------|----------|-----------------------|
| Sixlets                    | 1       | 0    | 0     | 0        | 0                     |
| Skittles original          | 0       | 1    | 0     | 0        | 0                     |
| Skittles wildberry         | 0       | 1    | 0     | 0        | 0                     |
| Nestle Smarties            | 1       | 0    | 0     | 0        | 0                     |
| Smarties candy             | 0       | 1    | 0     | 0        | 0                     |
| Snickers                   | 1       | 0    | 1     | 1        | 1                     |
| Snickers Crisper           | 1       | 0    | 1     | 1        | 0                     |
| Sour Patch Kids            | 0       | 1    | 0     | 0        | 0                     |
| Sour Patch Tricksters      | 0       | 1    | 0     | 0        | 0                     |
| Starburst                  | 0       | 1    | 0     | 0        | 0                     |
| Strawberry bon bons        | 0       | 1    | 0     | 0        | 0                     |
| Sugar Babies               | 0       | 0    | 1     | 0        | 0                     |
| Sugar Daddy                | 0       | 0    | 1     | 0        | 0                     |
| Super Bubble               | 0       | 1    | 0     | 0        | 0                     |
| Swedish Fish               | 0       | 1    | 0     | 0        | 0                     |
| Tootsie Pop                | 1       | 1    | 0     | 0        | 0                     |
| Tootsie Roll Juniors       | 1       | 0    | 0     | 0        | 0                     |
| Tootsie Roll Midgies       | 1       | 0    | 0     | 0        | 0                     |
| Tootsie Roll Snack Bars    | 1       | 0    | 0     | 0        | 0                     |
| Trolli Sour Bites          | 0       | 1    | 0     | 0        | 0                     |
| Twix                       | 1       | 0    | 1     | 0        | 0                     |
| Twizzlers                  | 0       | 1    | 0     | 0        | 0                     |
| Warheads                   | 0       | 1    | 0     | 0        | 0                     |
| Welch's Fruit Snacks       | 0       | 1    | 0     | 0        | 0                     |
| Werther's Original Caramel | 0       | 0    | 1     | 0        | 0                     |
| Whoppers                   | 1       | 0    | 0     | 0        | 0                     |
|                            | crisped | rice | wafer | hard bar | pluribus sugarpercent |
| 100 Grand                  |         | 1    | 0     | 1        | 0 0.732               |
| 3 Musketeers               |         | 0    | 0     | 1        | 0 0.604               |
| One dime                   |         | 0    | 0     | 0        | 0 0.011               |
| One quarter                |         | 0    | 0     | 0        | 0 0.011               |
| Air Heads                  |         | 0    | 0     | 0        | 0 0.906               |
| Almond Joy                 |         | 0    | 0     | 1        | 0 0.465               |
