Class10_HalloweenMiniProject

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Class 10: Halloween Mini-Project

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

```
nrow(candy)
```

```
## [1] 85
```

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

```
## [1] 38
```

85 candy types and 38 fruity candy types.

2. What is your favorate candy?

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

3 Musketeers

> 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
```

```
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	

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

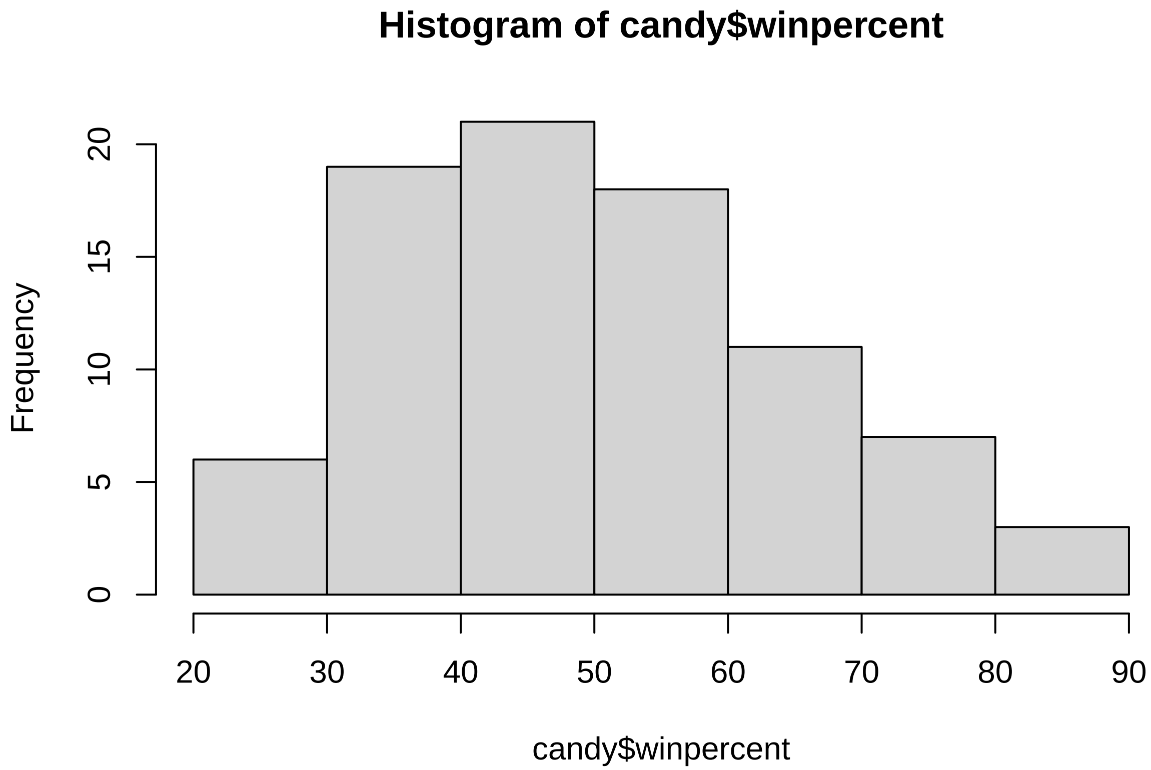
Winpercent is on a different sacle to others.

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

Zero indicates it's not chocolate while one means it's chocolate candy

> Q8. Plot a histogram of winpercent values

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



> Q9. Is the distribution of winpercent values symmetrical?

No

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

Above 50%.

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

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

```
## [1] 60.92153
```

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

```
## [1] 60.92153
```

```r
fruit <- candy[as.logical(candy$fruit), ]$winpercent
mean(fruit)
```

```
## [1] 44.11974
```

Q12. Is this difference statistically significant?

```r
t.test(chocolate, fruit)
```

```
##
##  Welch Two Sample t-test
##
## data:  chocolate 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 significant.

3. Overall Candy Rankings

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

