class09miniproj

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bg

ggplot , stats, corr analysis, principal component analysis ##data import csv from 538

```
candy_file <- read.csv(url("https://raw.githubusercontent.com/fivethirtyeight/data/master/can

candy = data.frame(candy_file, row.names="competitorname")
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
```

exploratory nalyss

q1 85 rows

```
nrow(candy)
```

```
[1] 85
```

q2 38

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

```
[1] 38
```

```
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 |>
  filter(row.names(candy)=="Twix") |>
  select(winpercent)
```

```
     winpercent
Twix   81.64291
```

q3 49.52411

```
candy |>
  filter(row.names(candy)=="Whoppers") |>
  select(winpercent)
```

```
         winpercent
Whoppers   49.52411
```

q4 76.77

```r
candy |>
  filter(row.names(candy)=="Kit Kat") |>
  select(winpercent)
```

```
        winpercent
Kit Kat    76.7686
```

q5 49.6535

```r
candy |>
  filter(row.names(candy)=="Tootsie Roll Snack Bars") |>
  select(winpercent)
```

```
                        winpercent
Tootsie Roll Snack Bars    49.6535
```

```r
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	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
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	

```
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	

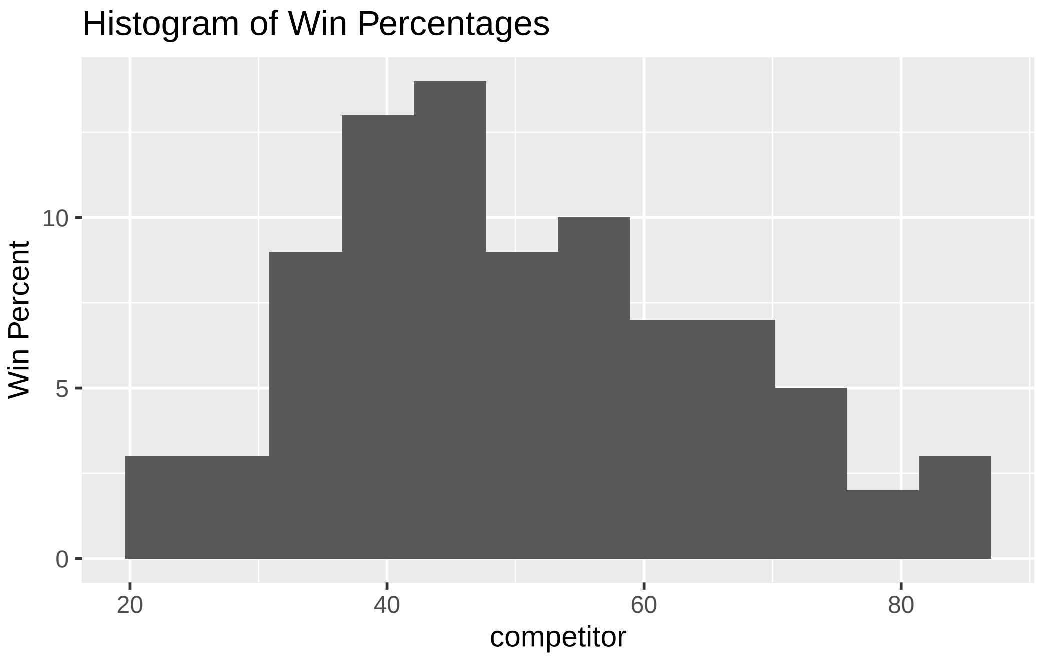
skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
pluribus	0	1	0.52	0.50	0.00	0.00	1.00	1.00	1.00	
sugarpercent	0	1	0.48	0.28	0.01	0.22	0.47	0.73	0.99	
pricepercent	0	1	0.47	0.29	0.01	0.26	0.47	0.65	0.98	
winpercent	0	1	50.32	14.71	22.45	39.14	47.83	59.86	84.18	

q6: last column, winpercent, mean i s 50.3

q7 `candy$chocolate` 1 means it has chocolate (true)

q8

```
library(ggplot2)

ggplot(candy, aes(winpercent)) +
  geom_histogram(bins = 12) +
  labs(title = "Histogram of Win Percentages",
       x = "competitor",
       y = "Win Percent")
```