| Baby Ruth                  |         | 0    | 0     | 1        | 0 0.604               |
| Boston Baked Beans         |         | 0    | 0     | 0        | 1 0.313               |
| Candy Corn                 |         | 0    | 0     | 0        | 1 0.906               |
| Caramel Apple Pops         |         | 0    | 0     | 0        | 0 0.604               |
| Charleston Chew            |         | 0    | 0     | 1        | 0 0.604               |
| Chewey Lemonhead Fruit Mix |         | 0    | 0     | 0        | 1 0.732               |
| Chiclets                   |         | 0    | 0     | 0        | 1 0.046               |
| Dots                       |         | 0    | 0     | 0        | 1 0.732               |
| Dum Dums                   |         | 0    | 1     | 0        | 0 0.732               |
| Fruit Chews                |         | 0    | 0     | 0        | 1 0.127               |

|                             |   |   |   |   |       |
|-----------------------------|---|---|---|---|-------|
| Fun Dip                     | 0 | 1 | 0 | 0 | 0.732 |
| Gobstopper                  | 0 | 1 | 0 | 1 | 0.906 |
| Haribo Gold Bears           | 0 | 0 | 0 | 1 | 0.465 |
| Haribo Happy Cola           | 0 | 0 | 0 | 1 | 0.465 |
| Haribo Sour Bears           | 0 | 0 | 0 | 1 | 0.465 |
| Haribo Twin Snakes          | 0 | 0 | 0 | 1 | 0.465 |
| Hershey's Kisses            | 0 | 0 | 0 | 1 | 0.127 |
| 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 |
| Jawbusters                  | 0 | 1 | 0 | 1 | 0.093 |
| Junior Mints                | 0 | 0 | 0 | 1 | 0.197 |
| Kit Kat                     | 1 | 0 | 1 | 0 | 0.313 |
| Laffy Taffy                 | 0 | 0 | 0 | 0 | 0.220 |
| Lemonhead                   | 0 | 1 | 0 | 0 | 0.046 |
| Lifesavers big ring gummies | 0 | 0 | 0 | 0 | 0.267 |
| Peanut butter M&M's         | 0 | 0 | 0 | 1 | 0.825 |
| M&M's                       | 0 | 0 | 0 | 1 | 0.825 |
| Mike & Ike                  | 0 | 0 | 0 | 1 | 0.872 |
| Milk Duds                   | 0 | 0 | 0 | 1 | 0.302 |
| Milky Way                   | 0 | 0 | 1 | 0 | 0.604 |
| Milky Way Midnight          | 0 | 0 | 1 | 0 | 0.732 |
| Milky Way Simply Caramel    | 0 | 0 | 1 | 0 | 0.965 |
| Mounds                      | 0 | 0 | 1 | 0 | 0.313 |
| Mr Good Bar                 | 0 | 0 | 1 | 0 | 0.313 |
| Nerds                       | 0 | 1 | 0 | 1 | 0.848 |
| Nestle Butterfinger         | 0 | 0 | 1 | 0 | 0.604 |
| Nestle Crunch               | 1 | 0 | 1 | 0 | 0.313 |
| Nik L Nip                   | 0 | 0 | 0 | 1 | 0.197 |
| Now & Later                 | 0 | 0 | 0 | 1 | 0.220 |
| Payday                      | 0 | 0 | 1 | 0 | 0.465 |
| Peanut M&Ms                 | 0 | 0 | 0 | 1 | 0.593 |
| Pixie Sticks                | 0 | 0 | 0 | 1 | 0.093 |
| Pop Rocks                   | 0 | 1 | 0 | 1 | 0.604 |
| Red vines                   | 0 | 0 | 0 | 1 | 0.581 |
| Reese's Miniatures          | 0 | 0 | 0 | 0 | 0.034 |
| Reese's Peanut Butter cup   | 0 | 0 | 0 | 0 | 0.720 |
| Reese's pieces              | 0 | 0 | 0 | 1 | 0.406 |
| Reese's stuffed with pieces | 0 | 0 | 0 | 0 | 0.988 |
