Class10

Liz

Background

In this mini project we will examine 538 Halloween Candy data.

What is your favorite candy? What is nougat anyways? And how do you say it in America?

I like Jolly-ranchers. I don't know what nougat is. Never heard of it. In america it means nut bread.

```
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
```

```
nrow(candy)
```

```
[1] 85
```

```
sum(candy$fruity=="1")
```

```
[1] 38
```

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

```
[1] 81.64291
```

```
rownames(candy)
```

```
 [1] "100 Grand"                   "3 Musketeers"
 [3] "One dime"                    "One quarter"
 [5] "Air Heads"                   "Almond Joy"
 [7] "Baby Ruth"                   "Boston Baked Beans"
 [9] "Candy Corn"                  "Caramel Apple Pops"
[11] "Charleston Chew"             "Chewey Lemonhead Fruit Mix"
[13] "Chiclets"                    "Dots"
[15] "Dum Dums"                    "Fruit Chews"
[17] "Fun Dip"                     "Gobstopper"
[19] "Haribo Gold Bears"           "Haribo Happy Cola"
[21] "Haribo Sour Bears"           "Haribo Twin Snakes"
[23] "HersheyÕs Kisses"            "HersheyÕs Krackel"
[25] "HersheyÕs Milk Chocolate"    "HersheyÕs Special Dark"
[27] "Jawbusters"                  "Junior Mints"
[29] "Kit Kat"                     "Laffy Taffy"
[31] "Lemonhead"                   "Lifesavers big ring gummies"
[33] "Peanut butter M&MÕs"         "M&MÕs"
[35] "Mike & Ike"                  "Milk Duds"
[37] "Milky Way"                   "Milky Way Midnight"
[39] "Milky Way Simply Caramel"    "Mounds"
[41] "Mr Good Bar"                 "Nerds"
[43] "Nestle Butterfinger"         "Nestle Crunch"
[45] "Nik L Nip"                   "Now & Later"
[47] "Payday"                      "Peanut M&Ms"
[49] "Pixie Sticks"                "Pop Rocks"
[51] "Red vines"                   "ReeseÕs Miniatures"
[53] "ReeseÕs Peanut Butter cup"   "ReeseÕs pieces"
[55] "ReeseÕs stuffed with pieces" "Ring pop"
[57] "Rolo"                        "Root Beer Barrels"
```

```
[59] "Runts"                       "Sixlets"
[61] "Skittles original"           "Skittles wildberry"
[63] "Nestle Smarties"             "Smarties candy"
[65] "Snickers"                    "Snickers Crisper"
[67] "Sour Patch Kids"             "Sour Patch Tricksters"
[69] "Starburst"                   "Strawberry bon bons"
[71] "Sugar Babies"                "Sugar Daddy"
[73] "Super Bubble"                "Swedish Fish"
[75] "Tootsie Pop"                 "Tootsie Roll Juniors"
[77] "Tootsie Roll Midgies"        "Tootsie Roll Snack Bars"
[79] "Trolli Sour Bites"           "Twix"
[81] "Twizzlers"                   "Warheads"
[83] "WelchÕs Fruit Snacks"        "WertherÕs Original Caramel"
[85] "Whoppers"
```

```
candy["Air Heads", ]$winpercent
```

```
[1] 52.34146
```