q9 dist is not symmetrical: median q10 below

```
median(candy$winpercent)
```

```
[1] 47.82975
```

q11 chocolate is higher on average than fruity

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

```
[1] 44.11974
```

```
mean(cc)
```

```
[1] 60.92153
```

q12, yes pval is very small and CI is above zero

```
t.test(cc,cf)
```

```

	Welch Two Sample t-test

data:  cc and cf
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 
```

q13 Nik L Nip Boston Baked Beans Chiclets Super Bubble Jawbusters

```
 candy |> arrange(winpercent) |> head(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
```

q 14 Snickers 1 0 1 1 1 0 0 1
Kit Kat 1 0 0 0 0 1 0 1
Twix 1 0 1 0 0 1 0 1
Reese’s Miniatures 1 0 0 1 0 0 0 0
Reese’s Peanut Butter cup

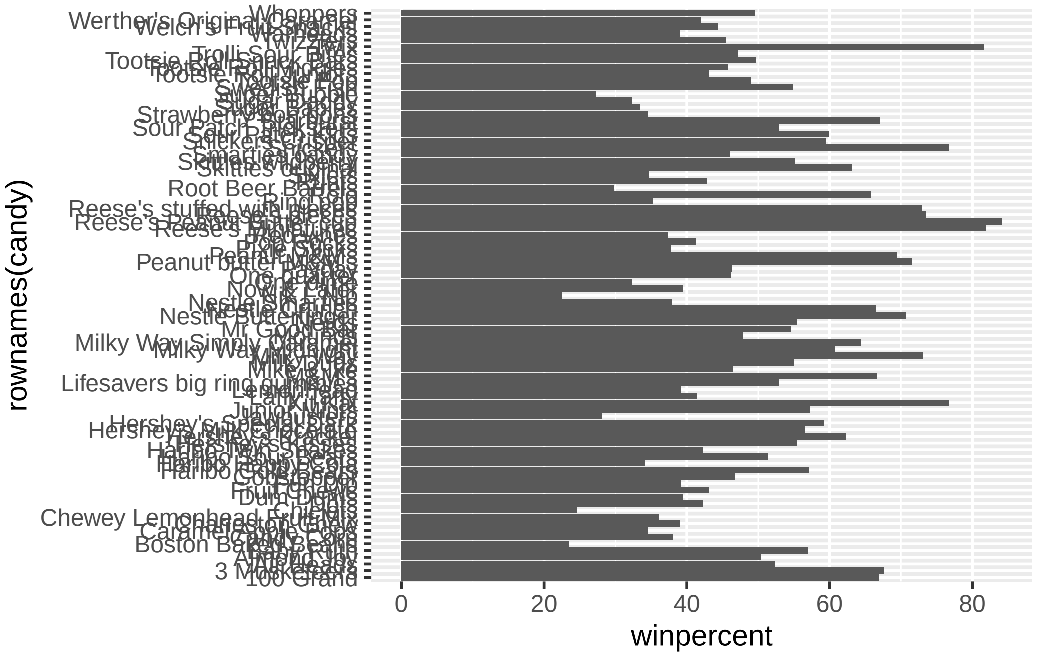
```
candy |> arrange(winpercent) |> tail(5)
```

```
                          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
```

