Halloween project

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Today we will examine 538 "match-up" data

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

	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_file<-"candy-data.csv"
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?

There are 85

```
nrow(candy)
```

```
[1] 85
```

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

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

```
[1] 38
```

```
head.candy <- as.logical(candy$fruity)

candy[head.candy,]
```

	chocolate	fruity	caramel	peanutyalmondy	nougat
Air Heads	0	1	0	0	0
Caramel Apple Pops	0	1	1	0	0
Chewey Lemonhead Fruit Mix	0	1	0	0	0
Chiclets	0	1	0	0	0
Dots	0	1	0	0	0
Dum Dums	0	1	0	0	0
Fruit Chews	0	1	0	0	0
Fun Dip	0	1	0	0	0
Gobstopper	0	1	0	0	0
Haribo Gold Bears	0	1	0	0	0
Haribo Sour Bears	0	1	0	0	0
Haribo Twin Snakes	0	1	0	0	0
Jawbusters	0	1	0	0	0
Laffy Taffy	0	1	0	0	0
Lemonhead	0	1	0	0	0
Lifesavers big ring gummies	0	1	0	0	0
Mike & Ike	0	1	0	0	0
Nerds	0	1	0	0	0
Nik L Nip	0	1	0	0	0
Now & Later	0	1	0	0	0
Pop Rocks	0	1	0	0	0
Red vines	0	1	0	0	0
Ring pop	0	1	0	0	0
Runts	0	1	0	0	0
Skittles original	0	1	0	0	0
Skittles wildberry	0	1	0	0	0
Smarties candy	0	1	0	0	0
Sour Patch Kids	0	1	0	0	0

Sour Patch Tricksters	0	1	0	0	0
Starburst	0	1	0	0	0
Strawberry bon bons	0	1	0	0	0
Super Bubble	0	1	0	0	0
Swedish Fish	0	1	0	0	0
Tootsie Pop	1	1	0	0	0
Trolli Sour Bites	0	1	0	0	0
Twizzlers	0	1	0	0	0
Warheads	0	1	0	0	0
Welch's Fruit Snacks	0	1	0	0	0

	crispedricewafer	hard	bar	pluribus	sugarpercent
Air Heads	0	0	0	0	0.906
Caramel Apple Pops	0	0	0	0	0.604
Chewey Lemonhead Fruit Mix	0	0	0	1	0.732
Chiclets	0	0	0	1	0.046
Dots	0	0	0	1	0.732
Dum Dums	0	1	0	0	0.732
Fruit Chews	0	0	0	1	0.127
Fun Dip	0	1	0	0	0.732
Gobstopper	0	1	0	1	0.906
Haribo Gold Bears	0	0	0	1	0.465
Haribo Sour Bears	0	0	0	1	0.465
Haribo Twin Snakes	0	0	0	1	0.465
Jawbusters	0	1	0	1	0.093
Laffy Taffy	0	0	0	0	0.220
Lemonhead	0	1	0	0	0.046
Lifesavers big ring gummies	0	0	0	0	0.267
Mike & Ike	0	0	0	1	0.872
Nerds	0	1	0	1	0.848
Nik L Nip	0	0	0	1	0.197
Now & Later	0	0	0	1	0.220
Pop Rocks	0	1	0	1	0.604
Red vines	0	0	0	1	0.581
Ring pop	0	1	0	0	0.732
Runts	0	1	0	1	0.872
Skittles original	0	0	0	1	0.941
Skittles wildberry	0	0	0	1	0.941
Smarties candy	0	1	0	1	0.267
Sour Patch Kids	0	0	0	1	0.069
Sour Patch Tricksters	0	0	0	1	0.069
Starburst	0	0	0	1	0.151
Strawberry bon bons	0	1	0	1	0.569
Super Bubble	0	0	0	0	0.162

Swedish Fish	0	0	0	1	0.604
Tootsie Pop	0	1	0	0	0.604
Trolli Sour Bites	0	0	0	1	0.313
Twizzlers	0	0	0	0	0.220
Warheads	0	1	0	0	0.093
Welch's Fruit Snacks	0	0	0	1	0.313