```r
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
```

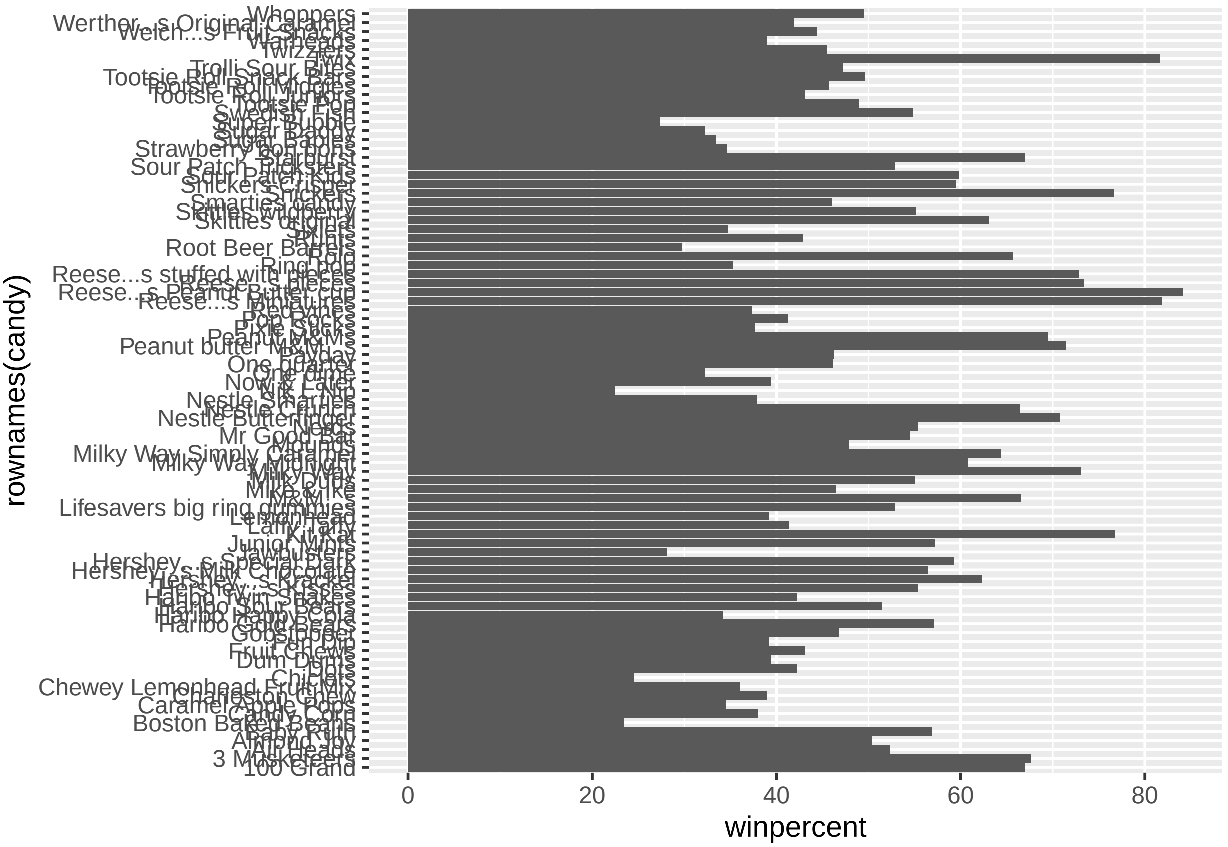
Q14. What are the top 5 all time favorite candy types out of this set?

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

```
##                            chocolate fruity caramel peanutyalmondy 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
##                            crispedricewafer hard bar pluribus sugarpercent
## 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
##                            pricepercent 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
```

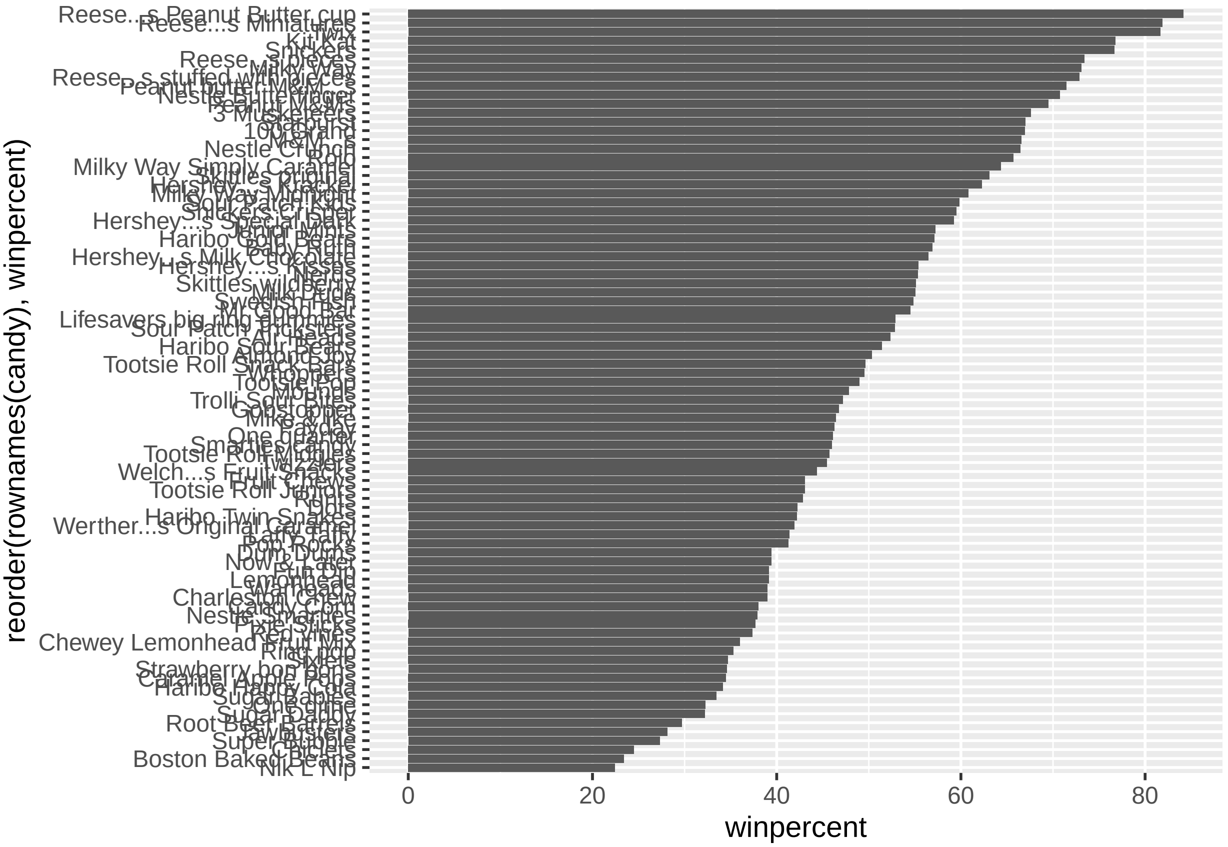
Q15. Make a first barplot of candy ranking based on winpercent values.

