# class9 halloween project

Chelsea A16871799

```
candy_file <- read.csv("candy-data.csv")
candy_file
```

```
               competitorname chocolate fruity caramel peanutyalmondy nougat
1                   100 Grand         1      0       1               0      0
2                 3 Musketeers         1      0       0               0      1
3                    One dime         0      0       0               0      0
4                 One quarter         0      0       0               0      0
5                   Air Heads         0      1       0               0      0
6                  Almond Joy         1      0       0               1      0
7                   Baby Ruth         1      0       1               1      1
8           Boston Baked Beans         0      0       0               1      0
9                   Candy Corn         0      0       0               0      0
10          Caramel Apple Pops         0      1       1               0      0
11             Charleston Chew         1      0       0               0      1
12  Chewey Lemonhead Fruit Mix         0      1       0               0      0
13                    Chiclets         0      1       0               0      0
14                        Dots         0      1       0               0      0
15                   Dum Dums         0      1       0               0      0
16                 Fruit Chews         0      1       0               0      0
17                    Fun Dip         0      1       0               0      0
18                  Gobstopper         0      1       0               0      0
19           Haribo Gold Bears         0      1       0               0      0
20           Haribo Happy Cola         0      0       0               0      0
21           Haribo Sour Bears         0      1       0               0      0
22          Haribo Twin Snakes         0      1       0               0      0
23            Hershey's Kisses         1      0       0               0      0
24           Hershey's Krackel         1      0       0               0      0
25    Hershey's Milk Chocolate         1      0       0               0      0
26      Hershey's Special Dark         1      0       0               0      0
27                   Jawbusters         0      1       0               0      0
```

| | | | | | | |
|---|---|---|---|---|---|---|
| 28 | Junior Mints | 1 | 0 | 0 | 0 | 0 |
| 29 | Kit Kat | 1 | 0 | 0 | 0 | 0 |
| 30 | Laffy Taffy | 0 | 1 | 0 | 0 | 0 |
| 31 | Lemonhead | 0 | 1 | 0 | 0 | 0 |
| 32 | Lifesavers big ring gummies | 0 | 1 | 0 | 0 | 0 |
| 33 | Peanut butter M&M's | 1 | 0 | 0 | 1 | 0 |
| 34 | M&M's | 1 | 0 | 0 | 0 | 0 |
| 35 | Mike & Ike | 0 | 1 | 0 | 0 | 0 |
| 36 | Milk Duds | 1 | 0 | 1 | 0 | 0 |
| 37 | Milky Way | 1 | 0 | 1 | 0 | 1 |
| 38 | Milky Way Midnight | 1 | 0 | 1 | 0 | 1 |
| 39 | Milky Way Simply Caramel | 1 | 0 | 1 | 0 | 0 |
| 40 | Mounds | 1 | 0 | 0 | 0 | 0 |
| 41 | Mr Good Bar | 1 | 0 | 0 | 1 | 0 |
| 42 | Nerds | 0 | 1 | 0 | 0 | 0 |
| 43 | Nestle Butterfinger | 1 | 0 | 0 | 1 | 0 |
| 44 | Nestle Crunch | 1 | 0 | 0 | 0 | 0 |
| 45 | Nik L Nip | 0 | 1 | 0 | 0 | 0 |
| 46 | Now & Later | 0 | 1 | 0 | 0 | 0 |
| 47 | Payday | 0 | 0 | 0 | 1 | 1 |
| 48 | Peanut M&Ms | 1 | 0 | 0 | 1 | 0 |
| 49 | Pixie Sticks | 0 | 0 | 0 | 0 | 0 |
| 50 | Pop Rocks | 0 | 1 | 0 | 0 | 0 |
| 51 | Red vines | 0 | 1 | 0 | 0 | 0 |
| 52 | Reese's Miniatures | 1 | 0 | 0 | 1 | 0 |
| 53 | Reese's Peanut Butter cup | 1 | 0 | 0 | 1 | 0 |
| 54 | Reese's pieces | 1 | 0 | 0 | 1 | 0 |
| 55 | Reese's stuffed with pieces | 1 | 0 | 0 | 1 | 0 |
| 56 | Ring pop | 0 | 1 | 0 | 0 | 0 |
| 57 | Rolo | 1 | 0 | 1 | 0 | 0 |
| 58 | Root Beer Barrels | 0 | 0 | 0 | 0 | 0 |
| 59 | Runts | 0 | 1 | 0 | 0 | 0 |
| 60 | Sixlets | 1 | 0 | 0 | 0 | 0 |
| 61 | Skittles original | 0 | 1 | 0 | 0 | 0 |
| 62 | Skittles wildberry | 0 | 1 | 0 | 0 | 0 |
| 63 | Nestle Smarties | 1 | 0 | 0 | 0 | 0 |
| 64 | Smarties candy | 0 | 1 | 0 | 0 | 0 |
| 65 | Snickers | 1 | 0 | 1 | 1 | 1 |
| 66 | Snickers Crisper | 1 | 0 | 1 | 1 | 0 |
| 67 | Sour Patch Kids | 0 | 1 | 0 | 0 | 0 |
| 68 | Sour Patch Tricksters | 0 | 1 | 0 | 0 | 0 |
| 69 | Starburst | 0 | 1 | 0 | 0 | 0 |
| 70 | Strawberry bon bons | 0 | 1 | 0 | 0 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 71 | Sugar Babies | 0 | 0 | 1 | 0 | 0 | |
| 72 | Sugar Daddy | 0 | 0 | 1 | 0 | 0 | |
| 73 | Super Bubble | 0 | 1 | 0 | 0 | 0 | |
| 74 | Swedish Fish | 0 | 1 | 0 | 0 | 0 | |
| 75 | Tootsie Pop | 1 | 1 | 0 | 0 | 0 | |
| 76 | Tootsie Roll Juniors | 1 | 0 | 0 | 0 | 0 | |
| 77 | Tootsie Roll Midgies | 1 | 0 | 0 | 0 | 0 | |
| 78 | Tootsie Roll Snack Bars | 1 | 0 | 0 | 0 | 0 | |
| 79 | Trolli Sour Bites | 0 | 1 | 0 | 0 | 0 | |
| 80 | Twix | 1 | 0 | 1 | 0 | 0 | |
| 81 | Twizzlers | 0 | 1 | 0 | 0 | 0 | |
| 82 | Warheads | 0 | 1 | 0 | 0 | 0 | |
| 83 | Welch's Fruit Snacks | 0 | 1 | 0 | 0 | 0 | |
| 84 | Werther's Original Caramel | 0 | 0 | 1 | 0 | 0 | |
| 85 | Whoppers | 1 | 0 | 0 | 0 | 0 | |

