

# Halloween (Class 10) Mini Project

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## Import candy data

```
candy_file <- "candy-data.csv"

candy = read.csv(candy_file, row.names=1)
head(candy)
```

	chocolate	fruity	caramel	peanut	yalmond	nougat	crisped	rice	wafer
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

There are 85 different candy types

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

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

[1] 38

38 candy types are fruity

### Stats on our favorite candies

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

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

[1] 76.7686

My favorite candy is Kit Kat and its winpercent is `rcandy["Kit Kat",]$winpercent%`.

Q4. What is the winpercent value for “Kit Kat”?

As stated above Kit Kat’s winpercent is `rcandy["Kit Kat",]$winpercent%`.

Q5. What is the winpercent value for “Tootsie Roll Snack Bars”?

Tootsie Rolls Snack Bars winpercent is `rcandy["Tootsie Rolls Snack Bars",]$winpercent%`.

### skimr

```
# install.packages("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	
peanutyalmond	0	1	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
nougat	0	1	0.08	0.28	0.00	0.00	0.00	0.00	1.00	
crispedricewafer	0	1	0.08	0.28	0.00	0.00	0.00	0.00	1.00	
hard	0	1	0.18	0.38	0.00	0.00	0.00	0.00	1.00	
bar	0	1	0.25	0.43	0.00	0.00	0.00	0.00	1.00	
pluribus	0	1	0.52	0.50	0.00	0.00	1.00	1.00	1.00	
sugarpercent	0	1	0.48	0.28	0.01	0.22	0.47	0.73	0.99	
pricepercent	0	1	0.47	0.29	0.01	0.26	0.47	0.65	0.98	
winpercent	0	1	50.32	14.71	22.45	39.14	47.83	59.86	84.18	

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

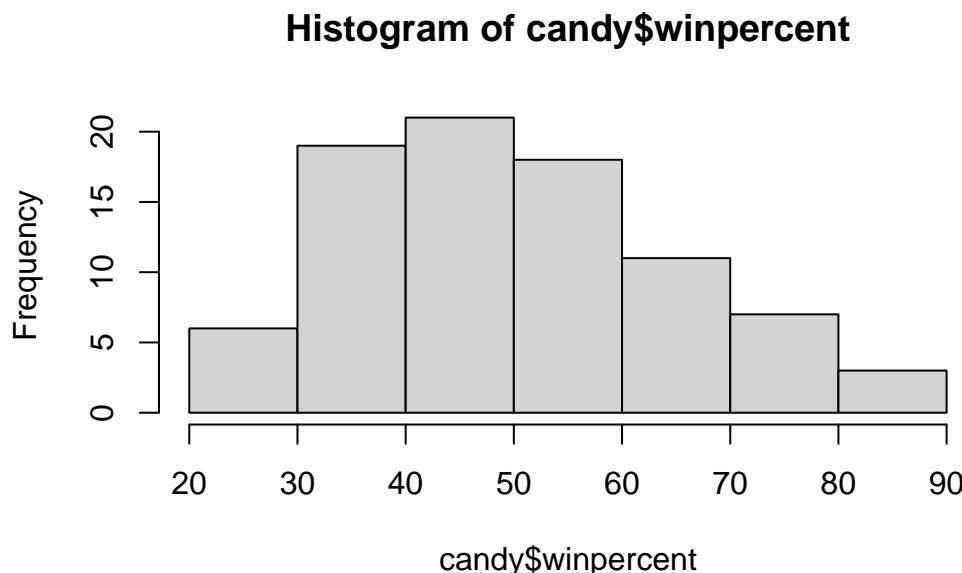
The win percent is on a different scale than the other columns. I can tell by looking at the mean and percentiles – the values for winpercent are »1 and the other columns are between 1 and 0.

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

The 0 is False and 1 is True for the categorie columns including chocolate. If a candy is/contains chocolate, it gets a 1 in the column, otherwise it gets a 0.

Q8. Plot a histogram of winpercent values

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



Q9. Is the distribution of winpercent values symmetrical?

No it is skewed to the left with a long tail to the right. In other words, though the range is 20 to 90, the peak of the curve is around 45, which is not the center of the distribution.

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

```
# library(DescTools)
median(candy$winpercent)
```

[1] 47.82975

```
# Mode(candy$winpercent) -- didn't work, used for categorical data !

dens <- density(candy$winpercent)
# mode
dens$x[which.max(dens$y)]
```

```
[1] 42.50432
```

I think the question is about the 50% mark on the x axis, in which case the center of the distribution (which I interpret as the median) is below that. If we consider the mode to be the center of the distribution, it is also below the 50%.

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

```
choc_mean_win <- mean(candy$winpercent [as.logical(candy$chocolate)])
fruity_mean_win <- mean(candy$winpercent [as.logical(candy$fruity)])

choc_mean_win > fruity_mean_win
```

```
[1] TRUE
```

Chocolate candy is higher ranked than fruit candy.

Q12. Is this difference statistically significant?