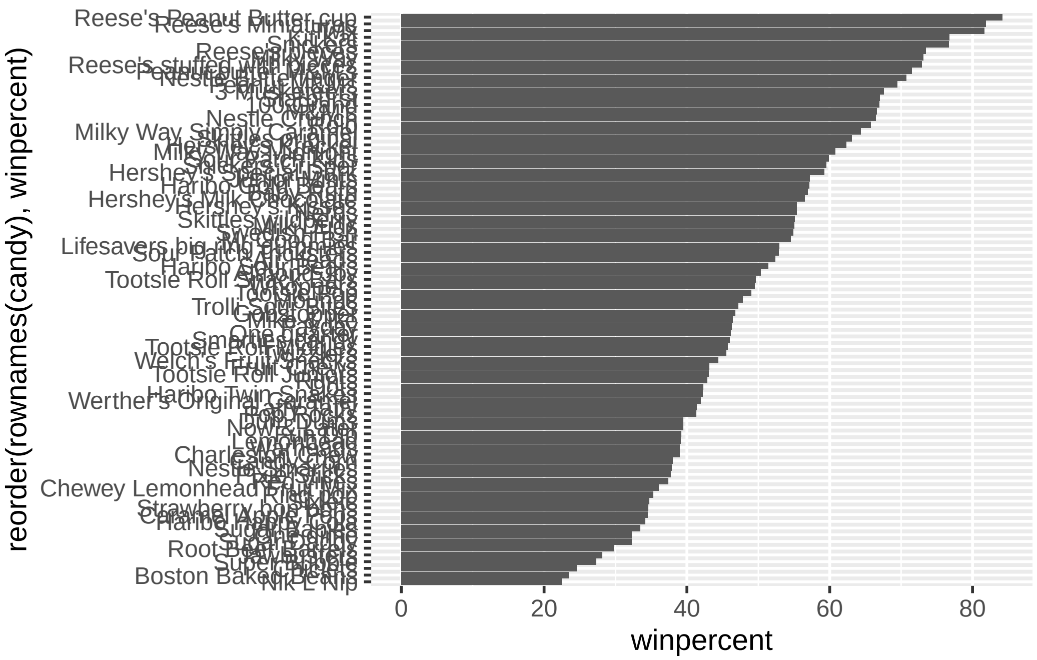
q15

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

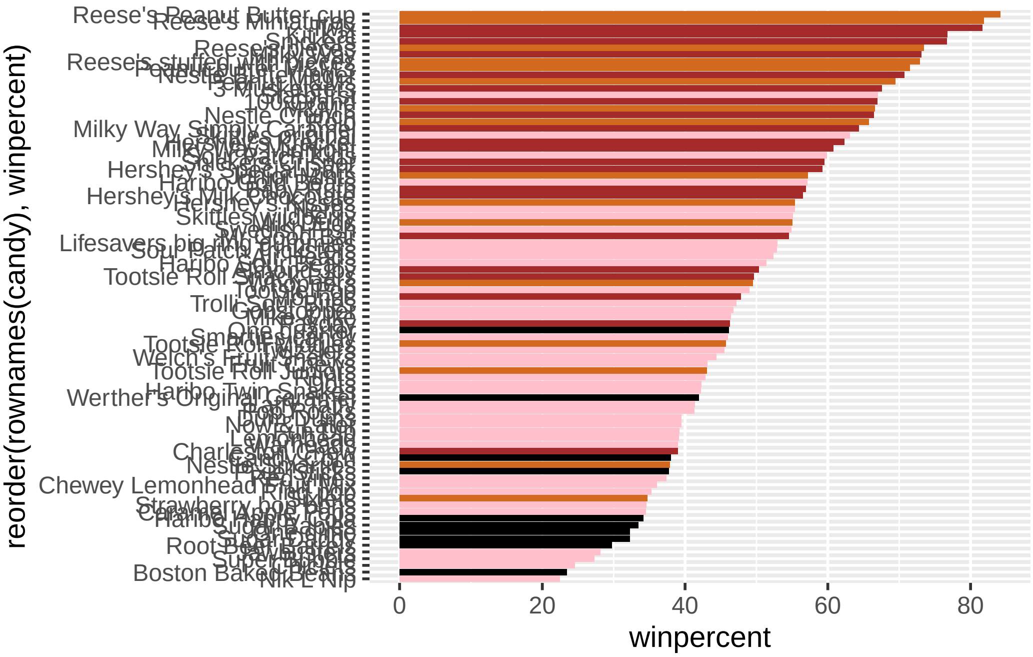


q16

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

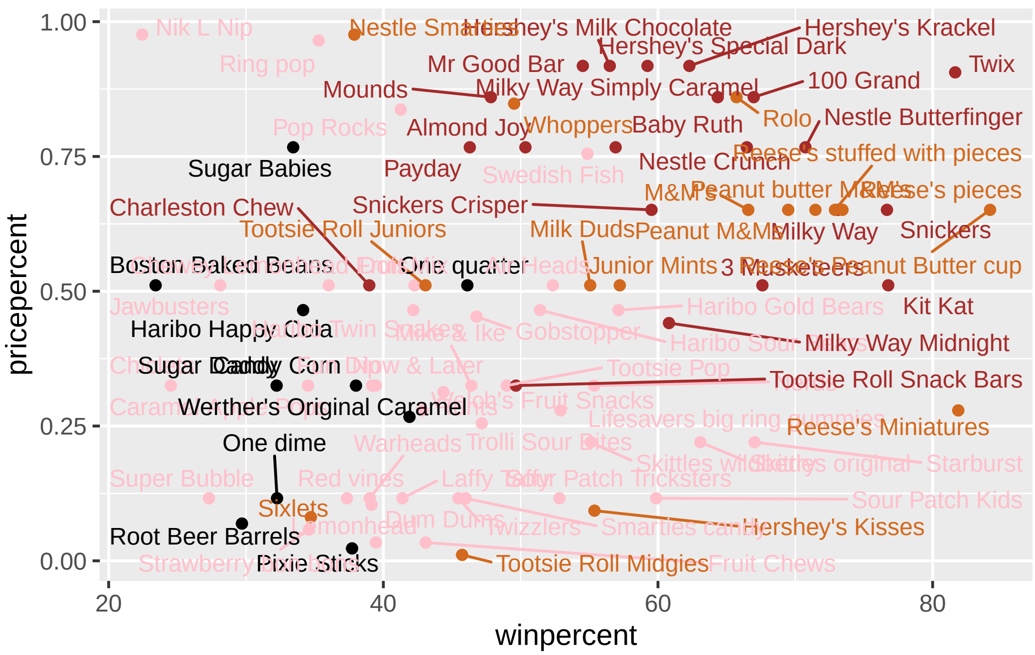


```
my_cols=rep("black", nrow(candy))
my_cols[as.logical(candy$chocolate)] = "chocolate"
my_cols[as.logical(candy$bar)] = "brown"
my_cols[as.logical(candy$fruity)] = "pink"

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



q17 sixlets q18 starburst ew!

```
library(ggrepel)