| | crispedricewafer | hard | bar | pluribus | sugarpercent | pricepercent | winpercent |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 0 | 1 | 0 | 0.732 | 0.860 | 66.97173 |
| 2 | 0 | 0 | 1 | 0 | 0.604 | 0.511 | 67.60294 |
| 3 | 0 | 0 | 0 | 0 | 0.011 | 0.116 | 32.26109 |
| 4 | 0 | 0 | 0 | 0 | 0.011 | 0.511 | 46.11650 |
| 5 | 0 | 0 | 0 | 0 | 0.906 | 0.511 | 52.34146 |
| 6 | 0 | 0 | 1 | 0 | 0.465 | 0.767 | 50.34755 |
| 7 | 0 | 0 | 1 | 0 | 0.604 | 0.767 | 56.91455 |
| 8 | 0 | 0 | 0 | 1 | 0.313 | 0.511 | 23.41782 |
| 9 | 0 | 0 | 0 | 1 | 0.906 | 0.325 | 38.01096 |
| 10 | 0 | 0 | 0 | 0 | 0.604 | 0.325 | 34.51768 |
| 11 | 0 | 0 | 1 | 0 | 0.604 | 0.511 | 38.97504 |
| 12 | 0 | 0 | 0 | 1 | 0.732 | 0.511 | 36.01763 |
| 13 | 0 | 0 | 0 | 1 | 0.046 | 0.325 | 24.52499 |
| 14 | 0 | 0 | 0 | 1 | 0.732 | 0.511 | 42.27208 |
| 15 | 0 | 1 | 0 | 0 | 0.732 | 0.034 | 39.46056 |
| 16 | 0 | 0 | 0 | 1 | 0.127 | 0.034 | 43.08892 |
| 17 | 0 | 1 | 0 | 0 | 0.732 | 0.325 | 39.18550 |
| 18 | 0 | 1 | 0 | 1 | 0.906 | 0.453 | 46.78335 |
| 19 | 0 | 0 | 0 | 1 | 0.465 | 0.465 | 57.11974 |
| 20 | 0 | 0 | 0 | 1 | 0.465 | 0.465 | 34.15896 |
| 21 | 0 | 0 | 0 | 1 | 0.465 | 0.465 | 51.41243 |
| 22 | 0 | 0 | 0 | 1 | 0.465 | 0.465 | 42.17877 |
| 23 | 0 | 0 | 0 | 1 | 0.127 | 0.093 | 55.37545 |
| 24 | 1 | 0 | 1 | 0 | 0.430 | 0.918 | 62.28448 |
| 25 | 0 | 0 | 1 | 0 | 0.430 | 0.918 | 56.49050 |
| 26 | 0 | 0 | 1 | 0 | 0.430 | 0.918 | 59.23612 |
| 27 | 0 | 1 | 0 | 1 | 0.093 | 0.511 | 28.12744 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 28 | 0 | 0 | 0 | 1 | 0.197 | 0.511 | 57.21925 |
| 29 | 1 | 0 | 1 | 0 | 0.313 | 0.511 | 76.76860 |
| 30 | 0 | 0 | 0 | 0 | 0.220 | 0.116 | 41.38956 |
| 31 | 0 | 1 | 0 | 0 | 0.046 | 0.104 | 39.14106 |
| 32 | 0 | 0 | 0 | 0 | 0.267 | 0.279 | 52.91139 |
| 33 | 0 | 0 | 0 | 1 | 0.825 | 0.651 | 71.46505 |
| 34 | 0 | 0 | 0 | 1 | 0.825 | 0.651 | 66.57458 |
| 35 | 0 | 0 | 0 | 1 | 0.872 | 0.325 | 46.41172 |
| 36 | 0 | 0 | 0 | 1 | 0.302 | 0.511 | 55.06407 |
| 37 | 0 | 0 | 1 | 0 | 0.604 | 0.651 | 73.09956 |
| 38 | 0 | 0 | 1 | 0 | 0.732 | 0.441 | 60.80070 |
| 39 | 0 | 0 | 1 | 0 | 0.965 | 0.860 | 64.35334 |
| 40 | 0 | 0 | 1 | 0 | 0.313 | 0.860 | 47.82975 |
| 41 | 0 | 0 | 1 | 0 | 0.313 | 0.918 | 54.52645 |
| 42 | 0 | 1 | 0 | 1 | 0.848 | 0.325 | 55.35405 |
| 43 | 0 | 0 | 1 | 0 | 0.604 | 0.767 | 70.73564 |
| 44 | 1 | 0 | 1 | 0 | 0.313 | 0.767 | 66.47068 |
| 45 | 0 | 0 | 0 | 1 | 0.197 | 0.976 | 22.44534 |