```
t.test(winpercent ~ fruity, data = candy)
```

```
Welch Two Sample t-test

data: winpercent by fruity
t = 3.9232, df = 79.384, p-value = 0.0001847
alternative hypothesis: true difference in means between group 0 and group 1 is not equal to
95 percent confidence interval:
 5.521665 16.893097
sample estimates:
mean in group 0 mean in group 1
 55.32712        44.11974
```

We can reject the null hypothesis (that there is no difference in means for chocolate vs fruity) because the p value is <5%

## Overall candy rankings

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

```
library(dplyr)
```

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

filter, lag

The following objects are masked from 'package:base':

intersect, setdiff, setequal, union

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

	chocolate	fruity	caramel	peanuty	almondy	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	
	crispedrice	wafers	hard	bar	pluribus	sugarpercent	pricepercent
Nik L Nip	0	0	0		1	0.197	0.976
Boston Baked Beans	0	0	0		1	0.313	0.511
Chiclets	0	0	0		1	0.046	0.325
Super Bubble	0	0	0		0	0.162	0.116
Jawbusters	0	1	0		1	0.093	0.511
	winpercent						
Nik L Nip	22.44534						
Boston Baked Beans	23.41782						
Chiclets	24.52499						
Super Bubble	27.30386						
Jawbusters	28.12744						

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

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

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

	chocolate	fruity	caramel	peanut	yalmond	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
	crispedrice	wafers	hard bar	pluribus	sugar	percent
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
	price	percent	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				

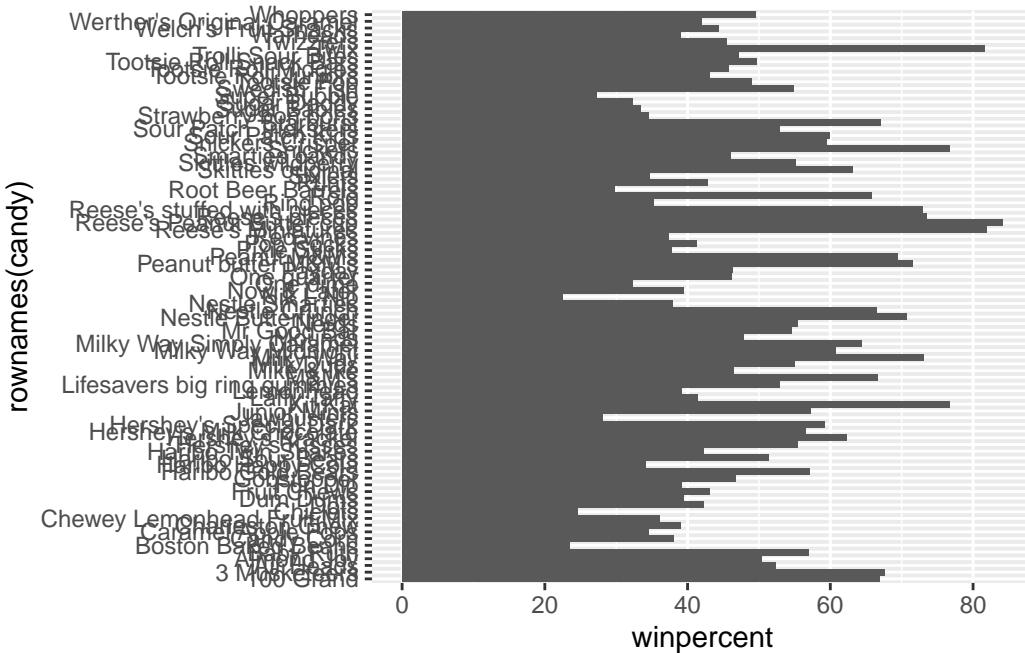
The top five most liked candies are Reese's PB cups, Reese's minis, Twix, Kit Kat, and Snickers.

I like using dplyr because the piping is intuitive for me for both reading and writing, since the logic flow is left to right rather than inside out.

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

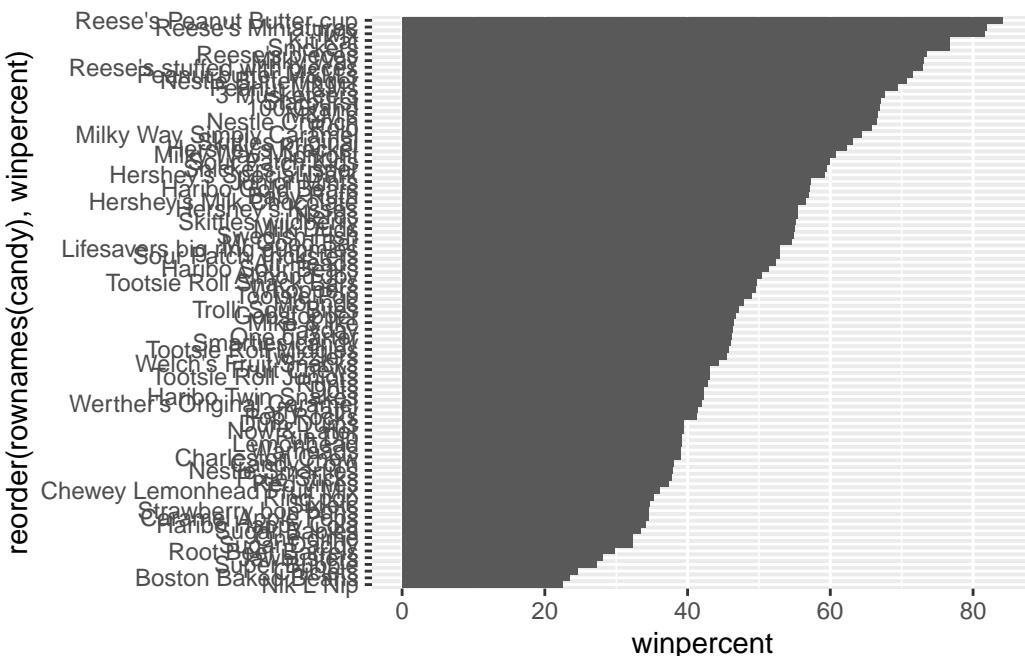
```
library(ggplot2)