	pricepercent	winpercent
Air Heads	0.511	52.34146
Caramel Apple Pops	0.325	34.51768
Chewey Lemonhead Fruit Mix	0.511	36.01763
Chiclets	0.325	24.52499
Dots	0.511	42.27208
Dum Dums	0.034	39.46056
Fruit Chews	0.034	43.08892
Fun Dip	0.325	39.18550
Gobstopper	0.453	46.78335
Haribo Gold Bears	0.465	57.11974
Haribo Sour Bears	0.465	51.41243
Haribo Twin Snakes	0.465	42.17877
Jawbusters	0.511	28.12744
Laffy Taffy	0.116	41.38956
Lemonhead	0.104	39.14106
Lifesavers big ring gummies	0.279	52.91139
Mike & Ike	0.325	46.41172
Nerds	0.325	55.35405
Nik L Nip	0.976	22.44534
Now & Later	0.325	39.44680
Pop Rocks	0.837	41.26551
Red vines	0.116	37.34852
Ring pop	0.965	35.29076
Runts	0.279	42.84914
Skittles original	0.220	63.08514
Skittles wildberry	0.220	55.10370
Smarties candy	0.116	45.99583
Sour Patch Kids	0.116	59.86400
Sour Patch Tricksters	0.116	52.82595
Starburst	0.220	67.03763
Strawberry bon bons	0.058	34.57899
Super Bubble	0.116	27.30386
Swedish Fish	0.755	54.86111
Tootsie Pop	0.325	48.98265
Trolli Sour Bites	0.255	47.17323
Twizzlers	0.116	45.46628

```
Warheads                        0.116   39.01190
Welch's Fruit Snacks            0.313   44.37552
```

Q3.Whta is your favorite candy in the dataset and what is its winecraft value?

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

```
[1] 81.64291
```

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	

```
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	

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
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?

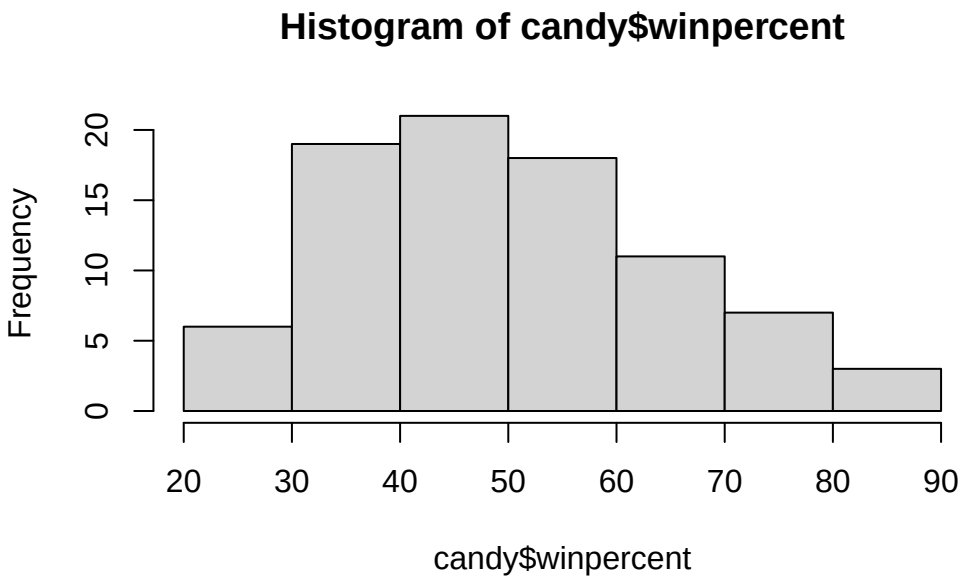
Yes, winpercent column looks very different and have values not between 0 to 1.

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

It indicates that at the 75 percentile, the data is at 1.However, data points below 75 percentile are 0.

Q8.Plot a historgram of winpercent values

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



Q9. Is the distribution of winpercent values symmetrical?

No, it's skewed.

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

The center is below 50%

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

Chocolate candy is more highly ranked than fruit candy.

```
choc.ind <- as.logical(candy$chocolate)
fruit.ind <- as.logical(candy$fruity)

choc.win <- candy[choc.ind,]$winpercent
fruit.win <- candy[fruit.ind,]$winpercent
```

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

```
[1] 60.92153
```

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

```
[1] 44.11974
```

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
```

Yes, it is statistically significant.