| Ring pop                    | 0 | 1 | 0 | 0 | 0.732 |
| Rolo                        | 0 | 0 | 0 | 1 | 0.860 |
| Root Beer Barrels           | 0 | 1 | 0 | 1 | 0.732 |
| Runts                       | 0 | 1 | 0 | 1 | 0.872 |

|                            |   |   |   |   |       |
|----------------------------|---|---|---|---|-------|
| Sixlets                    | 0 | 0 | 0 | 1 | 0.220 |
| Skittles original          | 0 | 0 | 0 | 1 | 0.941 |
| Skittles wildberry         | 0 | 0 | 0 | 1 | 0.941 |
| Nestle Smarties            | 0 | 0 | 0 | 1 | 0.267 |
| Smarties candy             | 0 | 1 | 0 | 1 | 0.267 |
| Snickers                   | 0 | 0 | 1 | 0 | 0.546 |
| Snickers Crisper           | 1 | 0 | 1 | 0 | 0.604 |
| Sour Patch Kids            | 0 | 0 | 0 | 1 | 0.069 |
| Sour Patch Tricksters      | 0 | 0 | 0 | 1 | 0.069 |
| Starburst                  | 0 | 0 | 0 | 1 | 0.151 |
| Strawberry bon bons        | 0 | 1 | 0 | 1 | 0.569 |
| Sugar Babies               | 0 | 0 | 0 | 1 | 0.965 |
| Sugar Daddy                | 0 | 0 | 0 | 0 | 0.418 |
| Super Bubble               | 0 | 0 | 0 | 0 | 0.162 |
| Swedish Fish               | 0 | 0 | 0 | 1 | 0.604 |
| Tootsie Pop                | 0 | 1 | 0 | 0 | 0.604 |
| Tootsie Roll Juniors       | 0 | 0 | 0 | 0 | 0.313 |
| Tootsie Roll Midgies       | 0 | 0 | 0 | 1 | 0.174 |
| Tootsie Roll Snack Bars    | 0 | 0 | 1 | 0 | 0.465 |
| Trolli Sour Bites          | 0 | 0 | 0 | 1 | 0.313 |
| Twix                       | 1 | 0 | 1 | 0 | 0.546 |
| Twizzlers                  | 0 | 0 | 0 | 0 | 0.220 |
| Warheads                   | 0 | 1 | 0 | 0 | 0.093 |
| Welch's Fruit Snacks       | 0 | 0 | 0 | 1 | 0.313 |
| Werther's Original Caramel | 0 | 1 | 0 | 0 | 0.186 |
| Whoppers                   | 1 | 0 | 0 | 1 | 0.872 |

|                            | price | percent  | win         | percent       | PC1 | PC2 |
|----------------------------|-------|----------|-------------|---------------|-----|-----|
| 100 Grand                  | 0.860 | 66.97173 | -3.81986175 | -0.5935787670 |     |     |
| 3 Musketeers               | 0.511 | 67.60294 | -2.79602364 | -1.5196062111 |     |     |
| One dime                   | 0.116 | 32.26109 | 1.20258363  | 0.1718120657  |     |     |
| One quarter                | 0.511 | 46.11650 | 0.44865378  | 0.4519735621  |     |     |
| Air Heads                  | 0.511 | 52.34146 | 0.70289922  | -0.5731343263 |     |     |
| Almond Joy                 | 0.767 | 50.34755 | -2.46833834 | 0.7035501120  |     |     |
| Baby Ruth                  | 0.767 | 56.91455 | -4.10531223 | -2.1000967736 |     |     |
| Boston Baked Beans         | 0.511 | 23.41782 | 0.71385813  | 1.2098216537  |     |     |
| Candy Corn                 | 0.325 | 38.01096 | 1.01357204  | 0.2834319621  |     |     |
| Caramel Apple Pops         | 0.325 | 34.51768 | 0.81049645  | -1.6960889498 |     |     |
| Charleston Chew            | 0.511 | 38.97504 | -2.15436587 | -1.9304213037 |     |     |
| Chewey Lemonhead Fruit Mix | 0.511 | 36.01763 | 1.65268482  | 0.0726434944  |     |     |