| 46 | 0 | 0 | 0 | 1 | 0.220 | 0.325 | 39.44680 |
| 47 | 0 | 0 | 1 | 0 | 0.465 | 0.767 | 46.29660 |
| 48 | 0 | 0 | 0 | 1 | 0.593 | 0.651 | 69.48379 |
| 49 | 0 | 0 | 0 | 1 | 0.093 | 0.023 | 37.72234 |
| 50 | 0 | 1 | 0 | 1 | 0.604 | 0.837 | 41.26551 |
| 51 | 0 | 0 | 0 | 1 | 0.581 | 0.116 | 37.34852 |
| 52 | 0 | 0 | 0 | 0 | 0.034 | 0.279 | 81.86626 |
| 53 | 0 | 0 | 0 | 0 | 0.720 | 0.651 | 84.18029 |
| 54 | 0 | 0 | 0 | 1 | 0.406 | 0.651 | 73.43499 |
| 55 | 0 | 0 | 0 | 0 | 0.988 | 0.651 | 72.88790 |
| 56 | 0 | 1 | 0 | 0 | 0.732 | 0.965 | 35.29076 |
| 57 | 0 | 0 | 0 | 1 | 0.860 | 0.860 | 65.71629 |
| 58 | 0 | 1 | 0 | 1 | 0.732 | 0.069 | 29.70369 |
| 59 | 0 | 1 | 0 | 1 | 0.872 | 0.279 | 42.84914 |
| 60 | 0 | 0 | 0 | 1 | 0.220 | 0.081 | 34.72200 |
| 61 | 0 | 0 | 0 | 1 | 0.941 | 0.220 | 63.08514 |
| 62 | 0 | 0 | 0 | 1 | 0.941 | 0.220 | 55.10370 |
| 63 | 0 | 0 | 0 | 1 | 0.267 | 0.976 | 37.88719 |
| 64 | 0 | 1 | 0 | 1 | 0.267 | 0.116 | 45.99583 |
| 65 | 0 | 0 | 1 | 0 | 0.546 | 0.651 | 76.67378 |
| 66 | 1 | 0 | 1 | 0 | 0.604 | 0.651 | 59.52925 |
| 67 | 0 | 0 | 0 | 1 | 0.069 | 0.116 | 59.86400 |
| 68 | 0 | 0 | 0 | 1 | 0.069 | 0.116 | 52.82595 |
| 69 | 0 | 0 | 0 | 1 | 0.151 | 0.220 | 67.03763 |
| 70 | 0 | 1 | 0 | 1 | 0.569 | 0.058 | 34.57899 |

```
71                0    0   0        1        0.965        0.767   33.43755
72                0    0   0        0        0.418        0.325   32.23100
73                0    0   0        0        0.162        0.116   27.30386
74                0    0   0        1        0.604        0.755   54.86111
75                0    1   0        0        0.604        0.325   48.98265
76                0    0   0        0        0.313        0.511   43.06890
77                0    0   0        1        0.174        0.011   45.73675
78                0    0   1        0        0.465        0.325   49.65350
79                0    0   0        1        0.313        0.255   47.17323
80                1    0   1        0        0.546        0.906   81.64291
81                0    0   0        0        0.220        0.116   45.46628
82                0    1   0        0        0.093        0.116   39.01190
83                0    0   0        1        0.313        0.313   44.37552
84                0    1   0        0        0.186        0.267   41.90431
85                1    0   0        1        0.872        0.848   49.52411
```

```
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
```