# How about a plot of win vs price
ggplot(candy) +
  aes(winpercent, pricepercent, label=rownames(candy)) +
  geom_point(col=my_cols) +
  geom_text_repel(col=my_cols, size=3.3, max.overlaps = 52)
```



q19 Tootsie Roll Midgies

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

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

q20 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

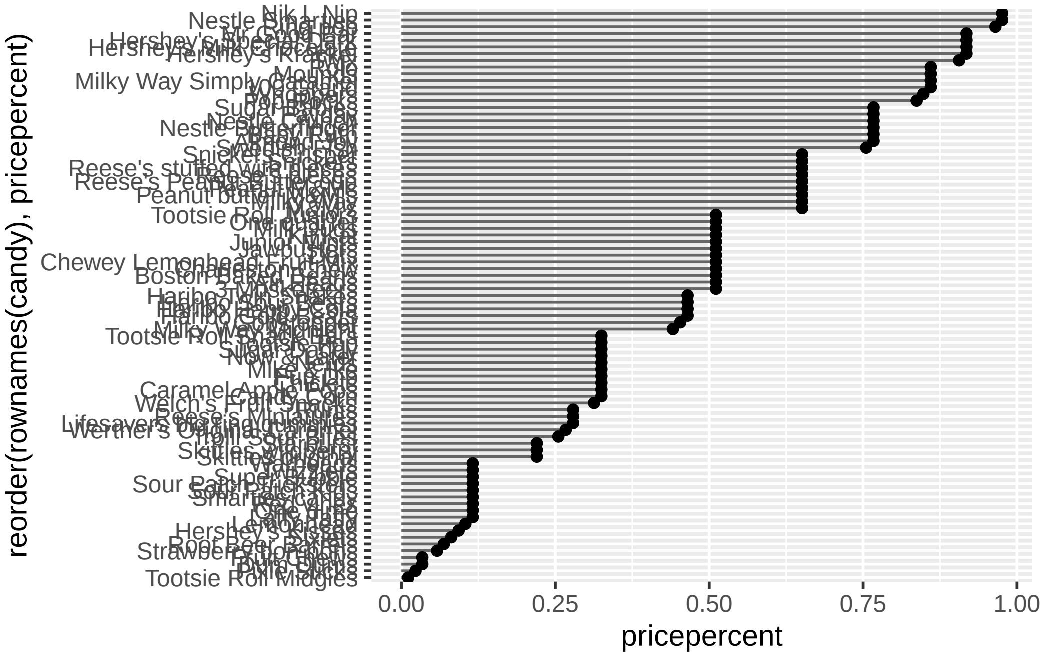
```
ord <- order(candy$pricepercent, decreasing = TRUE)
head( candy[ord,c(11,12)], n=5 )
```