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

```
[1] 76.7686
```

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

```
[1] 49.6535
```

```
candy["Sugar Daddy", ]$winpercent
```

```
[1] 32.231
```

```
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	

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

Table 3: Data summary

Name	candy
Number of rows	85
Number of columns	12
Column type frequency:	
numeric	12
Group variables	None

Variable type: numeric

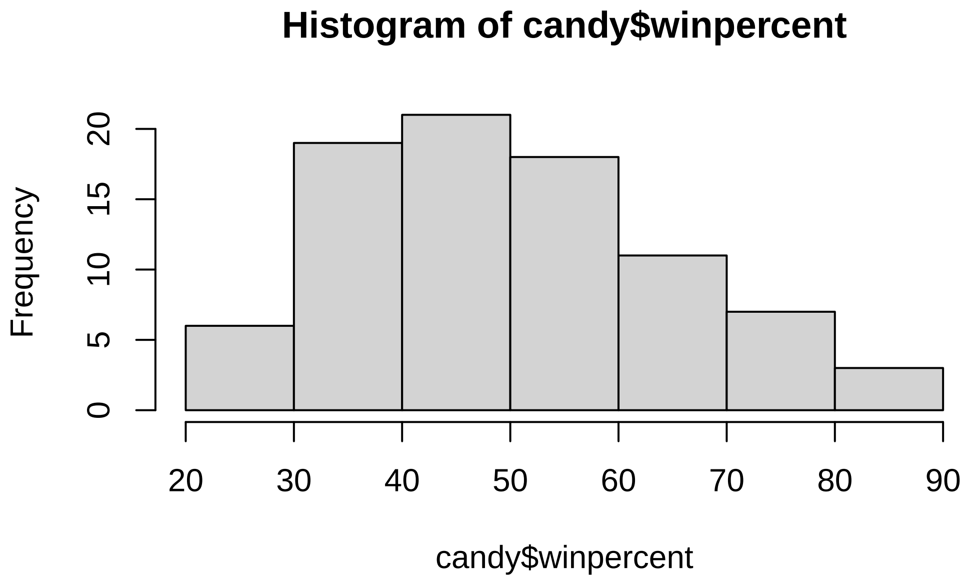
skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
chocolate	0	1	0.44	0.50	0.00	0.00	0.00	1.00	1.00	
fruity	0	1	0.45	0.50	0.00	0.00	0.00	1.00	1.00	
caramel	0	1	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
peanutyalmondy	0	1	0.16	0.37	0.00	0.00	0.00	0.00	1.00	
nougat	0	1	0.08	0.28	0.00	0.00	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?

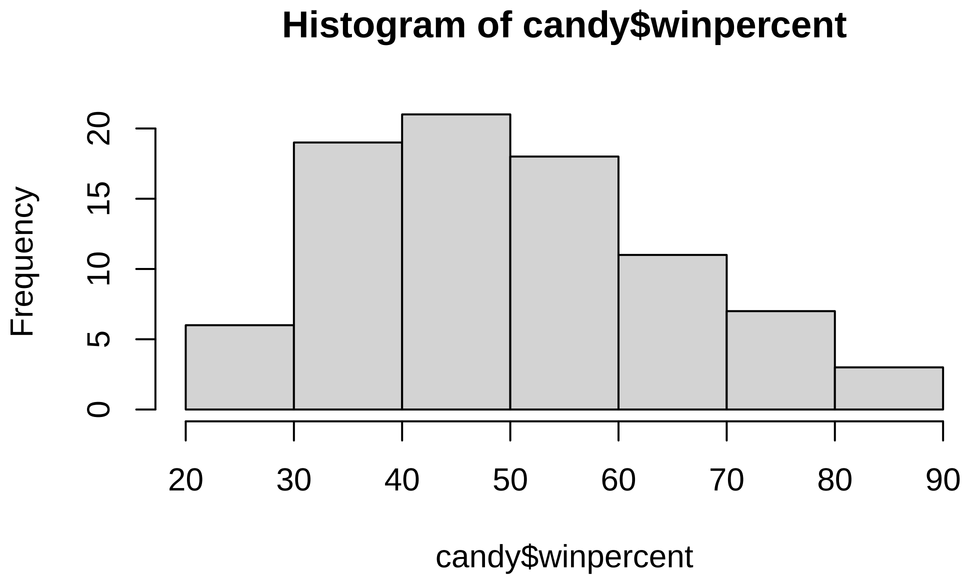
Yes the win percent

> Q8. Plot a histogram of winpercent values

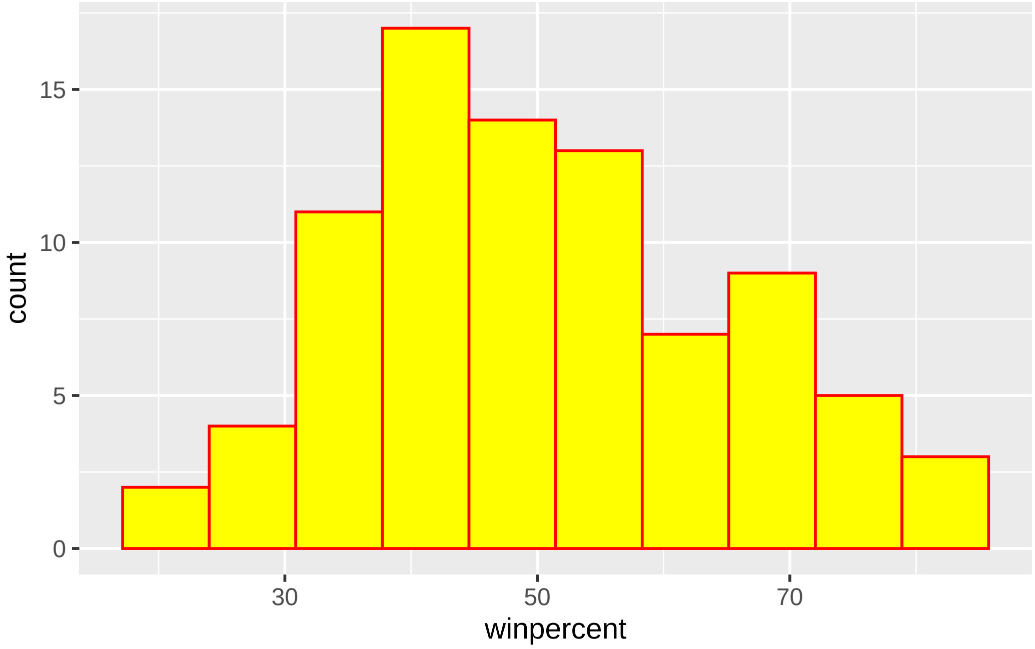
```
hist(candy$winpercent)
```