#Q1. How many different candy types are in this dataset?

```
nrow(candy)
```

```
[1] 85
```

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

```
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["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 |

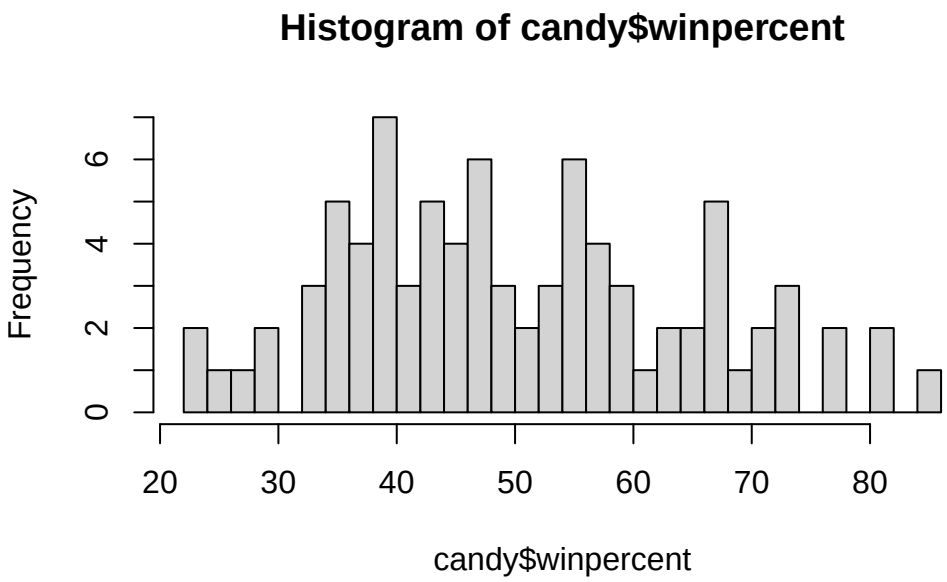
**Variable type: numeric**

| 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 | |

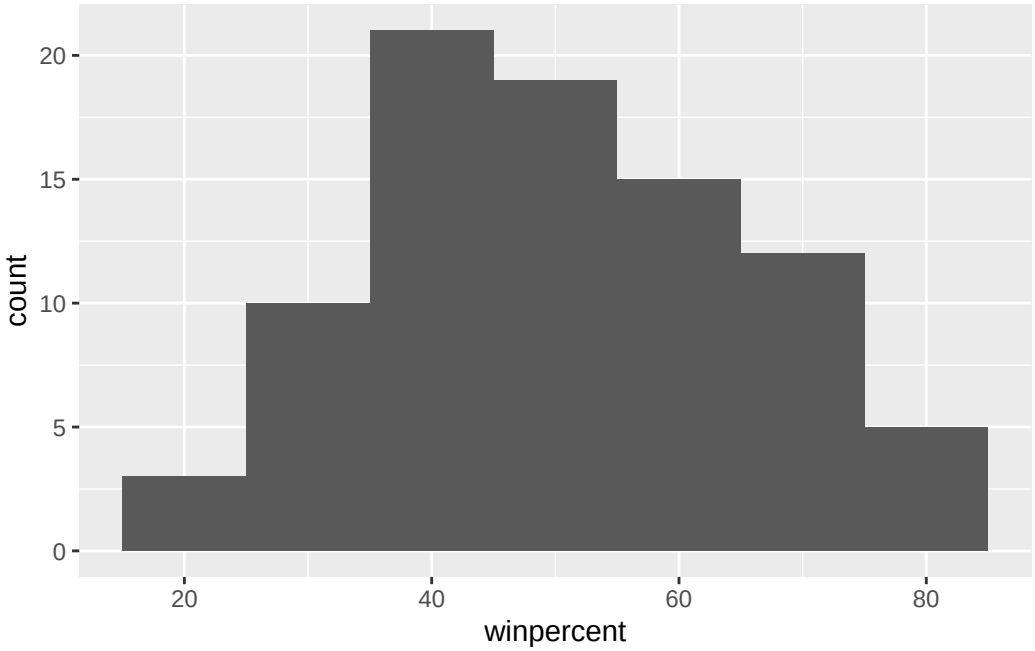
Q6. Is there any variable/column that looks to be on a different scale to the majority of the other columns in the dataset? #winpercent variable looks to be on different scale to majority of other columns. Q7. What do you think a zero and one represent for the candy$chocolate column? #for chocolate column, zero kind of represent false(not chocolate) and 1 represent true(is chocolate candy)

Q8. Plot a histogram of winpercent values

```
hist(candy$winpercent, breaks=30)
```




```
library(ggplot2)
ggplot(candy)+
  aes(winpercent)+
  geom_histogram(binwidth=10)
```




#Q9. Is the distribution of winpercent values symmetrical? #This distribution of winpercent value is asymmetric.

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

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

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

```
 [1] 66.97173 67.60294 50.34755 56.91455 38.97504 55.37545 62.28448 56.49050
 [9] 59.23612 57.21925 76.76860 71.46505 66.57458 55.06407 73.09956 60.80070
[17] 64.35334 47.82975 54.52645 70.73564 66.47068 69.48379 81.86626 84.18029
[25] 73.43499 72.88790 65.71629 34.72200 37.88719 76.67378 59.52925 48.98265
[33] 43.06890 45.73675 49.65350 81.64291 49.52411
```

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

```
 [1] 52.34146 34.51768 36.01763 24.52499 42.27208 39.46056 43.08892 39.18550
 [9] 46.78335 57.11974 51.41243 42.17877 28.12744 41.38956 39.14106 52.91139
[17] 46.41172 55.35405 22.44534 39.44680 41.26551 37.34852 35.29076 42.84914
[25] 63.08514 55.10370 45.99583 59.86400 52.82595 67.03763 34.57899 27.30386
[33] 54.86111 48.98265 47.17323 45.46628 39.01190 44.37552
```

```
mean(choc.win)
```

```
[1] 60.92153
```

```
mean(fruit.win)
```

```
[1] 44.11974
```

On average chocolate candy is higher ranked than fruit candy. Q12. Is this difference statistically significant?