```
                         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
```

q21

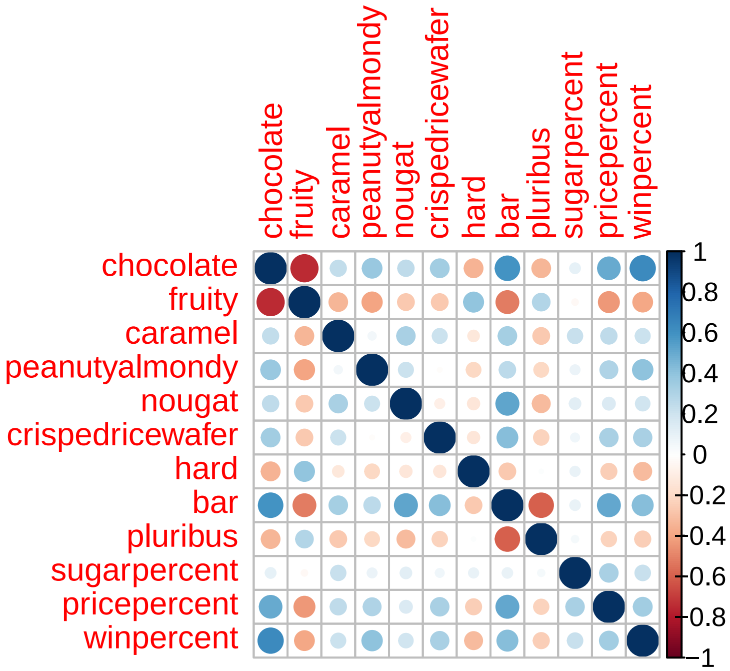
```
ggplot(candy) +
  aes(pricepercent, reorder(rownames(candy), pricepercent)) +
  geom_segment(aes(yend = reorder(rownames(candy), pricepercent),
                   xend = 0), col="gray40") +
    geom_point()
```



```
library(corrplot)
```

```
corrplot 0.95 loaded
```

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



Q22. fluribus & bar, fruity & bar, fruiy & chocolate < this one the most Q23. winpercent and chocolate or chocolate & bar

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

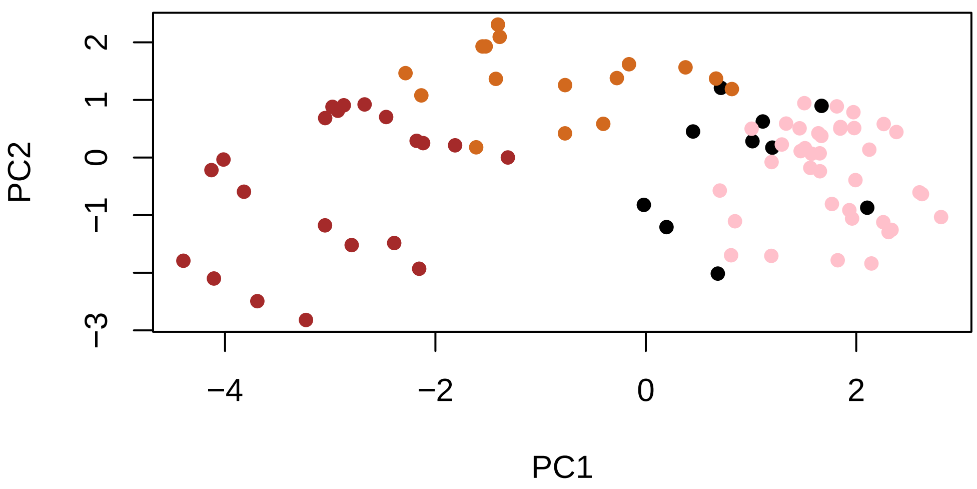
```
Importance of components:
                          PC1    PC2    PC3     PC4    PC5     PC6     PC7
Standard deviation     2.0788 1.1378 1.1092 1.07533 0.9518 0.81923 0.81530
Proportion of Variance 0.3601 0.1079 0.1025 0.09636 0.0755 0.05593 0.05539
Cumulative Proportion  0.3601 0.4680 0.5705 0.66688 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
```