| Chiclets                   | 0.325 | 24.52499 | 2.38180817  | 0.4430926071  |     |     |
| Dots                       | 0.511 | 42.27208 | 1.51249936  | 0.1623958592  |     |     |
| Dum Dums                   | 0.034 | 39.46056 | 2.14430933  | -1.8388386160 |     |     |
| Fruit Chews                | 0.034 | 43.08892 | 2.26133763  | 0.5818322520  |     |     |

|                             |       |          |             |               |
|-----------------------------|-------|----------|-------------|---------------|
| Fun Dip                     | 0.325 | 39.18550 | 1.82383348  | -1.7828662094 |
| Gobstopper                  | 0.453 | 46.78335 | 1.96047812  | -1.0584680267 |
| Haribo Gold Bears           | 0.465 | 57.11974 | 1.33360746  | 0.5892699921  |
| Haribo Happy Cola           | 0.465 | 34.15896 | 1.11167365  | 0.6257697808  |
| Haribo Sour Bears           | 0.465 | 51.41243 | 1.46152952  | 0.5073691482  |
| Haribo Twin Snakes          | 0.465 | 42.17877 | 1.66849016  | 0.3748646265  |
| Hershey's Kisses            | 0.093 | 55.37545 | 0.37722675  | 1.5654519145  |
| Hershey's Krackel           | 0.918 | 62.28448 | -3.04788356 | 0.6850792787  |
| Hershey's Milk Chocolate    | 0.918 | 56.49050 | -2.11696417 | 0.2504568891  |
| Hershey's Special Dark      | 0.918 | 59.23612 | -2.17850376 | 0.2898570052  |
| Jawbusters                  | 0.511 | 28.12744 | 2.62491587  | -0.6343671618 |
| Junior Mints                | 0.511 | 57.21925 | -0.16010610 | 1.6194428347  |
| Kit Kat                     | 0.511 | 76.76860 | -2.87086546 | 0.9069655335  |
| Laffy Taffy                 | 0.116 | 41.38956 | 1.65450042  | -0.2379605144 |
| Lemonhead                   | 0.104 | 39.14106 | 2.33564695  | -1.2553404646 |
| Lifesavers big ring gummies | 0.279 | 52.91139 | 1.19528766  | -0.0783610246 |
| Peanut butter M&M's         | 0.651 | 71.46505 | -1.52223814 | 1.9291395890  |
| M&M's                       | 0.651 | 66.57458 | -0.76747561 | 1.2573539136  |
| Mike & Ike                  | 0.325 | 46.41172 | 1.57487290  | 0.0664259746  |
| Milk Duds                   | 0.511 | 55.06407 | -0.76836937 | 0.4192793946  |
| Milky Way                   | 0.651 | 73.09956 | -3.69272218 | -2.4933313173 |
| Milky Way Midnight          | 0.441 | 60.80070 | -3.23036513 | -2.8201031327 |
| Milky Way Simply Caramel    | 0.860 | 64.35334 | -3.04936226 | -1.1774777304 |
| Mounds                      | 0.860 | 47.82975 | -1.81292795 | 0.2120726312  |
| Mr Good Bar                 | 0.918 | 54.52645 | -2.67327849 | 0.9217207344  |
| Nerds                       | 0.325 | 55.35405 | 1.93426895  | -0.9133307225 |
| Nestle Butterfinger         | 0.767 | 70.73564 | -2.97855081 | 0.8798835368  |
| Nestle Crunch               | 0.767 | 66.47068 | -2.92740488 | 0.8119013154  |
| Nik L Nip                   | 0.976 | 22.44534 | 1.63985272  | 0.4210217322  |
| Now & Later                 | 0.325 | 39.44680 | 1.98070982  | 0.5117150919  |
| Payday                      | 0.767 | 46.29660 | -2.39180556 | -1.4839637512 |
| Peanut M&Ms                 | 0.651 | 69.48379 | -1.38897069 | 2.0947188031  |