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

```r
x<-c(5,2,3,6)
sort(x)
```

```
[1] 2 3 5 6
```

```r
sort(x,decreasing = T)
```

```
[1] 6 5 3 2
```

```r
x
```

```
[1] 5 2 3 6
```

```r
order(x)
```

```
[1] 2 3 1 4
```

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

```
[1] 2 3 5 6
```

```r
y <- c("D","A","E")
order(y)
```

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

```r
y[order(y)]
```

```
[1] "A" "D" "E"
```

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

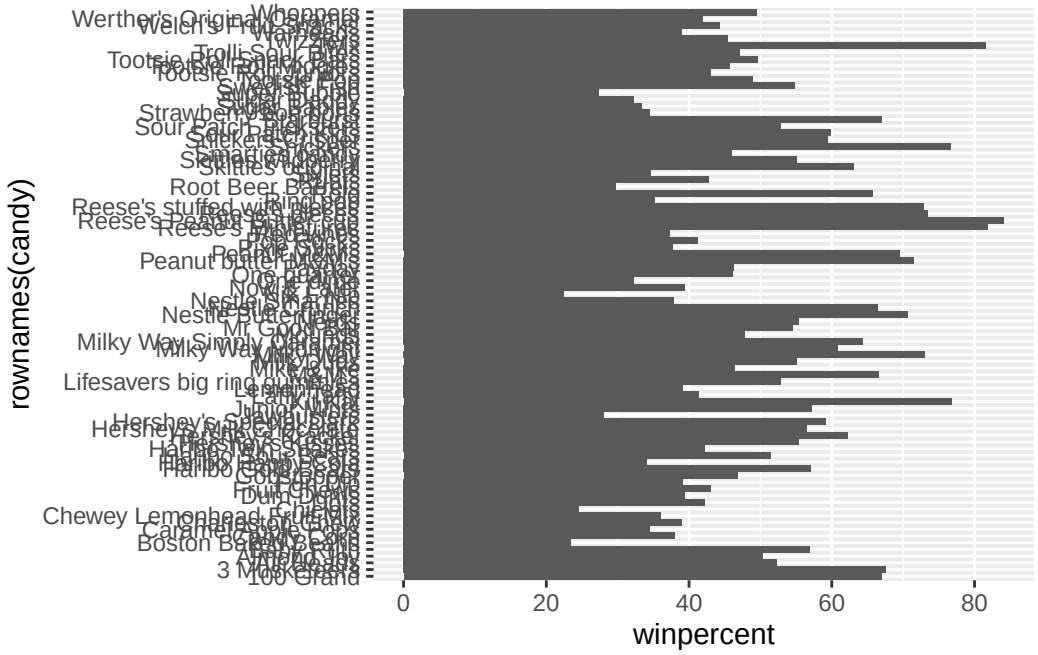
Q14. What are the top 5 all time favorite candy types out of this set?

```
inds<-order(candy$winpercent, decreasing=TRUE)
head(candy[inds,],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
```

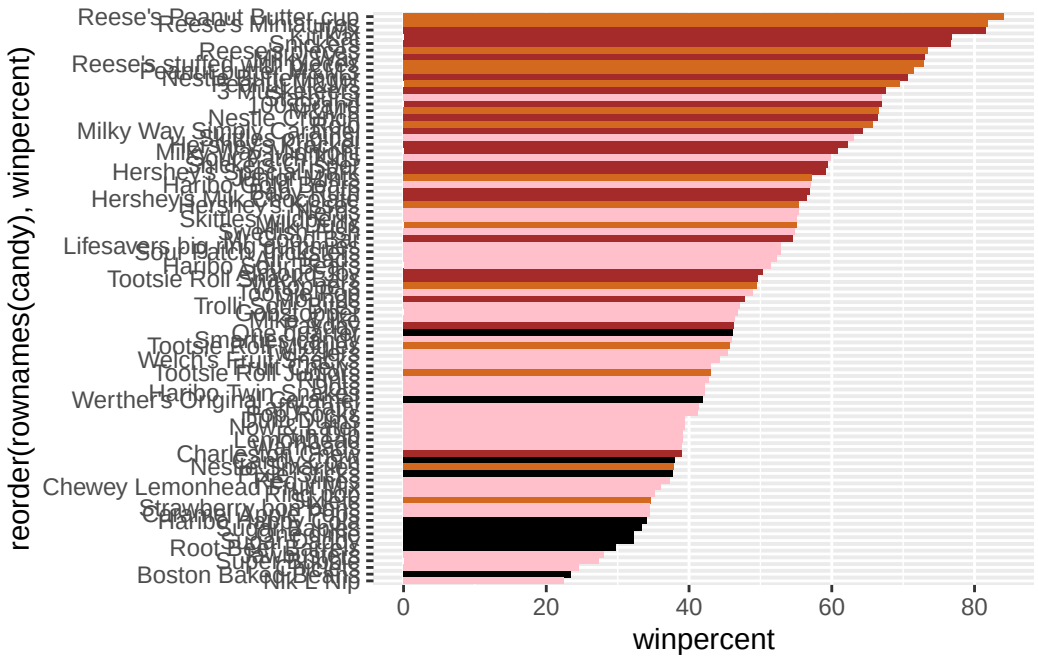
Q15. Make a first barplot of candy ranking based on winpercent values.

```
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?