```
pca$rotation[,1]
```

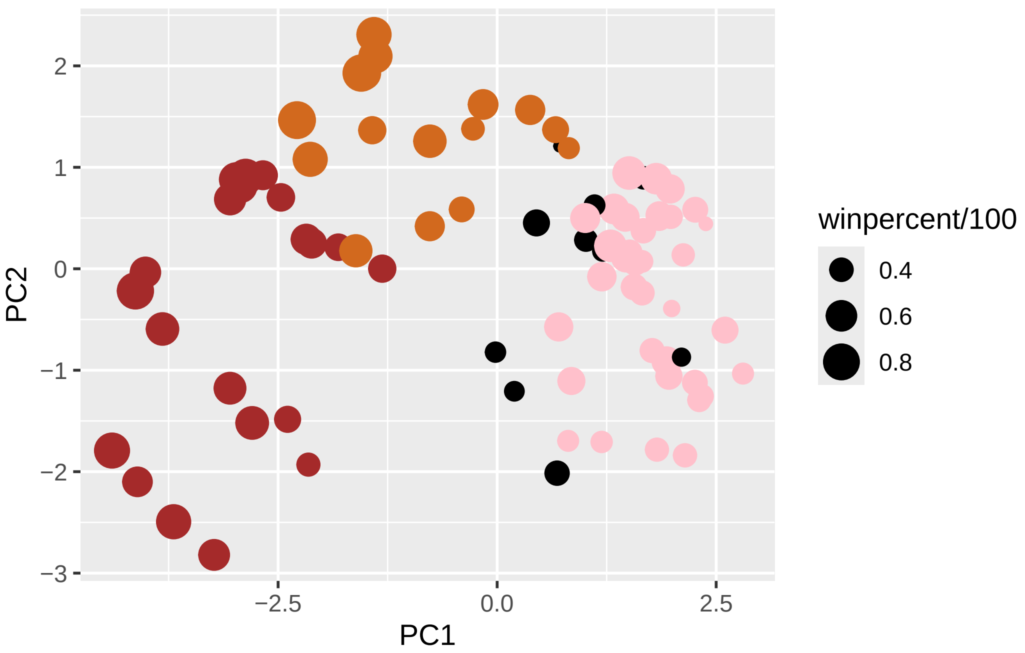
```
       chocolate           fruity          caramel   peanutyalmondy
      -0.4019466        0.3683883       -0.2299709       -0.2407155
          nougat crispedricewafer             hard              bar
      -0.2268102       -0.2215182        0.2111587       -0.3947433
```