| Pixie Sticks                | 0.023 | 37.72234 | 1.67042227  | 0.8969792365  |
| Pop Rocks                   | 0.837 | 41.26551 | 1.76879348  | -0.8060325640 |
| Red vines                   | 0.116 | 37.34852 | 2.12406849  | 0.1366822960  |
| Reese's Miniatures          | 0.279 | 81.86626 | -1.55210251 | 1.9287569793  |
| Reese's Peanut Butter cup   | 0.651 | 84.18029 | -2.28427985 | 1.4648923293  |
| Reese's pieces              | 0.651 | 73.43499 | -1.40590761 | 2.3077984818  |
| Reese's stuffed with pieces | 0.651 | 72.88790 | -2.13382398 | 1.0787289654  |
| Ring pop                    | 0.965 | 35.29076 | 1.19274412  | -1.7069749284 |
| Rolo                        | 0.860 | 65.71629 | -1.61259322 | 0.1773734932  |
| Root Beer Barrels           | 0.069 | 29.70369 | 2.10440254  | -0.8711340556 |
| Runts                       | 0.279 | 42.84914 | 2.25699185  | -1.1223199934 |

|                            |              |          |             |               |
|----------------------------|--------------|----------|-------------|---------------|
| Sixlets                    | 0.081        | 34.72200 | 0.81799664  | 1.1888290122  |
| Skittles original          | 0.220        | 63.08514 | 1.29259129  | 0.2263705137  |
| Skittles wildberry         | 0.220        | 55.10370 | 1.47148517  | 0.1118354559  |
| Nestle Smarties            | 0.976        | 37.88719 | -0.27556563 | 1.3792344137  |
| Smarties candy             | 0.116        | 45.99583 | 2.60115214  | -0.6047947520 |
| Snickers                   | 0.651        | 76.67378 | -4.39576792 | -1.7919312516 |
| Snickers Crisper           | 0.651        | 59.52925 | -4.01457335 | -0.0347673522 |
| Sour Patch Kids            | 0.116        | 59.86400 | 1.81551769  | 0.8879445215  |
| Sour Patch Tricksters      | 0.116        | 52.82595 | 1.97326660  | 0.7869473239  |
| Starburst                  | 0.220        | 67.03763 | 1.50658493  | 0.9437290830  |
| Strawberry bon bons        | 0.058        | 34.57899 | 2.80647837  | -1.0331193111 |
| Sugar Babies               | 0.767        | 33.43755 | -0.01900559 | -0.8219542293 |
| Sugar Daddy                | 0.325        | 32.23100 | 0.19642038  | -1.2073694698 |
| Super Bubble               | 0.116        | 27.30386 | 1.99242820  | -0.3915898648 |
| Swedish Fish               | 0.755        | 54.86111 | 1.00547407  | 0.5003327040  |
| Tootsie Pop                | 0.325        | 48.98265 | 0.84734171  | -1.1060686710 |
| Tootsie Roll Juniors       | 0.511        | 43.06890 | -0.40463667 | 0.5848580362  |
| Tootsie Roll Midgies       | 0.011        | 45.73675 | 0.66730732  | 1.3709464980  |
| Tootsie Roll Snack Bars    | 0.325        | 49.65350 | -1.31149842 | 0.0009721286  |
| Trolli Sour Bites          | 0.255        | 47.17323 | 1.85048456  | 0.5304055168  |
| Twix                       | 0.906        | 81.64291 | -4.12909044 | -0.2180299573 |
| Twizzlers                  | 0.116        | 45.46628 | 1.56312584  | -0.1794588354 |
| Warheads                   | 0.116        | 39.01190 | 2.30707033  | -1.2940268825 |