```
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. What is the worst ranked chocolate candy?

Sixlets is the worst ranked chocolate candy.

Q18. What is the best ranked fruity candy?

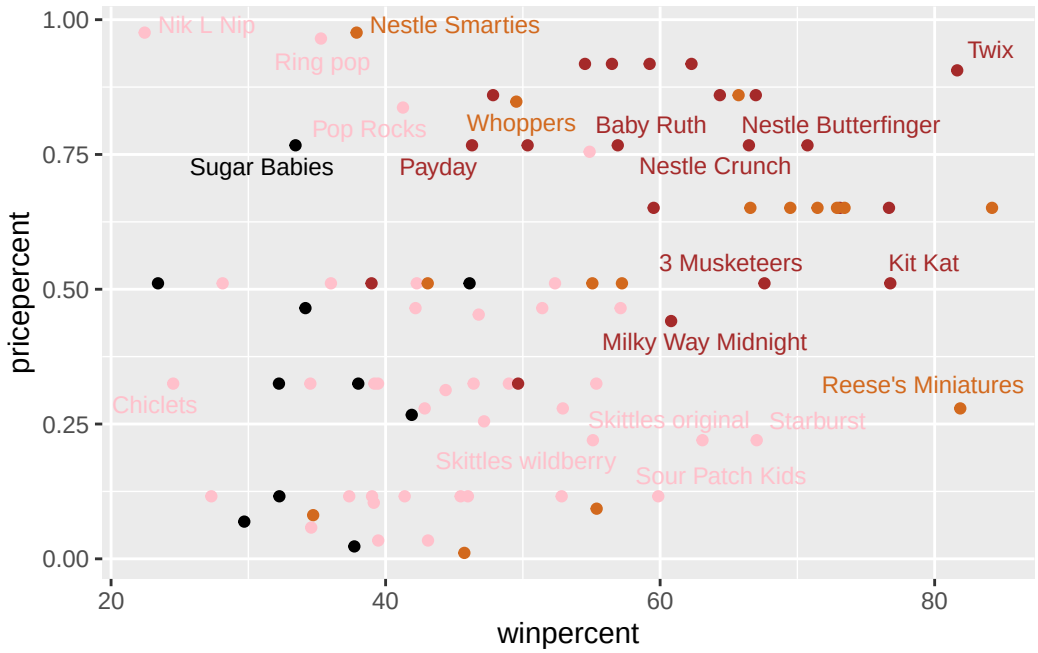
Starburst is the best ranked fruity candy.

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 Miniatures

```
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)
```

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



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

The following are the 5 most expensive candy types in the dataset. Nik L Nip is the least popular.