```
   pluribus   sugarpercent   pricepercent     winpercent
  0.2600041     -0.1083088     -0.3207361     -0.3298035
```

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



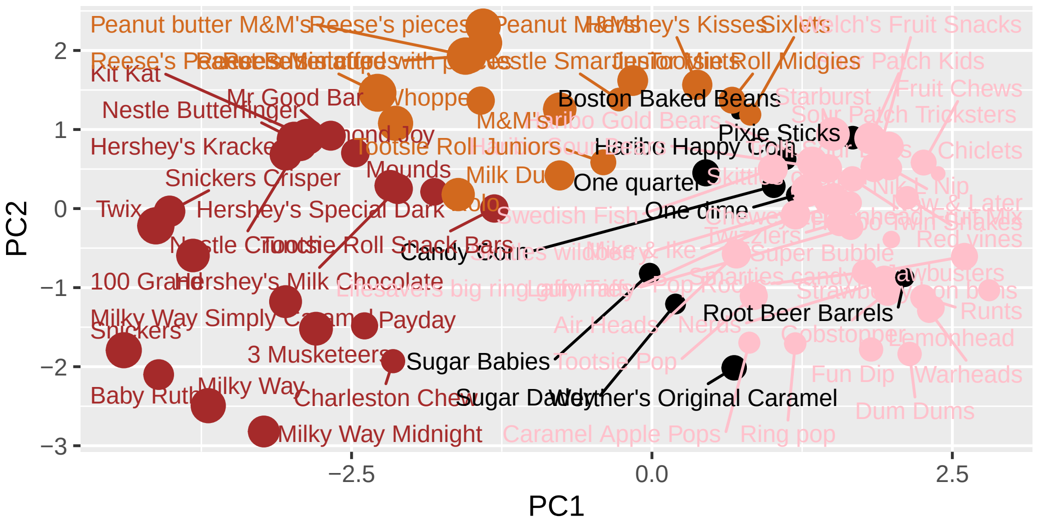
```
# new df with candy data and pca
my_data <- cbind(candy, pca$x[,1:3])

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 = 56)  +
  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")
```

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)
```

q24 chocolate, bar, win percent, price. saw previously in correlation and in price / winning percent

```r
pca$rotation
```

```
                        PC1         PC2         PC3          PC4          PC5
chocolate        -0.4019466  0.21404160  0.01601358 -0.016673032  0.066035846
fruity            0.3683883 -0.18304666 -0.13765612 -0.004479829  0.143535325
caramel          -0.2299709 -0.40349894 -0.13294166 -0.024889542 -0.507301501
peanutyalmondy   -0.2407155  0.22446919  0.18272802  0.466784287  0.399930245
nougat           -0.2268102 -0.47016599  0.33970244  0.299581403 -0.188852418
crispedricewafer -0.2215182  0.09719527 -0.36485542 -0.605594730  0.034652316
hard              0.2111587 -0.43262603 -0.20295368 -0.032249660  0.574557816
bar              -0.3947433 -0.22255618  0.10696092 -0.186914549  0.077794806
pluribus          0.2600041  0.36920922 -0.26813772  0.287246604 -0.392796479
sugarpercent     -0.1083088 -0.23647379 -0.65509692  0.433896248  0.007469103
pricepercent     -0.3207361  0.05883628 -0.33048843  0.063557149  0.043358887
winpercent       -0.3298035  0.21115347 -0.13531766  0.117930997  0.168755073
                         PC6         PC7         PC8          PC9         PC10
chocolate        -0.09018950 -0.08360642 -0.49084856 -0.151651568  0.107661356
fruity           -0.04266105  0.46147889  0.39805802 -0.001248306  0.362062502
caramel          -0.40346502 -0.44274741  0.26963447  0.019186442  0.229799010
peanutyalmondy   -0.09416259 -0.25710489  0.45771445  0.381068550 -0.145912362
nougat            0.09012643  0.36663902 -0.18793955  0.385278987  0.011323453
crispedricewafer -0.09007640  0.13077042  0.13567736  0.511634999 -0.264810144
hard             -0.12767365 -0.31933477 -0.38881683  0.258154433  0.220779142
bar               0.25307332  0.24192992 -0.02982691  0.091872886 -0.003232321
pluribus          0.03184932  0.04066352 -0.28652547  0.529954405  0.199303452
sugarpercent      0.02737834  0.14721840 -0.04114076 -0.217685759 -0.488103337
pricepercent      0.62908570 -0.14308215  0.16722078 -0.048991557  0.507716043
winpercent       -0.56947283  0.40260385 -0.02936405 -0.124440117  0.358431235
                        PC11        PC12
chocolate         0.10045278  0.69784924
fruity            0.17494902  0.50624242
caramel           0.13515820  0.07548984
peanutyalmondy    0.11244275  0.12972756
nougat           -0.38954473  0.09223698
crispedricewafer -0.22615618  0.11727369
hard              0.01342330 -0.10430092
bar               0.74956878 -0.22010569
pluribus          0.27971527 -0.06169246
sugarpercent      0.05373286  0.04733985
pricepercent     -0.26396582 -0.06698291
winpercent       -0.11251626 -0.37693153
```