```
library(ggplot2)

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



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

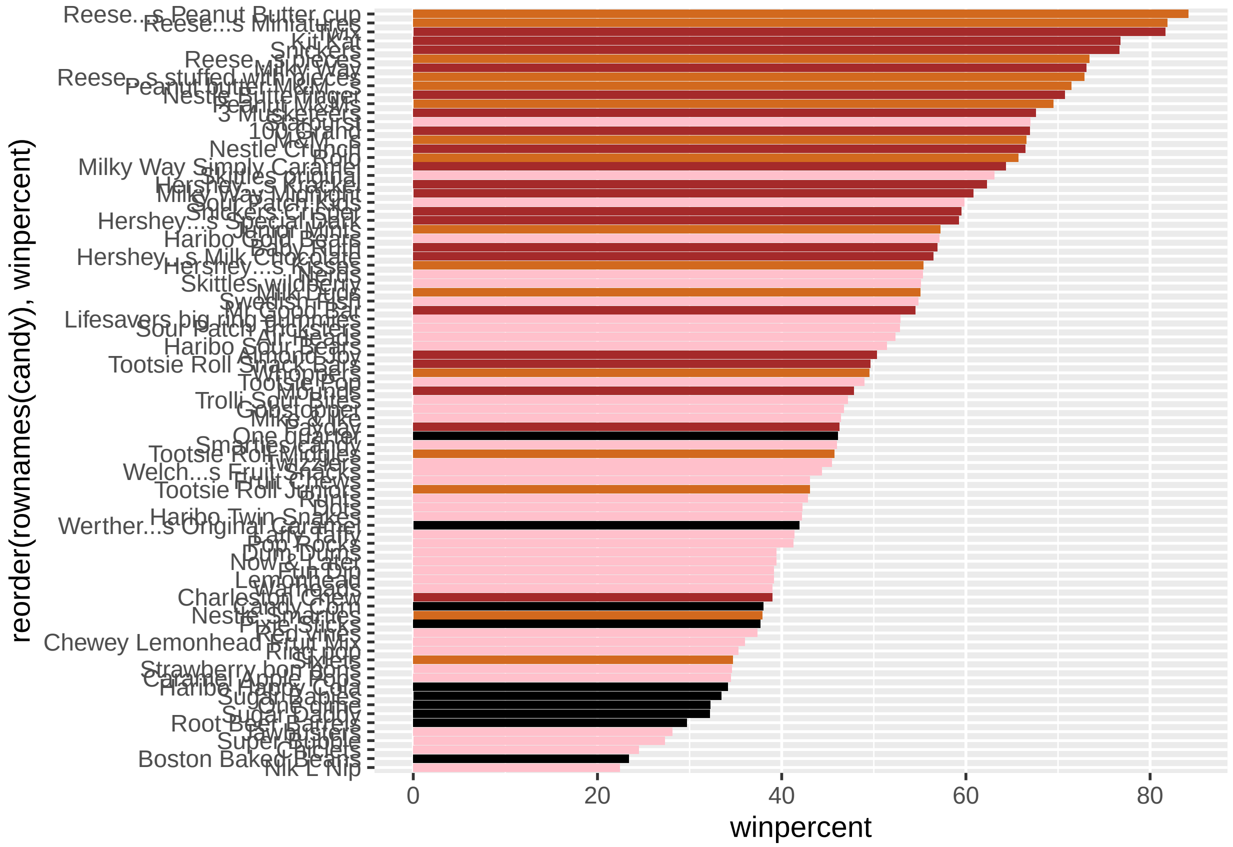
```
library(ggplot2)

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



Time to add some useful 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"
```

```
library(ggplot2)