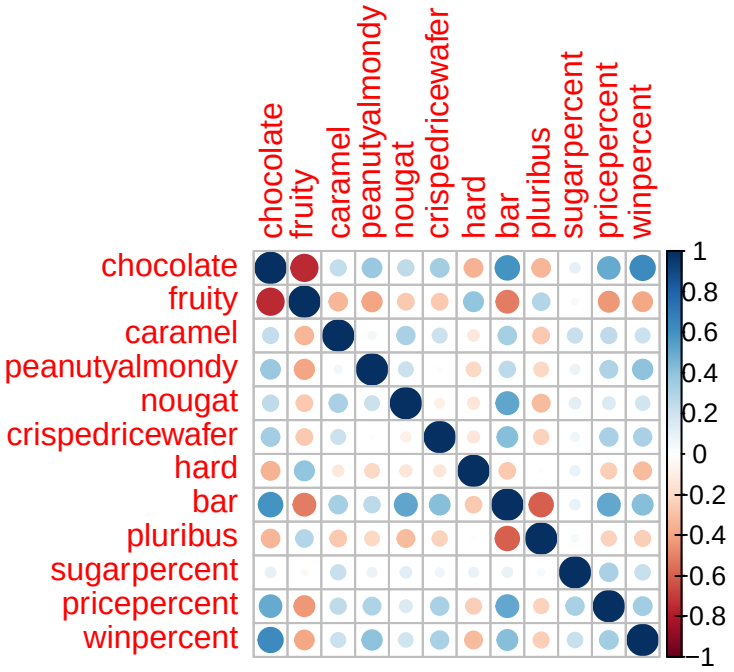
```
ord <- order(candy$pricepercent, decreasing = TRUE)
head( candy[ord,c(11,12)], n=5 )
```

```
                      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
```

```
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)?

winpercent and pricepercent are most anti-correlated.

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

chocolate and fruity are most positively correlated.

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

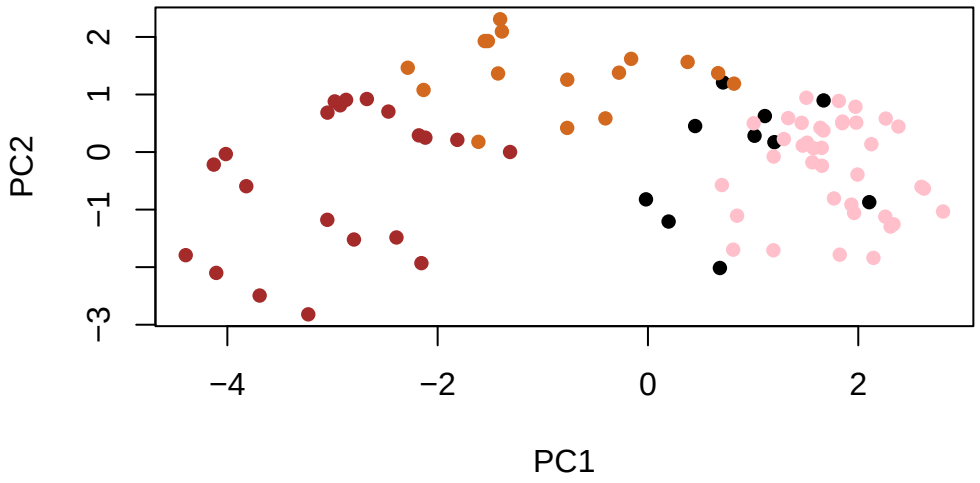
Fruity, pluribus, and hard. Yes.

```
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
```

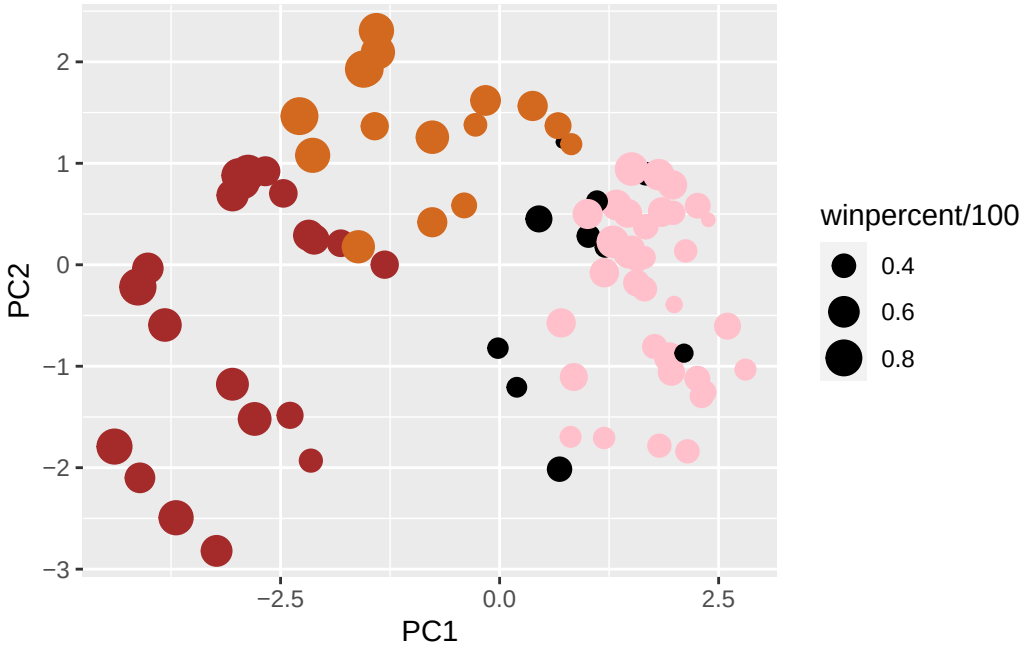
```
Proportion of Variance 0.3601 0.1079 0.1025 0.09636 0.0755 0.05593 0.05539
Cumulative Proportion  0.3601 0.4680 0.5705 0.66688 0.7424 0.79830 0.85369
                           PC8     PC9    PC10    PC11    PC12
Standard deviation     0.74530 0.67824 0.62349 0.43974 0.39760
Proportion of Variance 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[,1:2], col=my_cols, pch=16)
```



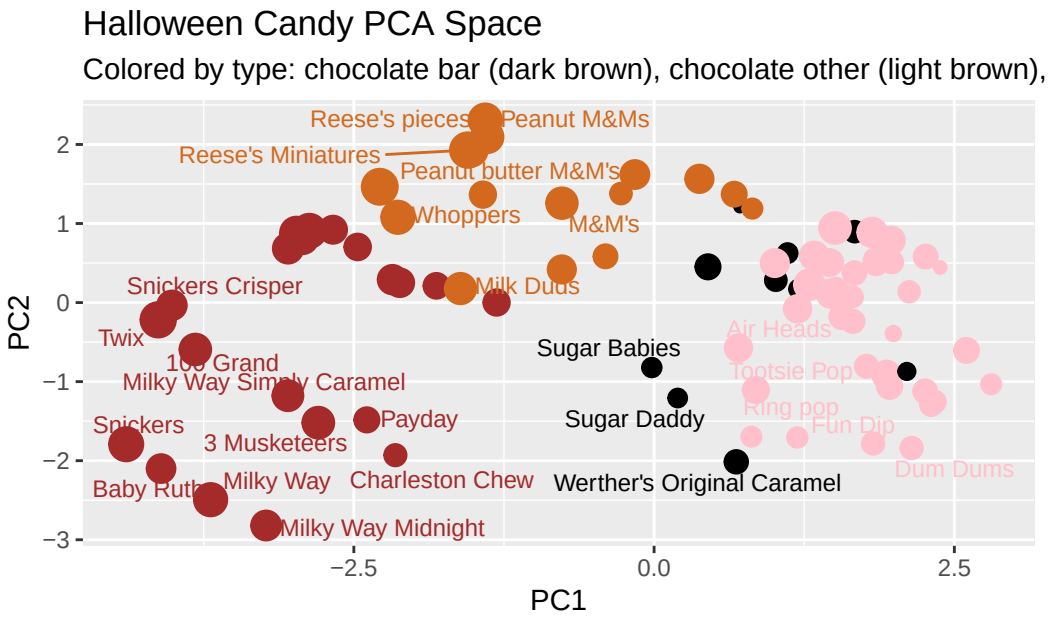