```
t.test(choc.win,fruit.win)
```

```
    Welch Two Sample t-test

data:  choc.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
```

This difference is statistically significant as p value=2.871e-08.

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

```
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
```

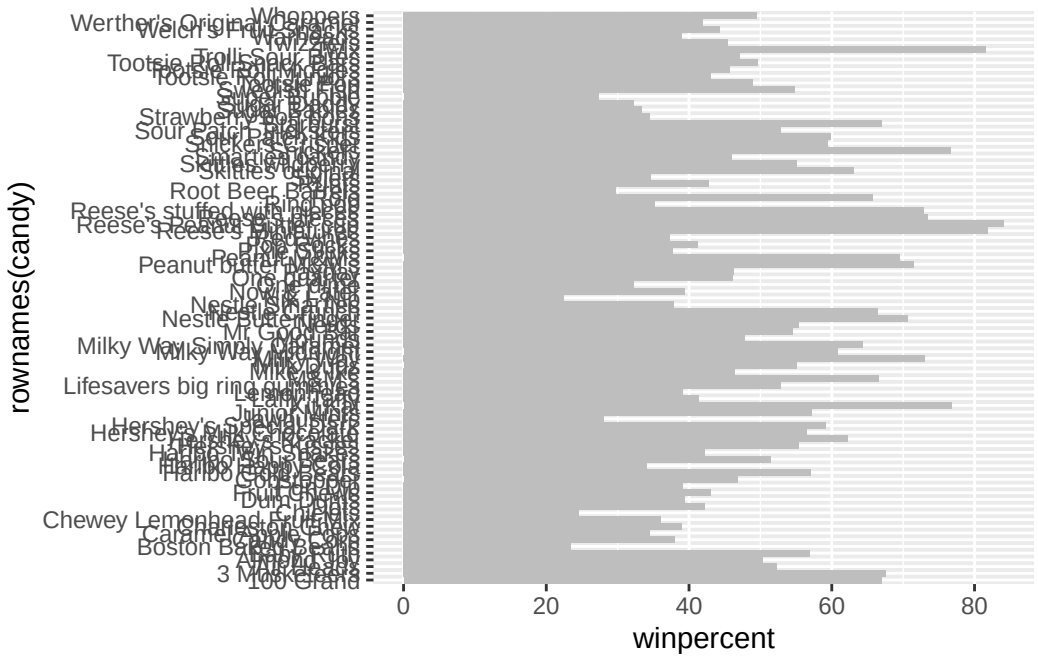
Q14. What are the top 5 all time favorite candy types out of this set?

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

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

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

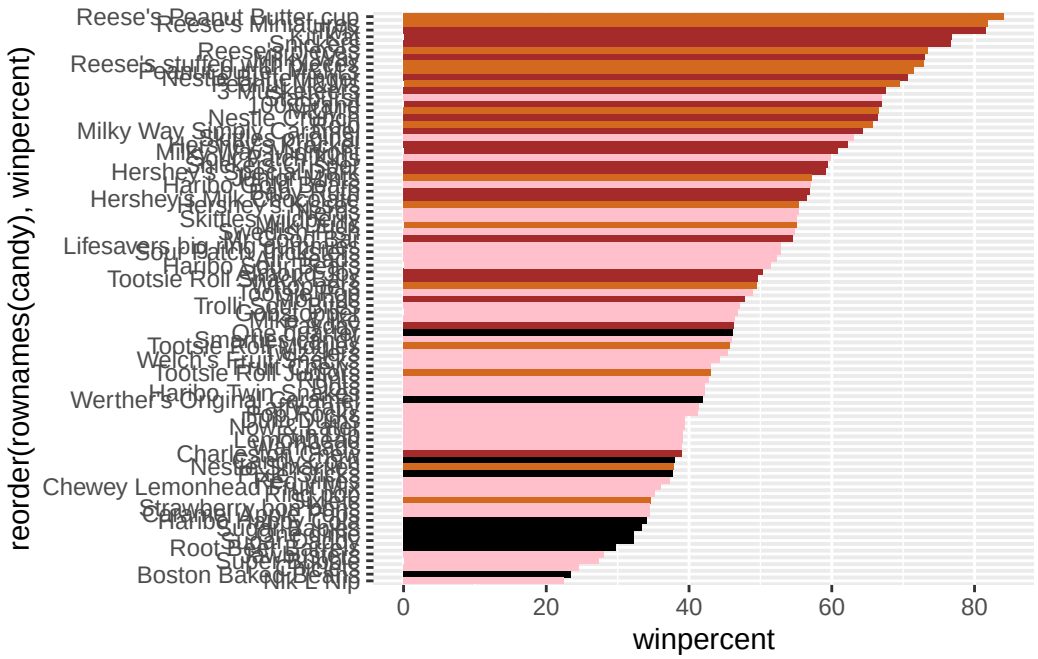
```
ggplot(candy) +
  aes(winpercent, rownames(candy)) +
  geom_col(fill="gray")
```




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