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



Now, for the first time, using this plot we can answer questions like: > Q17. What is the worst ranked chocolate candy?

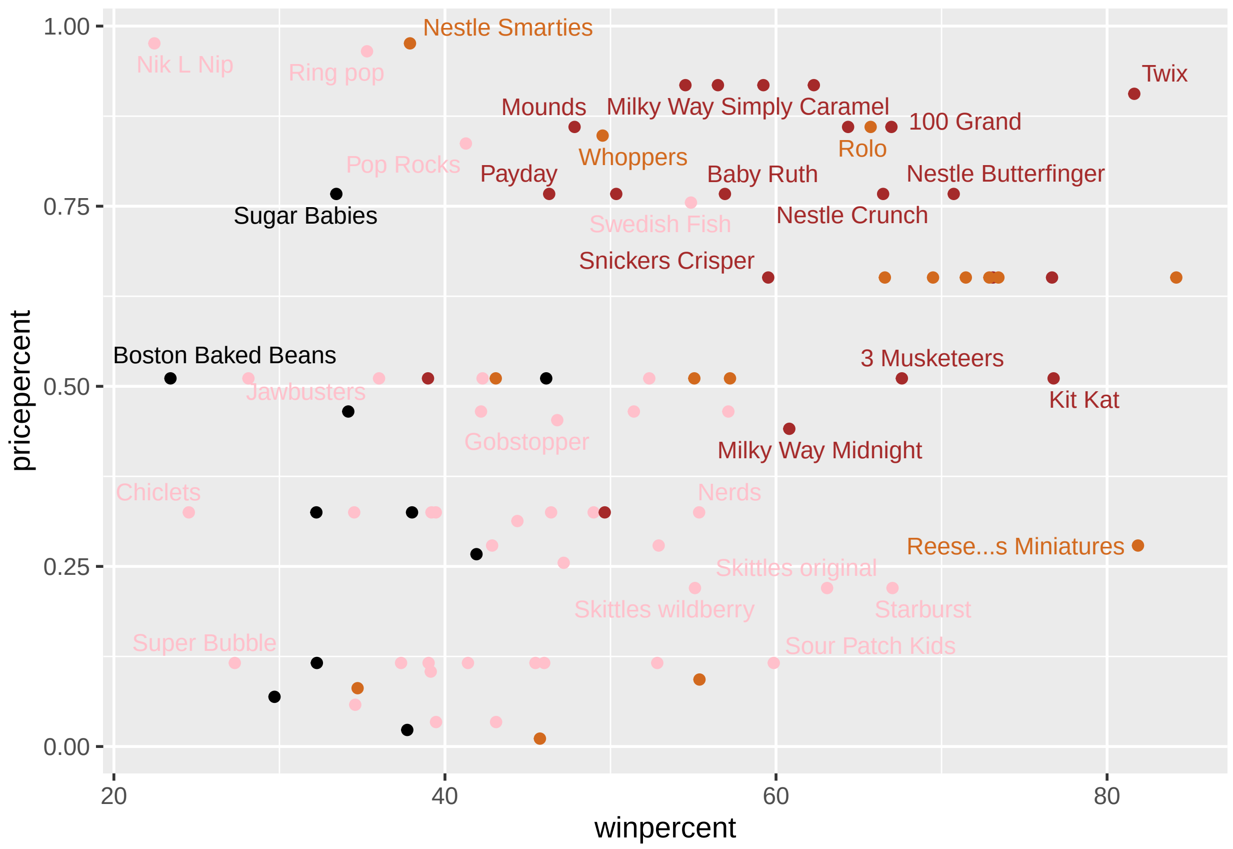
Reeses Peanut Buttercup

> Q18. What is the best ranked fruity candy?

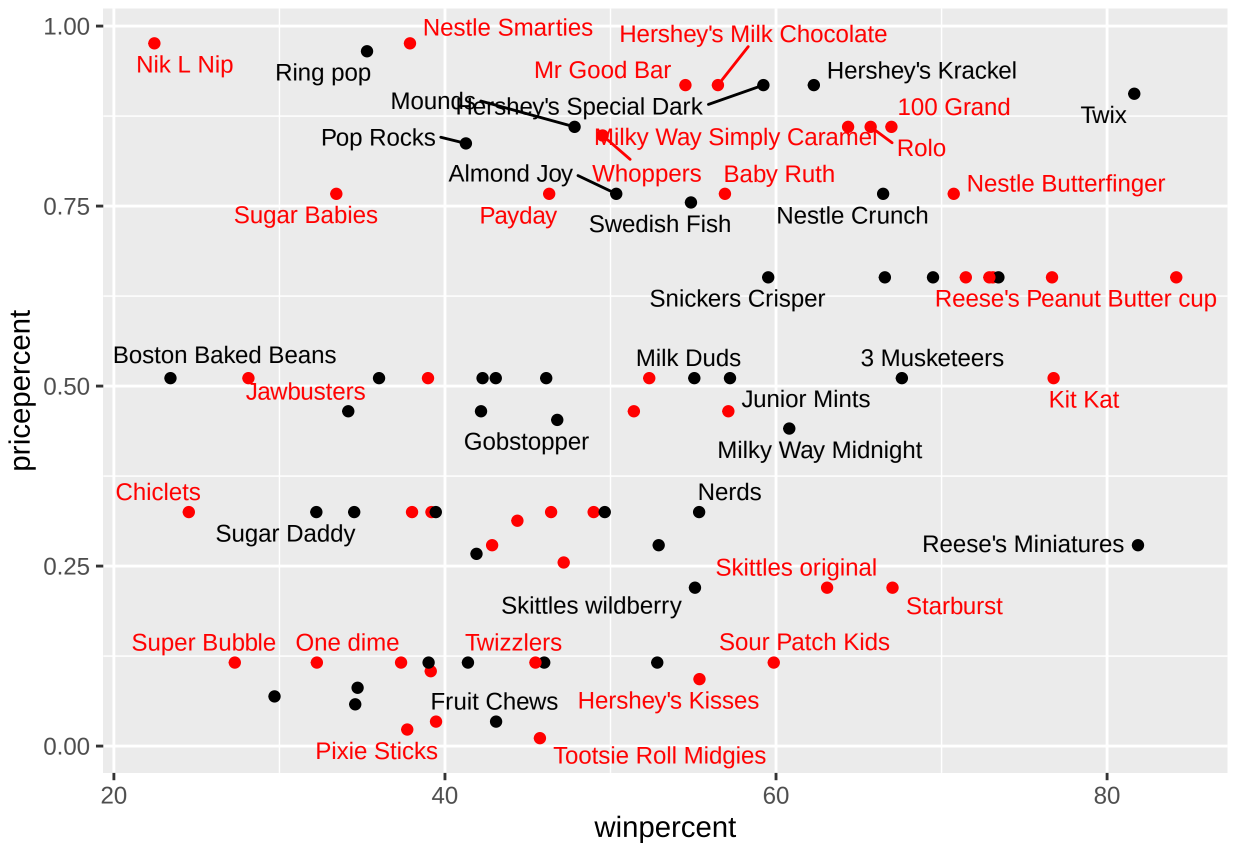
Starburst

4. Taking a look at pricepercent