```r
hist(candy$winpercent, breaks = 7)
```



```
library(ggplot2)
ggplot(candy)+
  aes(winpercent)+
  geom_histogram(bins=10, col="red", fill="yellow")
```



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

```
[1] 60.92153
```

And for fruit candy…

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

```
[1] 44.11974
```

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

```

	Welch Two Sample t-test

data:  chocolate.win and fruit.win
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 
```

```r
x <- c(5, 1, 2, 6)
sort(x, decreasing = T)
```

```
[1] 6 5 2 1
```

```r
x[ order(x) ]
```

```
[1] 1 2 5 6
```

```r
y <- c("barry", "alice", "chandra")
y
```

```
[1] "barry"   "alice"   "chandra"
```

```r
sort(y)
```

```
[1] "alice"   "barry"   "chandra"
```

```r
order(y)
```

```
[1] 2 1 3
```

```r
order(candy$winpercent)
```

```
 [1] 45  8 13 73 27 58 72  3 71 20 10 70 60 56 12 51 49 63  9 11 82 31 17 46 15
[26] 50 30 84 22 14 59 76 16 83 81 77 64  4 47 35 18 79 40 75 85 78  6 21  5 68
[51] 32 41 74 36 62 42 23 25  7 19 28 26 66 67 38 24 61 39 57 44 34  1 69  2 48
[76] 43 33 55 37 54 65 29 80 52 53
```

First we want to order/arrange the whole database winpercent values

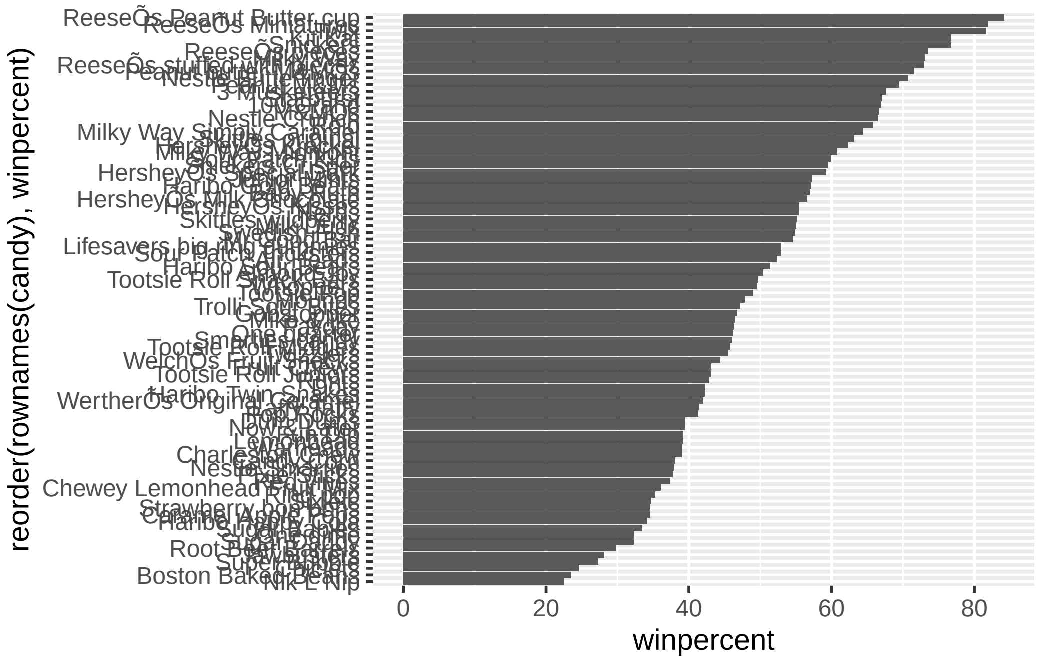
```r
inds <- order(candy$winpercent)
head(candy[inds, ], n=5)
```

```
                   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
```

#barplot

The default barplot, made with `geom_col()`

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



```
ggsave("mybarplot.png")
```

```
Saving 5.5 x 3.5 in image
```

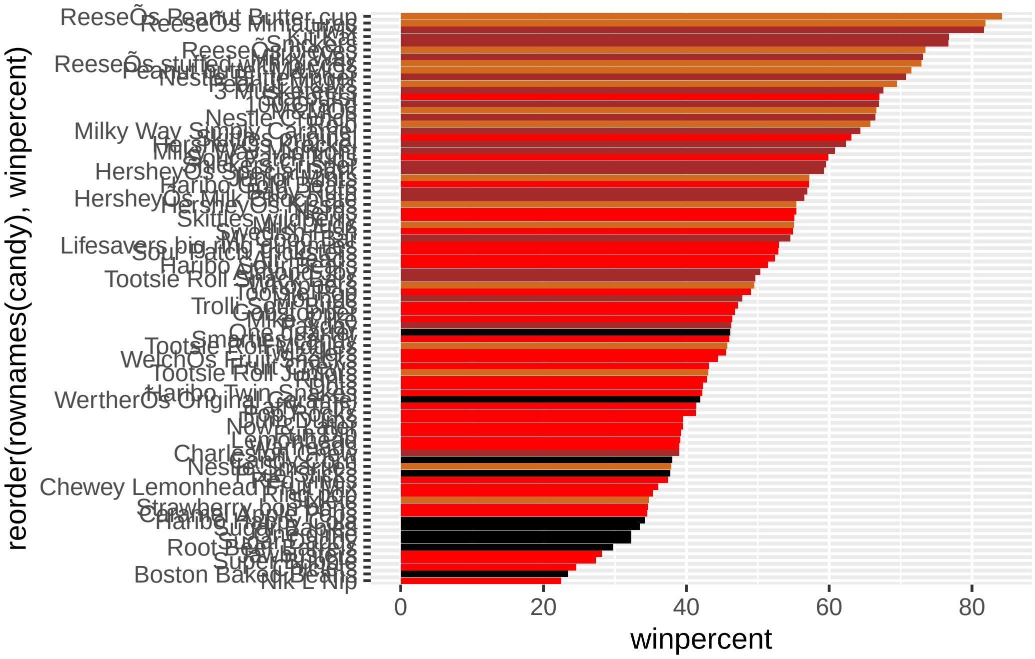
```
my_cols <- rep("black", nrow(candy))
my_cols[as.logical(candy$chocolate)] <- "chocolate"
my_cols[as.logical(candy$bar)] <- "brown"
my_cols[as.logical(candy$fruity)] <- "red"
my_cols
```