```
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"
```

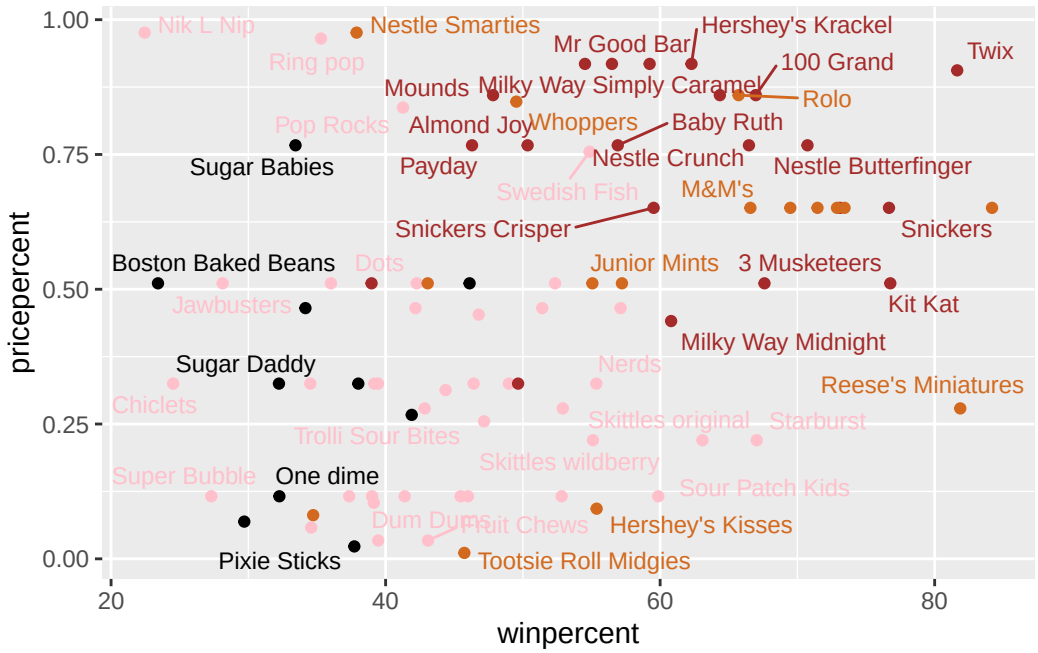
```
library(ggplot2)
ggplot(candy)+
aes(winpercent, reorder(rownames(candy),winpercent))+
  geom_col(fill=my_cols)
```




- Q17. What is the worst ranked chocolate candy? Sixlets is the worst ranked chocolate candy.
- Q18. What is the best ranked fruity candy? starburst is the best ranked fruity candy.

```
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 = 10)
```

```
Warning: ggrepel: 40 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? Reese's Minature is the the highest ranked for winpercent for least money.

Q20. 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 )
```

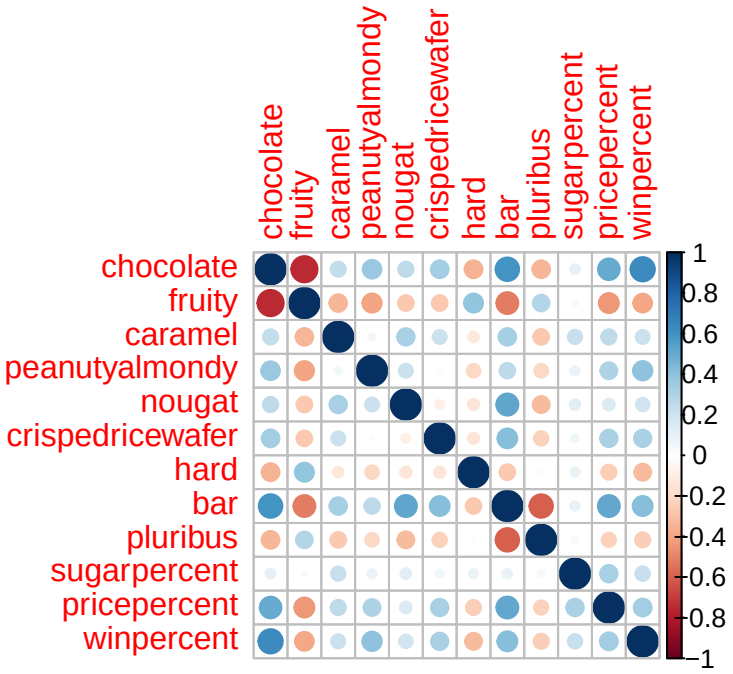
```
                           pricepercent winpercent
Nik L Nip                         0.976   22.44534
Nestle Smarties                   0.976   37.88719
Ring pop                          0.965   35.29076
Hershey's Krackel                 0.918   62.28448
Hershey's Milk Chocolate          0.918  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

top 5 most expensive candy is Nik L Nip, Nestle Smarties, Ring pop, Hershey's Krackel, Hershey's Milk Chocolate. among this the least popular is the Nik L Nip.

```
library(corrplot)
```

```
corrplot 0.92 loaded
```