```
library(ggrepel)

# How about a plot of price vs win
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)
```



```
library(ggrepel)

# How about a plot of price vs win
rownames(candy)= gsub(" " , "'", row.names(candy))
my_cols <- rep(c("red", "black"), round(nrow(candy)/2))
my_cols = c(my_cols, "red")
ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols , size=3.3, max.overlaps = 7)
```



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?

It's Reese's Miniatures.

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

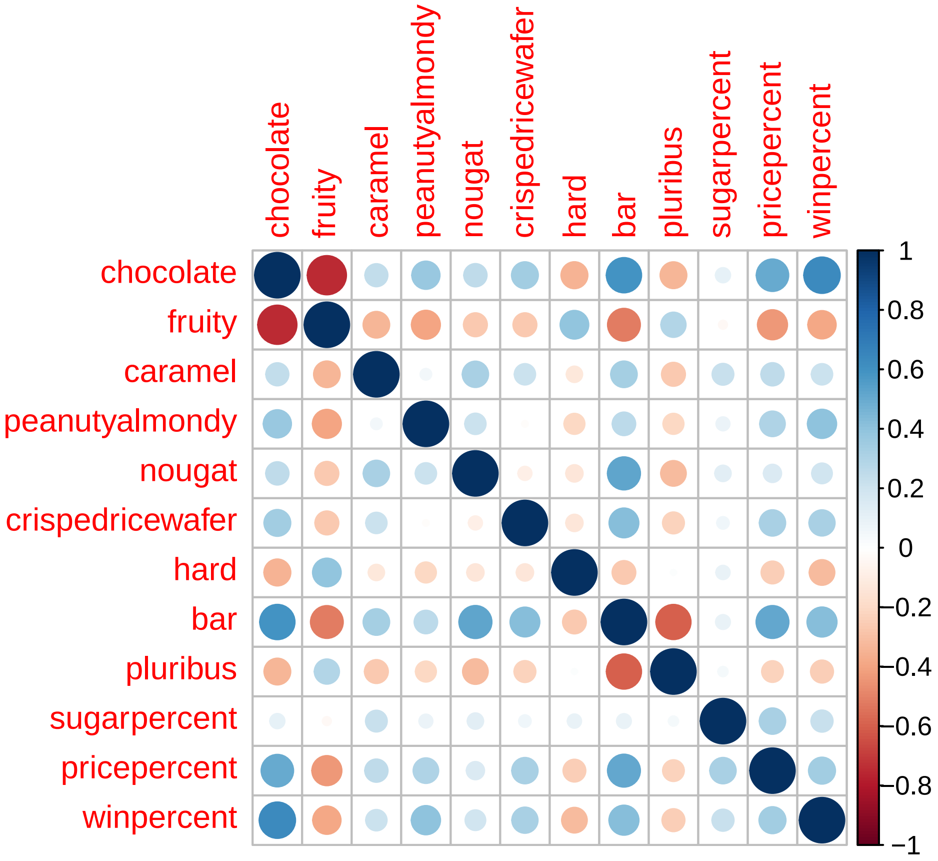
It's Hershey's Krackel.