```
 [1] "brown"     "brown"     "black"     "black"     "red"       "brown"    
 [7] "brown"     "black"     "black"     "red"       "brown"     "red"      
[13] "red"       "red"       "red"       "red"       "red"       "red"      
[19] "red"       "black"     "red"       "red"       "chocolate" "brown"    
[25] "brown"     "brown"     "red"       "chocolate" "brown"     "red"      
[31] "red"       "red"       "chocolate" "chocolate" "red"       "chocolate"
[37] "brown"     "brown"     "brown"     "brown"     "brown"     "red"      
[43] "brown"     "brown"     "red"       "red"       "brown"     "chocolate"
[49] "black"     "red"       "red"       "chocolate" "chocolate" "chocolate"
[55] "chocolate" "red"       "chocolate" "black"     "red"       "chocolate"
```

```
[61] "red"       "red"       "chocolate" "red"       "brown"     "brown"
[67] "red"       "red"       "red"       "red"       "black"     "black"
[73] "red"       "red"       "red"       "chocolate" "chocolate" "brown"
[79] "red"       "brown"     "red"       "red"       "red"       "black"
[85] "chocolate"
```

Now I can use this vector to color up my bars

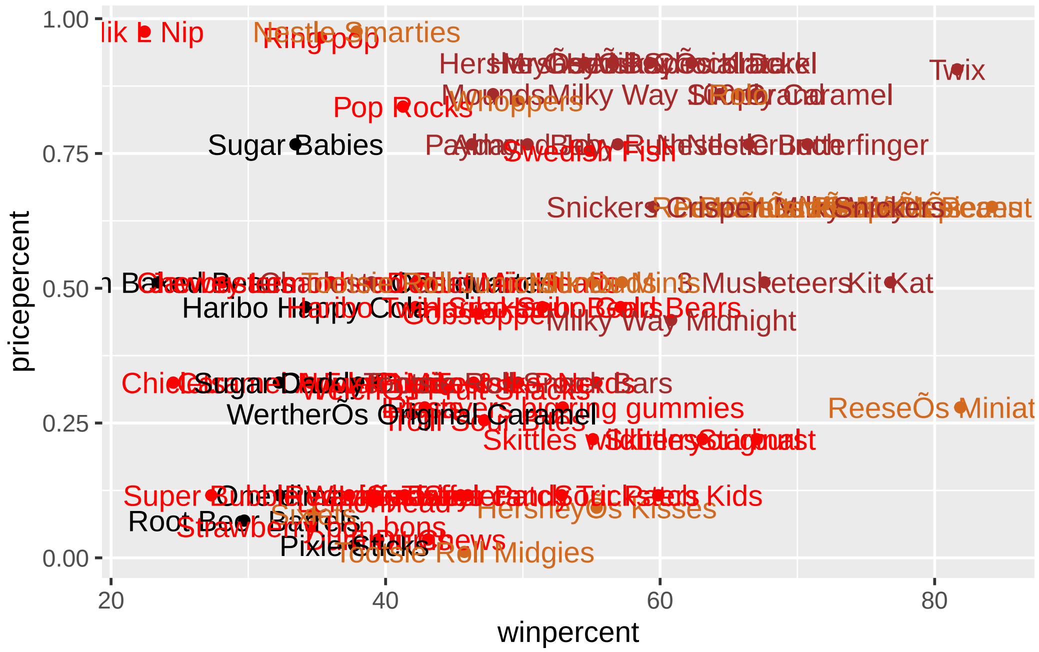
```
ggplot(candy) +
  aes(winpercent, reorder(rownames(candy), winpercent)) +
  geom_col(fill = my_cols)
```



#4. Taking a look at pricepercentage

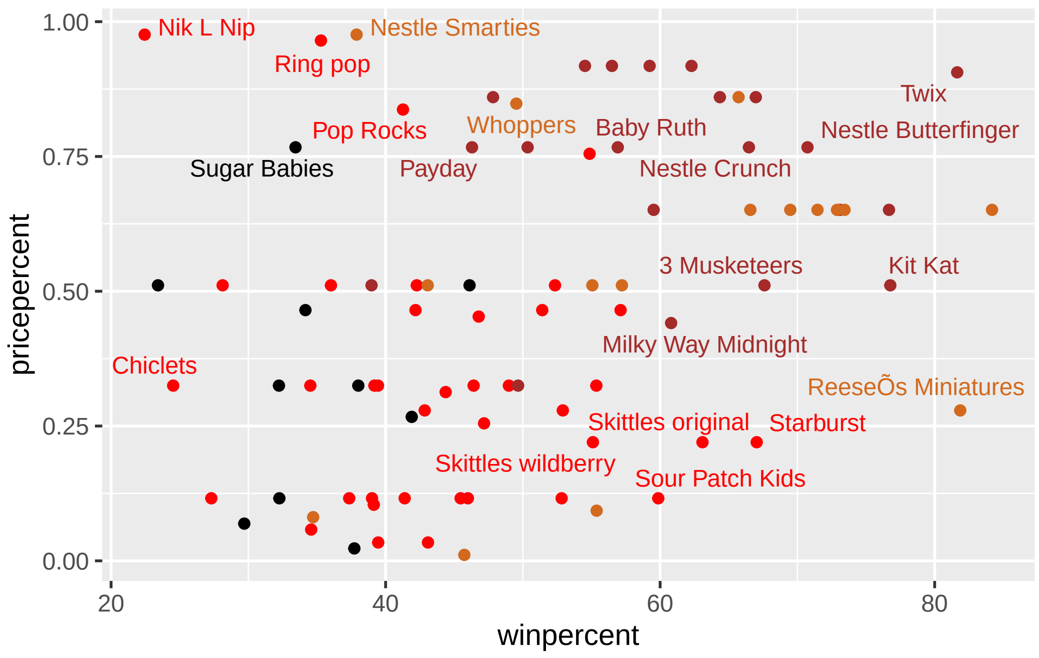
What about value for money? What is the best candy for the least money?

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