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



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

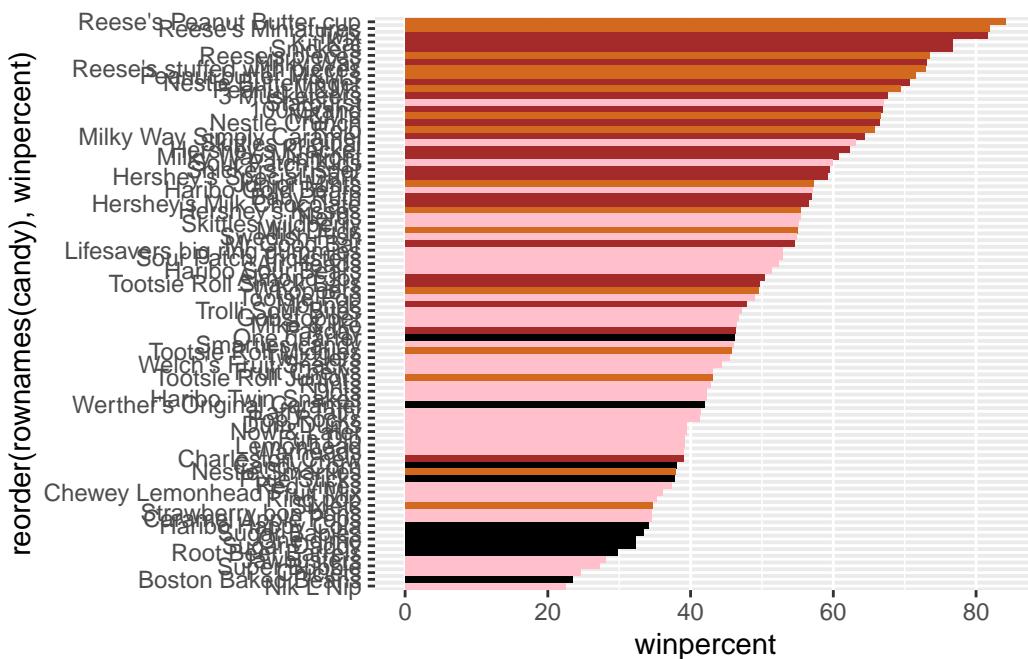
```
ggplot(candy) + aes(winpercent, reorder(rownames(candy), winpercent)) + geom_col()
```