```
rownames(candy)= gsub(" ", "'", row.names(candy))
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
```

5 Exploring the correlation structure

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



> Q22. Examining this plot what two variables are anti-correlated (i.e. have minus values)?

fruity and chocolate.

Q23. Similarly, what two variables are most positively correlated

chocolate and bar!

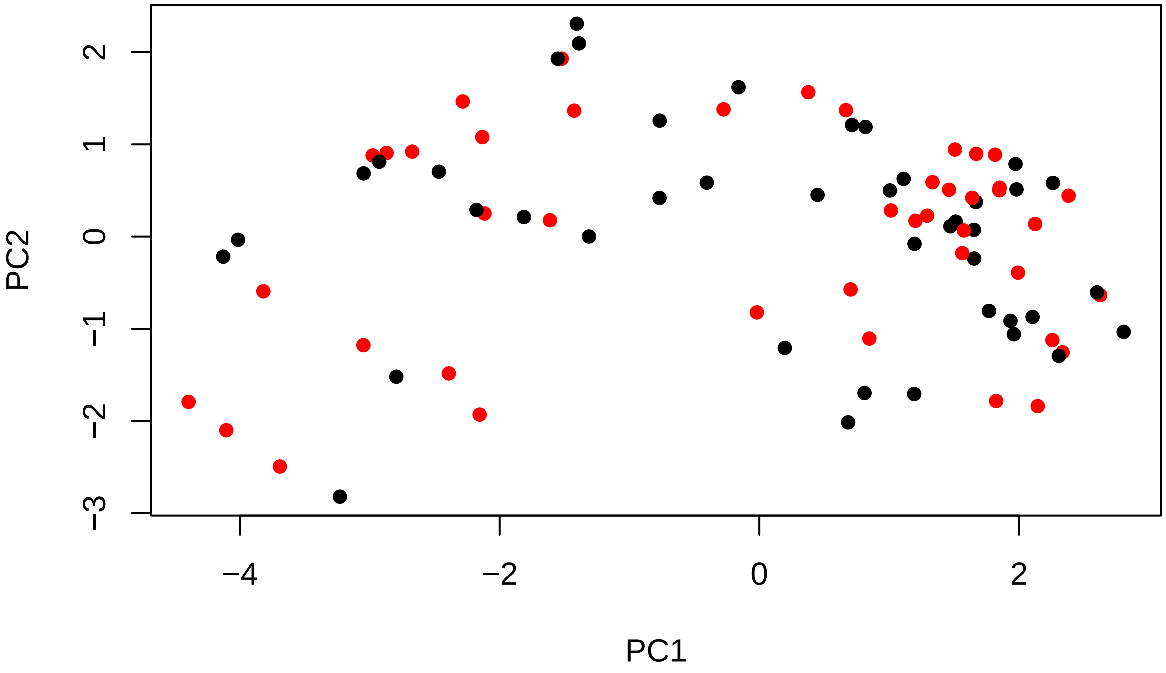
6. Principal Component Analysis