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

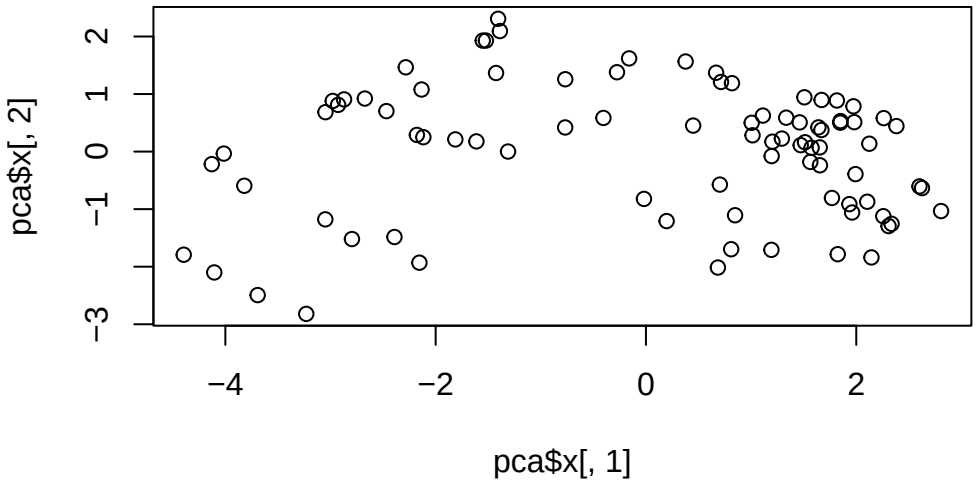



Q22. Examining this plot what two variables are anti-correlated (i.e. have minus values)? #chocolaty and fruity are anti-correlated Q23. Similarly, what two variables are most positively correlated? #winpercent and chocolate are most positive correlated.

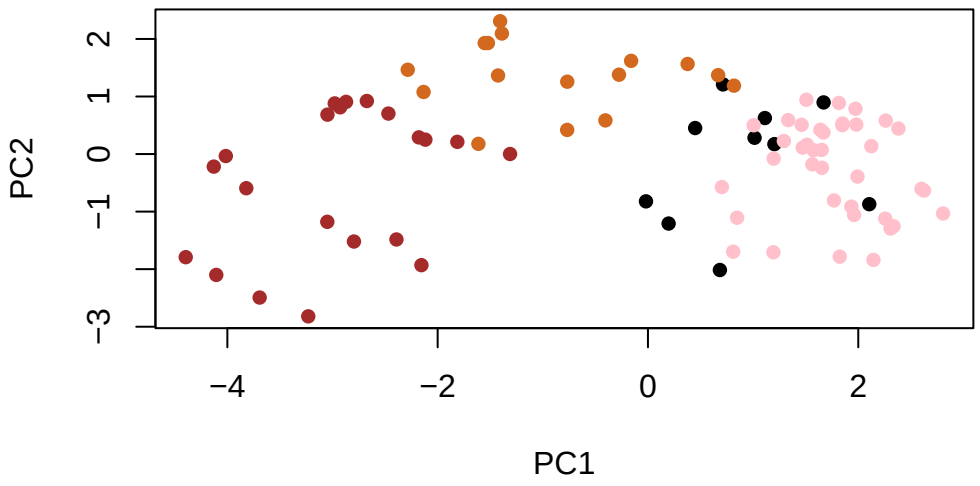
```
pca <- prcomp(candy, scale=TRUE)
summary(pca)
```

```
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
```