```r
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)
```

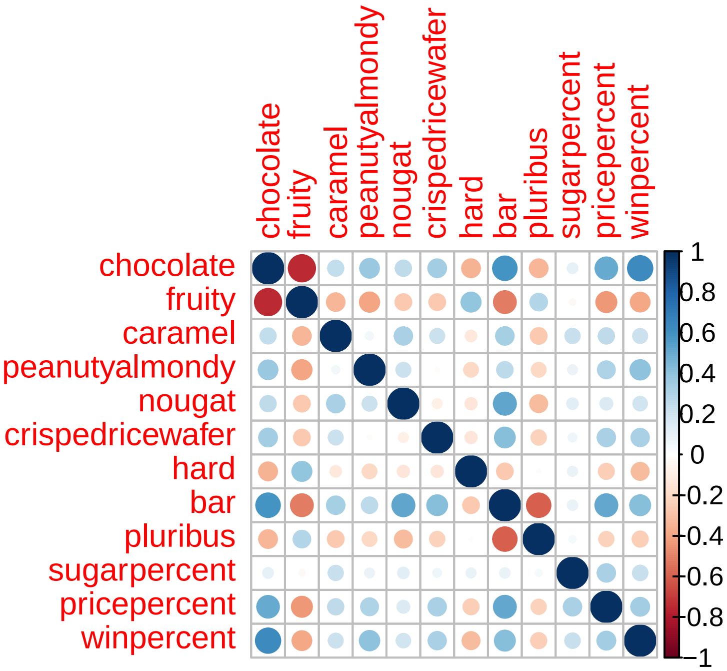
```
Warning: ggrepel: 65 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```



```
library(corrplot)
```

```
corrplot 0.92 loaded
```