| Welch's Fruit Snacks       | 0.313        | 44.37552 | 1.84808801  | 0.5022006184  |
| Werther's Original Caramel | 0.267        | 41.90431 | 0.68420363  | -2.0146385440 |
| Whoppers                   | 0.848        | 49.52411 | -1.42549552 | 1.3654147702  |
|                            | PC3          |          |             |               |
| 100 Grand                  | -2.186308676 |          |             |               |
| 3 Musketeers               | 1.412198551  |          |             |               |
| One dime                   | 2.060771178  |          |             |               |
| One quarter                | 1.476492844  |          |             |               |
| Air Heads                  | -0.929389343 |          |             |               |
| Almond Joy                 | 0.858108916  |          |             |               |
| Baby Ruth                  | 1.347834706  |          |             |               |
| Boston Baked Beans         | 0.941899950  |          |             |               |
| Candy Corn                 | -0.840681586 |          |             |               |
| Caramel Apple Pops         | -0.207020586 |          |             |               |
| Charleston Chew            | 1.675469334  |          |             |               |
| Chewey Lemonhead Fruit Mix | -0.909617411 |          |             |               |
| Chiclets                   | 1.000422079  |          |             |               |
| Dots                       | -0.967135199 |          |             |               |
| Dum Dums                   | -0.385372660 |          |             |               |
| Fruit Chews                | 0.978626618  |          |             |               |

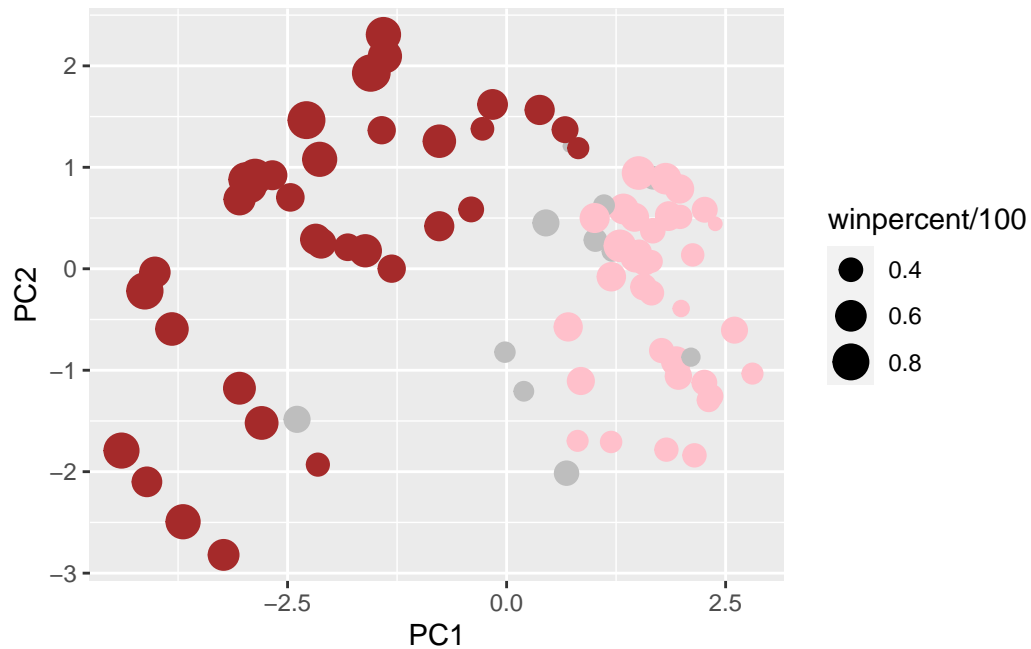


|                             |              |
|-----------------------------|--------------|
| Fun Dip                     | -0.719415821 |
| Gobstopper                  | -1.873874385 |
| Haribo Gold Bears           | -0.431929774 |
| Haribo Happy Cola           | 0.054459647  |
| Haribo Sour Bears           | -0.379443632 |
| Haribo Twin Snakes          | -0.294528131 |
| Hershey's Kisses            | 1.104739528  |
| Hershey's Krackel           | -1.154357778 |
| Hershey's Milk Chocolate    | 0.218316614  |
| Hershey's Special Dark      | 0.193067056  |
| Jawbusters                  | 0.114043053  |
| Junior Mints                | 0.442156347  |
| Kit Kat                     | -0.545771148 |
| Laffy Taffy                 | 1.217408326  |
| Lemonhead                   | 1.125823900  |
| Lifesavers big ring gummies | 0.814040659  |
| Peanut butter M&M's         | -0.815897653 |
| M&M's                       | -1.260658369 |
| Mike & Ike                  | -1.114406454 |
| Milk Duds                   | -0.137573021 |
| Milky Way                   | 0.843423990  |
| Milky Way Midnight          | 0.902884388  |
| Milky Way Simply Caramel    | -1.382617058 |
| Mounds                      | 0.636094539  |
| Mr Good Bar                 | 0.997161433  |
| Nerds                       | -1.670281710 |