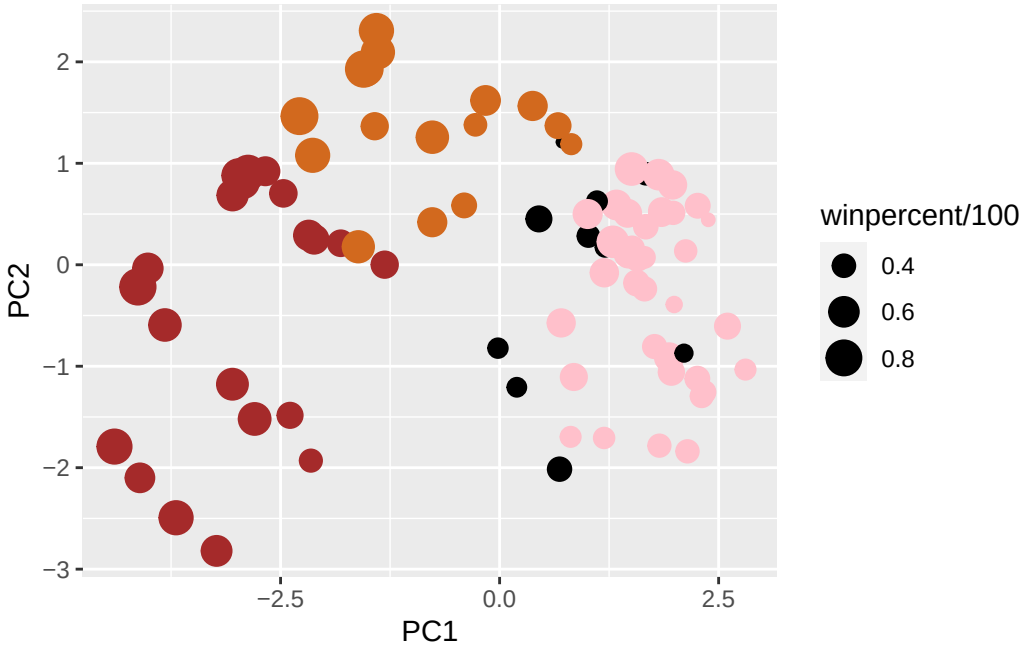
```
plot(pca$x[,1],pca$x[,2])
```




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

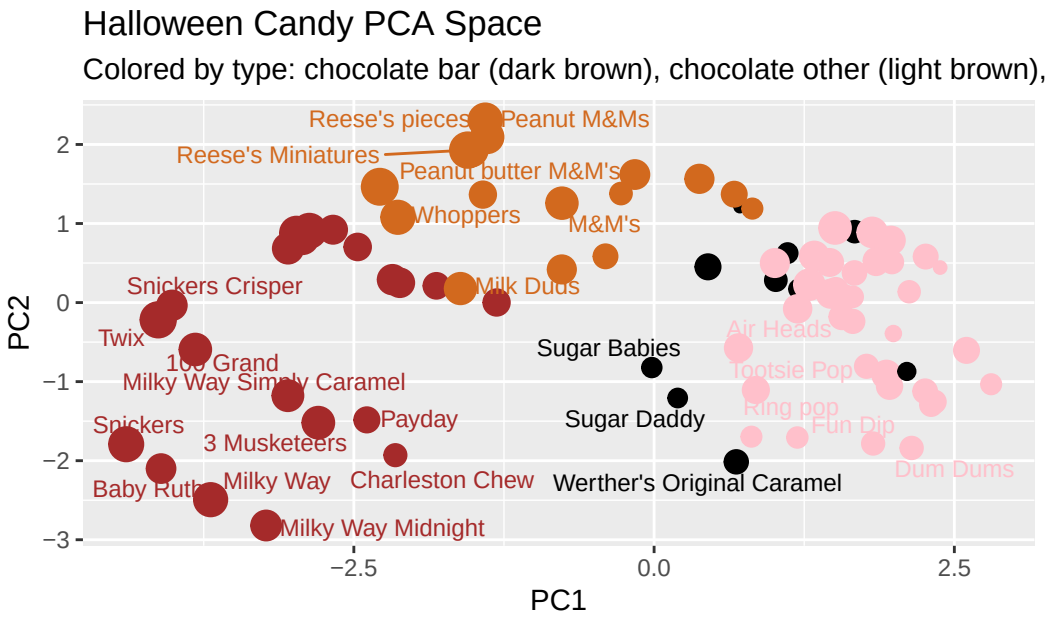



```
# Make a new data-frame with our PCA results and candy data
my_data <- cbind(candy, pca$x[,1:3])
p <- ggplot(my_data) +
        aes(x=PC1, y=PC2,
            size=winpercent/100,
            text=rownames(my_data),
            label=rownames(my_data)) +
        geom_point(col=my_cols)
p
```




```
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
       caption="Data from 538")
```

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

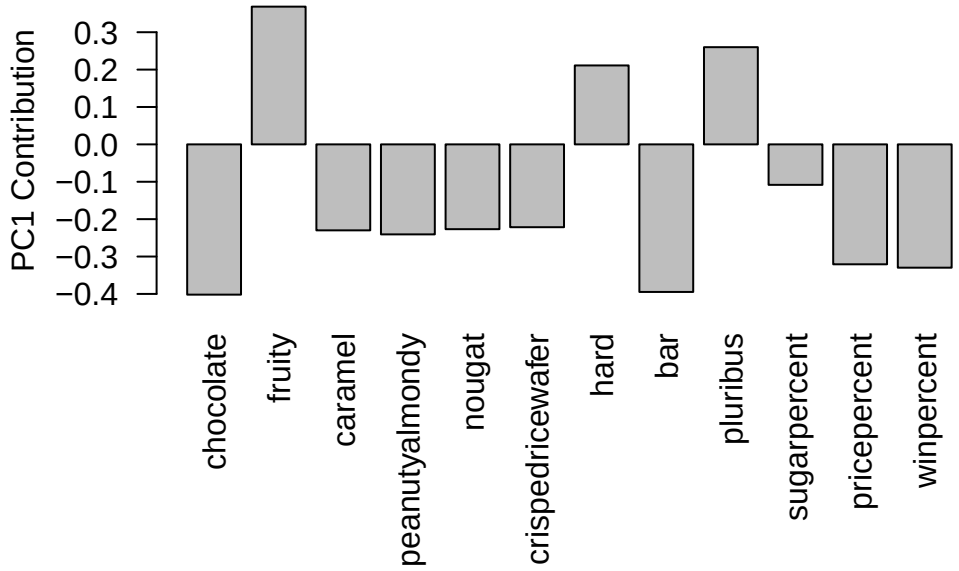



```
library(plotly)
```

```
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")
```




Q24. What original variables are picked up strongly by PC1 in the positive direction? Do these make sense to you? Fruity, hard, and pluribus.(positive direction)