```
# Make a new data-frame with our PCA results and candy data
my_data <- cbind(candy, pca$x[,1:3])
```

```
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
```



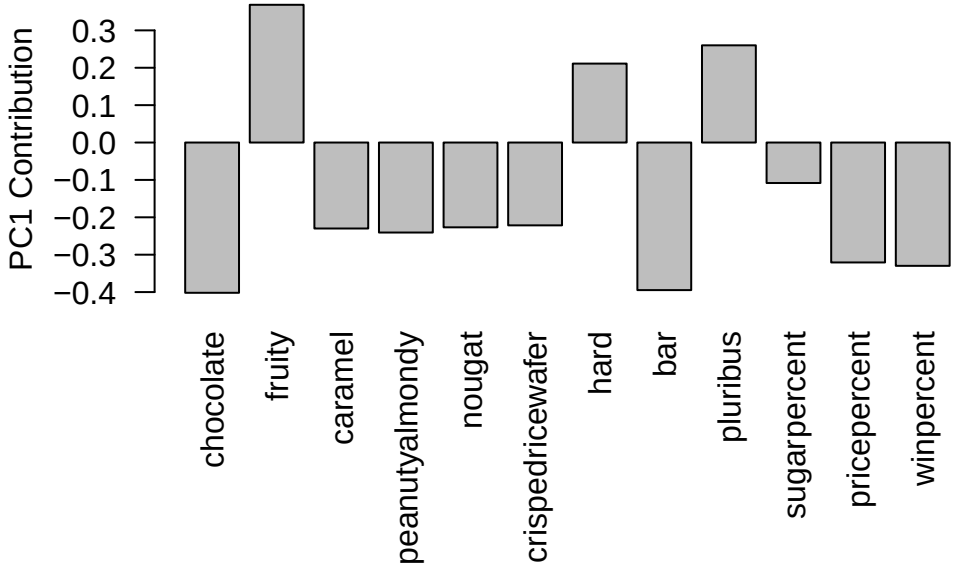

```
library(ggrepel)

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)
#ggplotly(p)
```

```
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