| Nestle Butterfinger         | 0.348599786  |
| Nestle Crunch               | -0.747159803 |
| Nik L Nip                   | -0.083217936 |
| Now & Later                 | 0.460099768  |
| Payday                      | 2.091687409  |
| Peanut M&Ms                 | -0.260214925 |
| Pixie Sticks                | 1.394703254  |
| Pop Rocks                   | -1.567639814 |
| Red vines                   | -0.115183020 |
| Reese's Miniatures          | 1.884620322  |
| Reese's Peanut Butter cup   | -0.156138940 |
| Reese's pieces              | 0.136661895  |
| Reese's stuffed with pieces | -0.673152403 |
| Ring pop                    | -1.423826969 |
| Rolo                        | -1.931879747 |
| Root Beer Barrels           | -0.594335570 |
| Runts                       | -1.557678507 |

|                            |              |
|----------------------------|--------------|
| Sixlets                    | 1.093105891  |
| Skittles original          | -1.306145308 |
| Skittles wildberry         | -1.232745536 |
| Nestle Smarties            | -0.080047831 |
| Smarties candy             | 0.003482896  |
| Snickers                   | 1.434654778  |
| Snickers Crisper           | -1.089868643 |
| Sour Patch Kids            | 0.863881832  |
| Sour Patch Tricksters      | 0.928605869  |
| Starburst                  | 0.487658690  |
| Strawberry bon bons        | -0.524069119 |
| Sugar Babies               | -1.802826526 |
| Sugar Daddy                | 0.520140143  |
| Super Bubble               | 1.481310204  |
| Swedish Fish               | -1.068588828 |
| Tootsie Pop                | -0.480874078 |
| Tootsie Roll Juniors       | 0.836999949  |
| Tootsie Roll Midgies       | 1.179339290  |
| Tootsie Roll Snack Bars    | 0.885976952  |
| Trolli Sour Bites          | 0.254559391  |
| Twix                       | -1.943536689 |
| Twizzlers                  | 1.179917535  |
| Warheads                   | 1.004249910  |
| Welch's Fruit Snacks       | 0.213204782  |
| Werther's Original Caramel | 0.506488679  |
| Whoppers                   | -2.759982292 |

```
#generate plot
p <- ggplot(my_data) +
  aes(x=PC1, y=PC2,
      size=winpercent/100,
      text=rownames(my_data),
      label=rownames(my_data)) +
  geom_point(col=mycols)

p
```



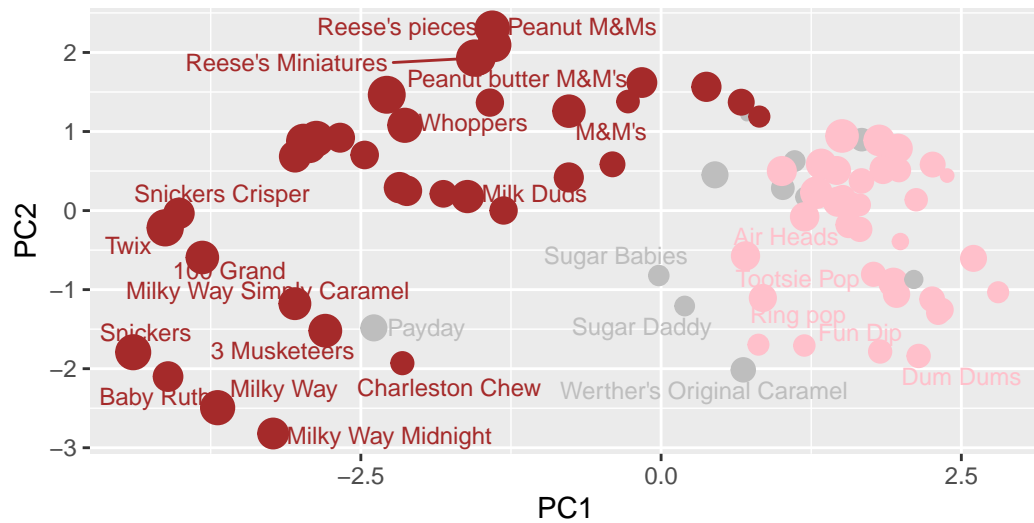
```
library(ggrepel)

p + geom_text_repel(size=3.3, col=mycols, 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: 59 unlabeled data points (too many overlaps). Consider increasing max.overlaps

## Halloween Candy PCA Space

Colored by type: chocolate bar (dark brown), chocolate other (light brown),



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':

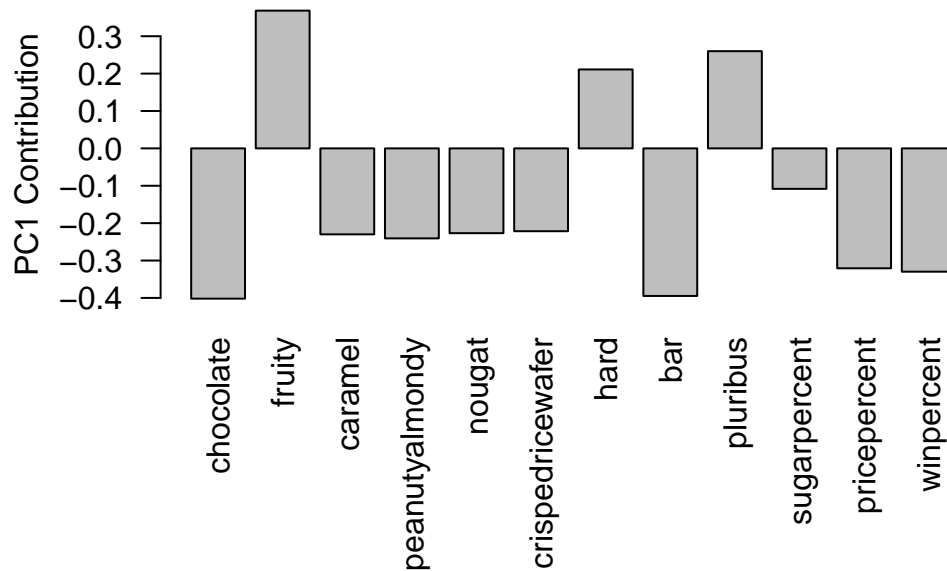
filter

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")
```



**Question 24. What original variables are picked up strongly by PC1 in the positive direction? Do these make sense to you?**

Fruity, Hard and Pluribus variables are picked up strongly by PC1 in the positive direction. This makes sense because they are positively correlated.