## Adding color

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

```
ggplot(candy) + aes(winpercent, reorder(rownames(candy), winpercent)) +
  # geom_col(col=my_cols) # the inside (fill) is gray while the border is colored
  geom_col(fill=my_cols)
```

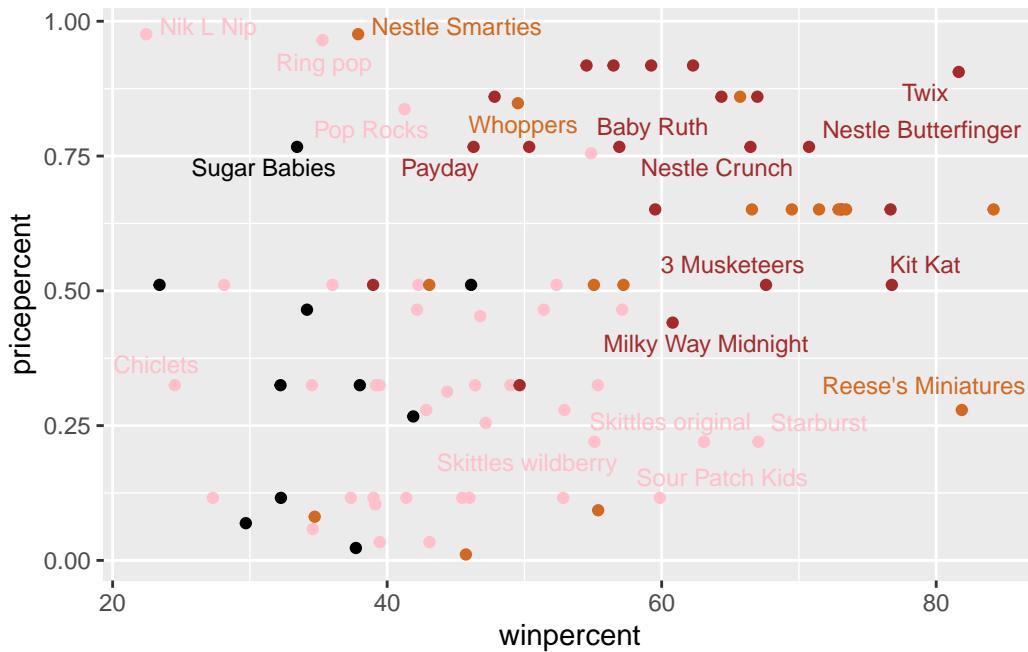


## Pricepoint

```
library(ggrepel)

ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols, size=3.3, max.overlaps = 5)
```

Warning: ggrepel: 65 unlabeled data points (too many overlaps). Consider increasing max.overlaps



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

We can see on the graph: Reeses mini's is the bottom corner-most value (highest winpercent for lowest pricepercent).

Q20. What are the top 5 most expensive candy types in the dataset and of these which is the least popular?

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

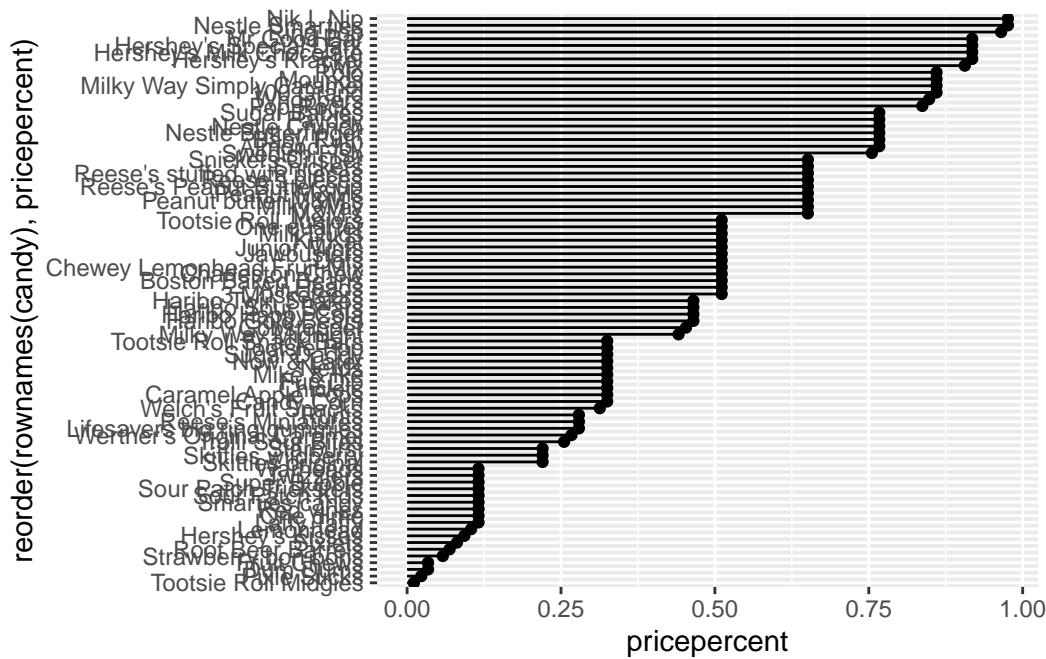
	chocolate	fruity	caramel	peanut	almond	nougat
Nik L Nip	0	1	0	0	0	0
Nestle Smarties	1	0	0	0	0	0
Ring pop	0	1	0	0	0	0
Hershey's Krackel	1	0	0	0	0	0
Hershey's Milk Chocolate	1	0	0	0	0	0
	crisped	rice	wafer	hard	bar	pluribus
Nik L Nip	0	0	0	1	0	0.197
Nestle Smarties	0	0	0	1	0	0.267