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



#PCA: Principal Component Analysis

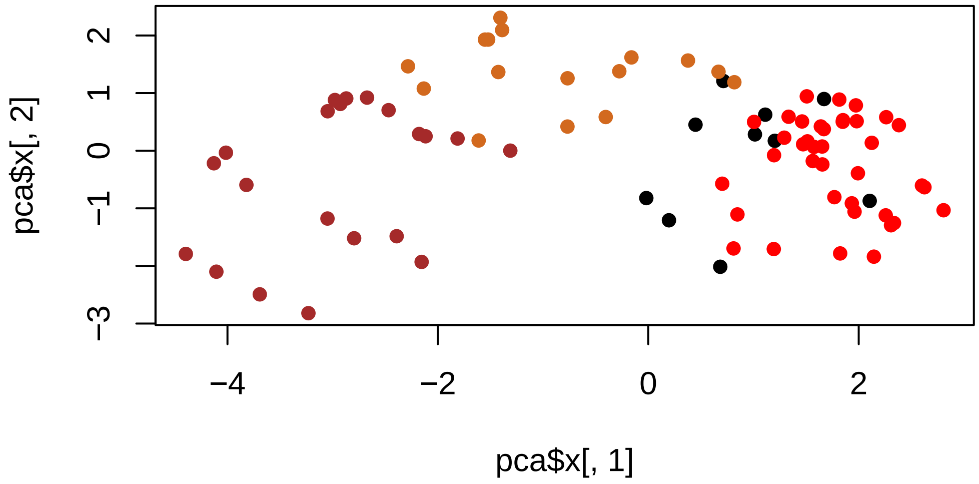
The main function that always there for us `pcomp`. It has an important argument that is set to `scale=FALSE`

```
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
```

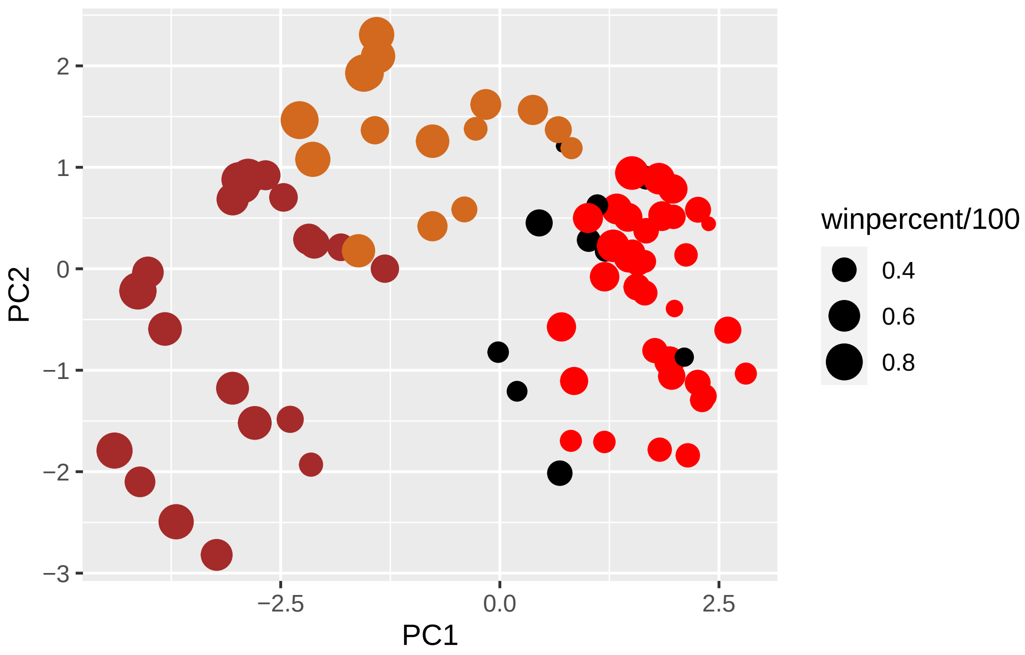
My PCA plot (a.k.a) PC1 vs PC2 score plot.