```
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
```

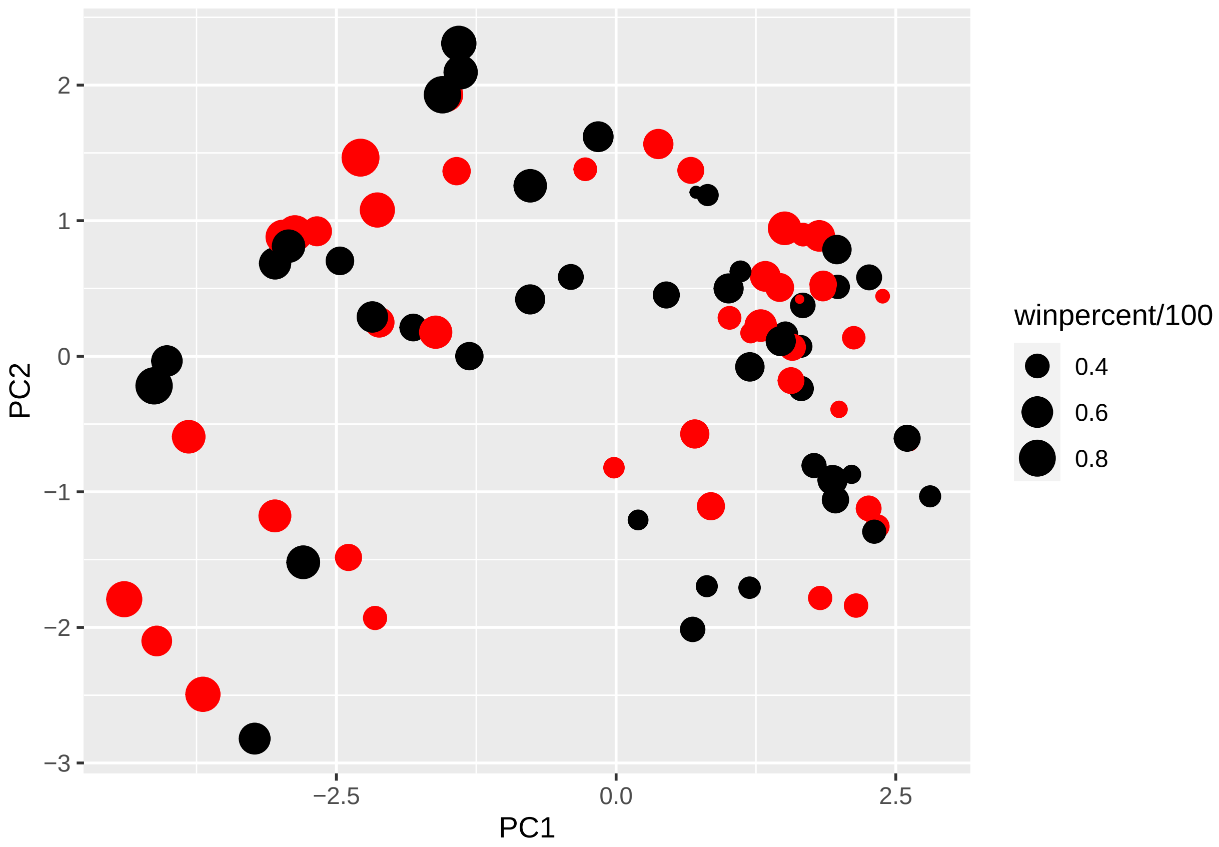
Now we can plot our main PCA score plot of PC1 vs PC2.

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

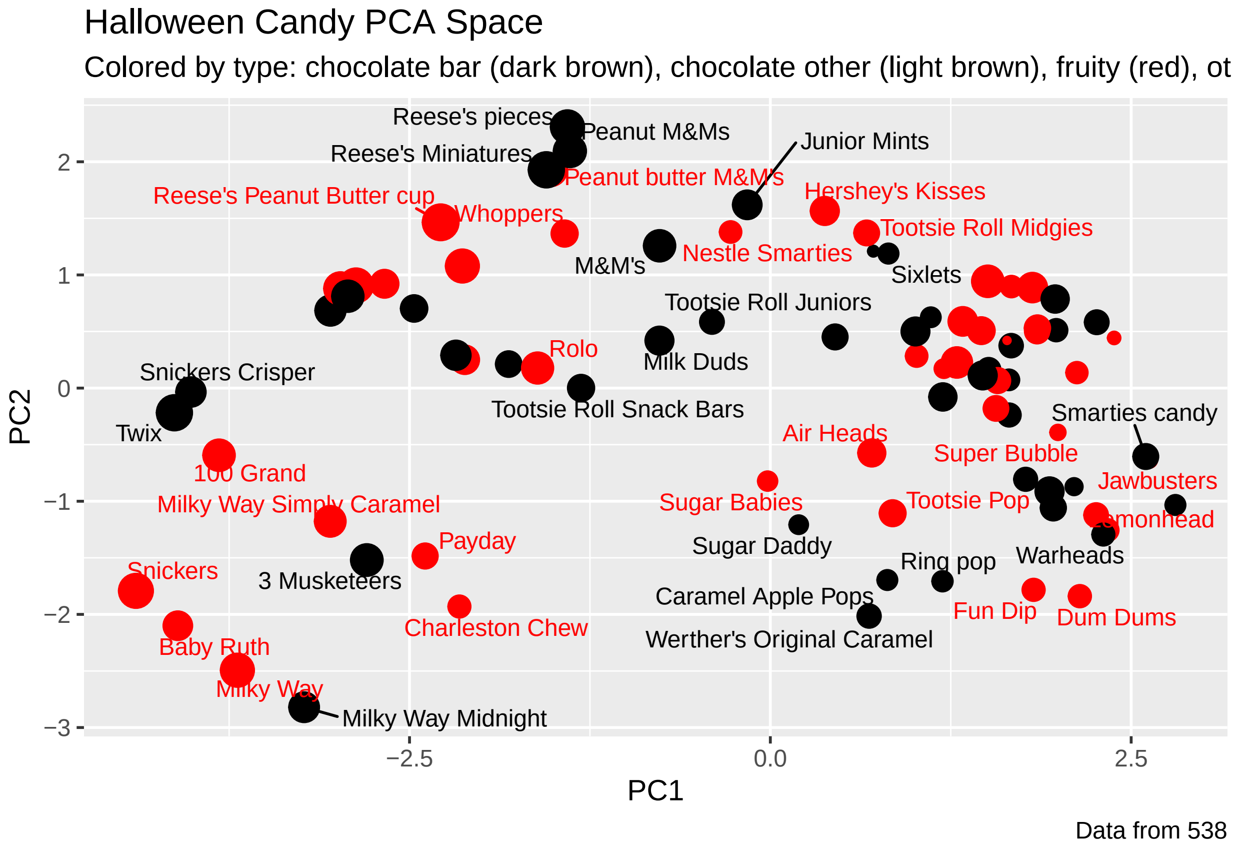


Make a new data-frame with our PCA results and candy data