	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			

The 5 most expensive candies are Nik L Nip, Ring Pop, Nestle Smarties, Hershey's Krackel, and Hershey's Milk Chocolate. The least popular of these is clear on the graph: 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_point() +
  geom_segment(aes(yend=reorder(rownames(candy), pricepercent), xend=0))
```

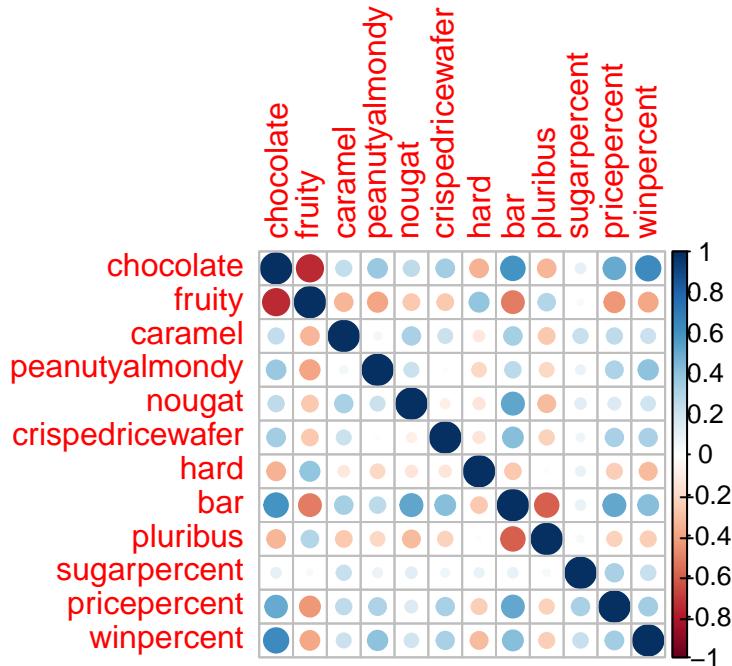


## Correlation

```
# install.packages("corrplot")
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/fruity and pluribus/bar are anticorrelated.

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

It appears that chocolate and winpercent are the most positively correlated.

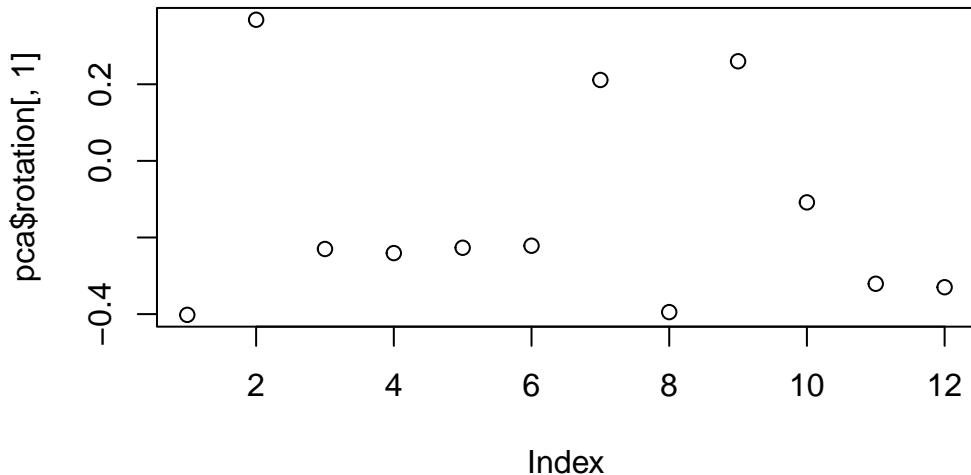
## PCA

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

Importance of components:

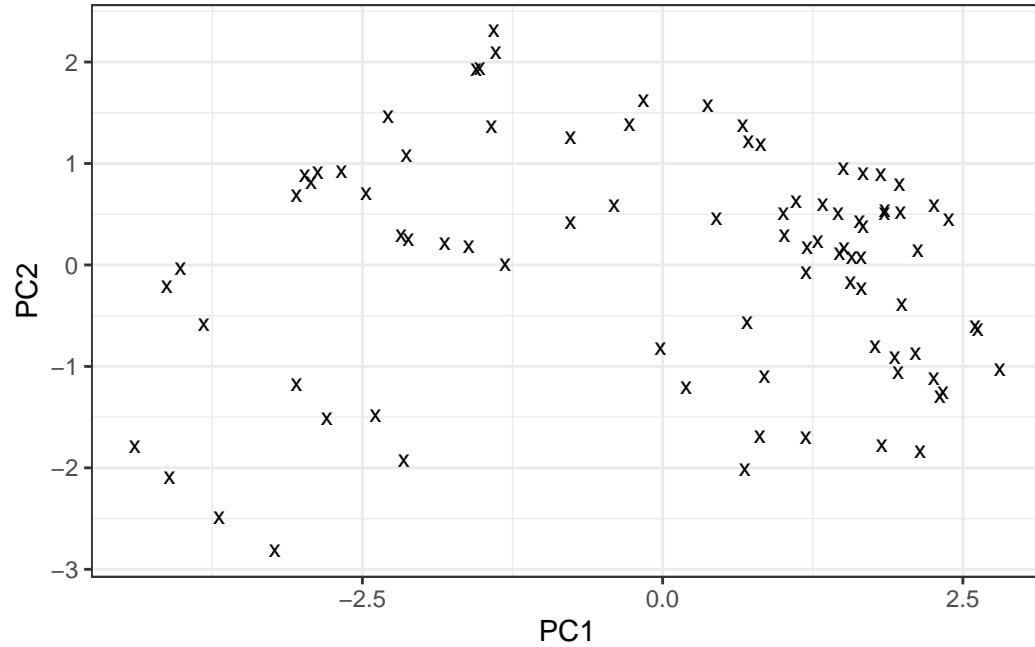
	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Standard deviation	2.0788	1.1378	1.1092	1.07533	0.9518	0.81923	0.81530
Proportion of Variance	0.3601	0.1079	0.1025	0.09636	0.0755	0.05593	0.05539
Cumulative Proportion	0.3601	0.4680	0.5705	0.66688	0.7424	0.79830	0.85369
	PC8	PC9	PC10	PC11	PC12		
Standard deviation	0.74530	0.67824	0.62349	0.43974	0.39760		
Proportion of Variance	0.04629	0.03833	0.03239	0.01611	0.01317		
Cumulative Proportion	0.89998	0.93832	0.97071	0.98683	1.00000		

```
plot(pca$rotation[,1])
```

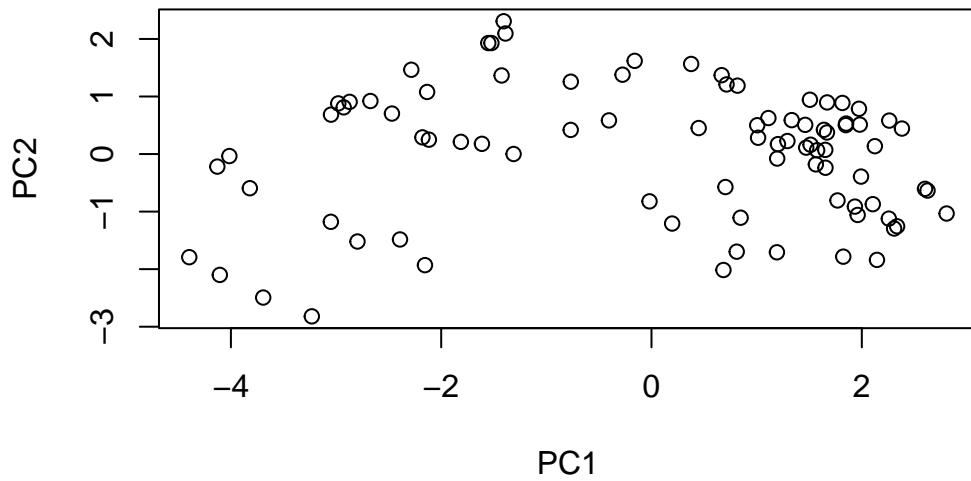


```
ggplot(pca$x) +
  aes(x = PC1, y = PC2) +
  geom_point(size = 3, shape="x") +
```