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



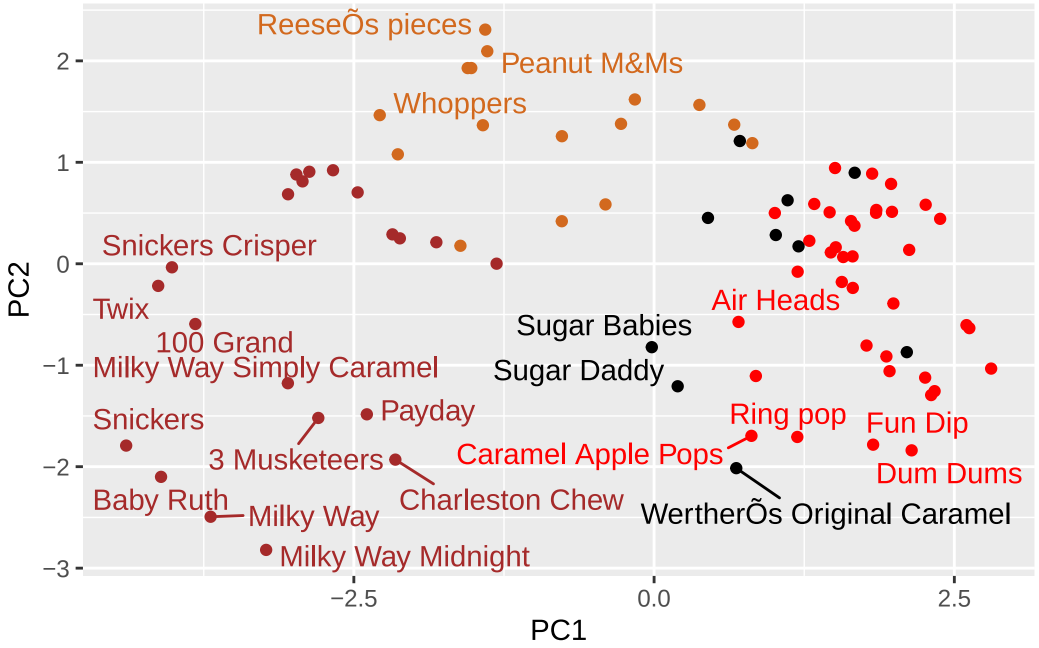
```
my_data <- cbind(candy, pca$x[, 1:3])
```

```
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
```

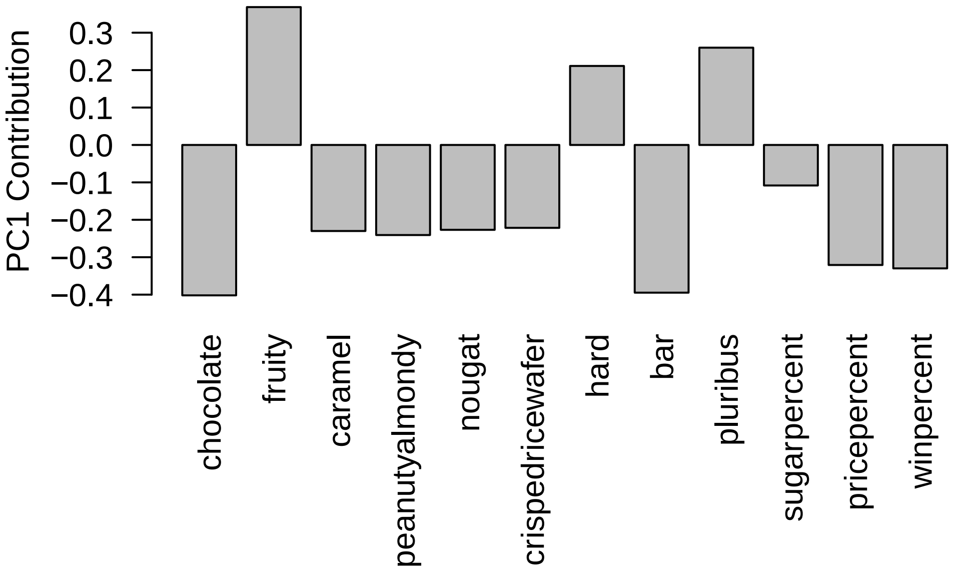


```
p <- ggplot(my_data) +
    aes(x=PC1, y=PC2, label=row.names(my_data)) +
  geom_point(col= my_cols) +
geom_text_repel(col=my_cols, max.overlaps =7)

p
```

```
Warning: ggrepel: 63 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```



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


PC1 Contribution
chocolate
fruity
caramel
peanutyalmondy
nougat
crispedricewafer
hard
bar
pluribus
sugarpercent
pricepercent
winpercent