```
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
```



```
library(ggrepel)

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), fruity (red
       caption="Data from 538")
```

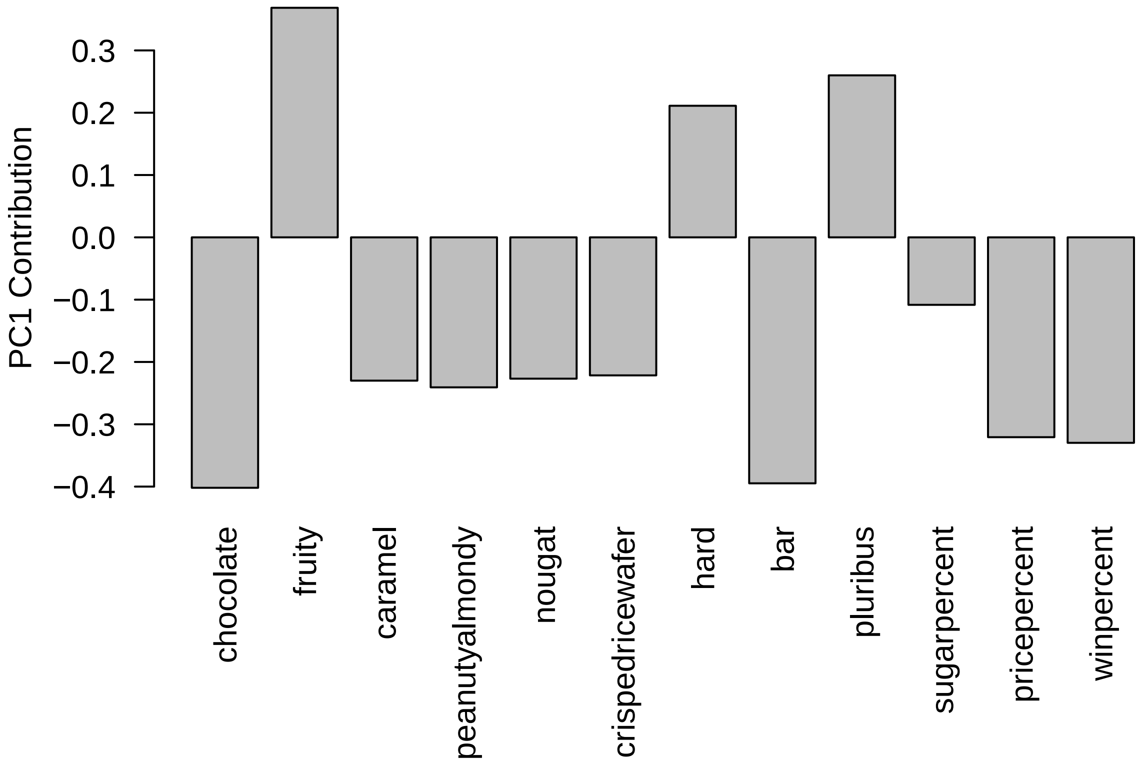


```
# library(plotly)
# ggplotly(p)
```

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

"Fruity"! Yes, that makes sense since it never taste both like candy and chocolate:)

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


PC1 Contribution
0.3
0.2
0.1
0.0
−0.1
−0.2
−0.3
−0.4
chocolate
fruity
caramel
peanutyalmondy
nougat
crispedricewafer
hard
bar
pluribus
sugarpercent
pricepercent
winpercent