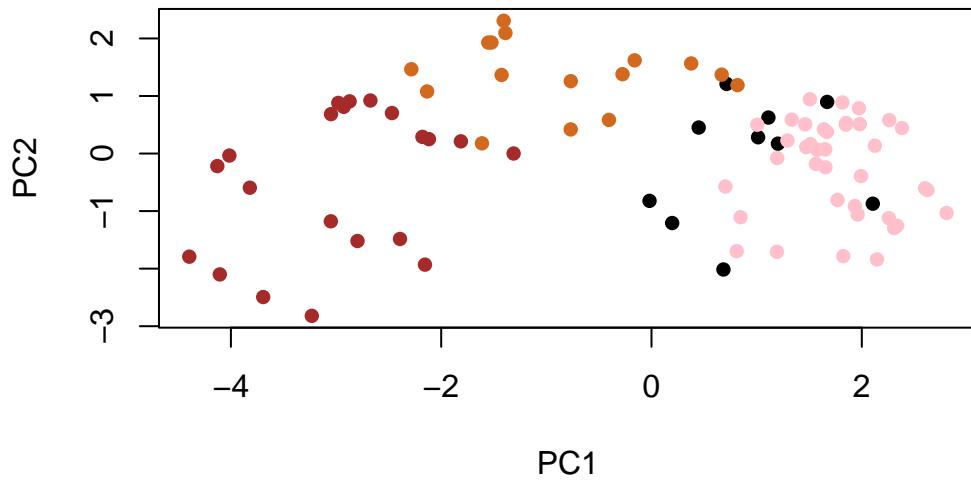
```
xlab("PC1") +  
ylab("PC2") +  
theme_bw()
```



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



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



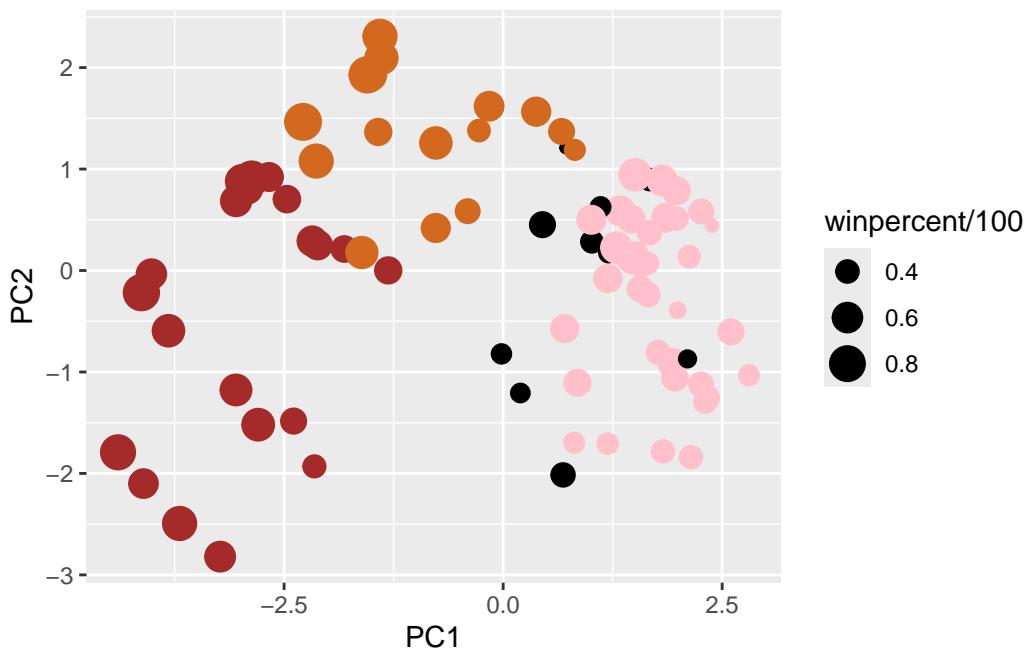
```

# Make a new data-frame with our PCA results and candy data
my_data <- cbind(candy, pca$x[,1:3])

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

p

```



```

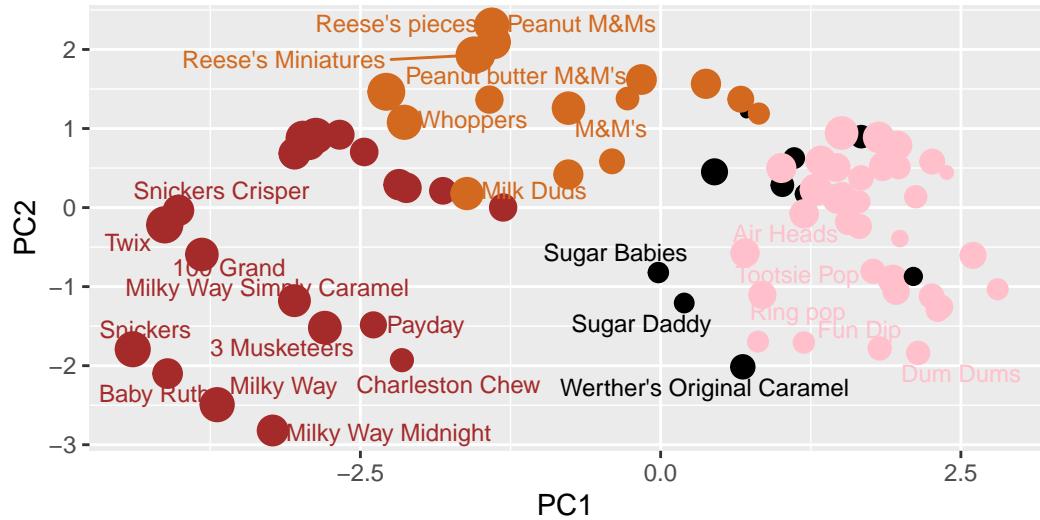
p + geom_text_repel(size=3.3, col=my_cols, max.overlaps = 7) +
  theme(legend.position = "none") +
  labs(title="Halloween Candy PCA Space",
       subtitle="Colored by type: chocolate bar (dark brown), chocolate other (light brown),
       caption="Data from 538")

```

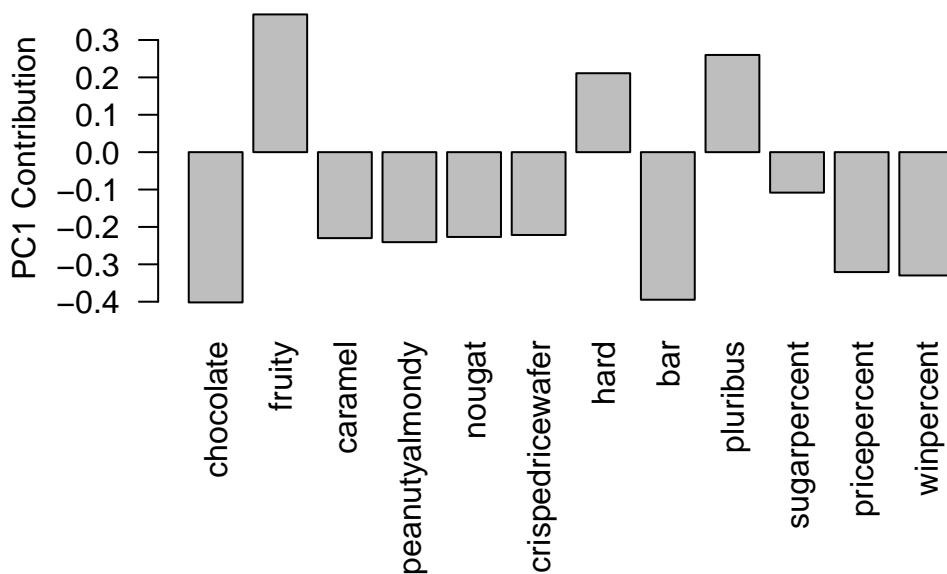
Warning: ggrepel: 59 unlabeled data points (too many overlaps). Consider increasing max.overlaps

## Halloween Candy PCA Space

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



```
par(mar=c(8,4,2,2))
barplot(pca$rotation[,1], las=2, ylab="PC1 Contribution")
```



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

fruity and pluribus – makes sense because i think people like those the least.

Also, overall, the fruity vs chocolate and bar vs pluribus are the most strongly picked up signals, which matches the correlation data observation.