DATA 608 - Assignment 1

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```
library('dplyr')
library('ggplot2')
library('kableExtra')
library('formattable')
library('tinytex')

mpeach <- "#FBAA82"
mteal <- "#73A2AC"
mdarkteal <- "#0B5D69"
mgray <- "#4C4C4C"

# set plot theme for assignment
my_plot_theme <- list(
  theme_classic() +
  theme(plot.background = element_rect(fill = "#F3F2E8"),
        panel.background = element_rect(fill = "#F3F2E8"),
        panel.grid.major.x = element_line(color = "white"),
        axis.title.y = element_text(face = "bold"),
        axis.title.x = element_text(face = "bold")))
```

Principles of Data Visualization and Introduction to ggplot2

I have provided you with data about the 5,000 fastest growing companies in the US, as compiled by Inc. magazine. lets read this in:

```
inc <- read.csv("https://raw.githubusercontent.com/charleyferrari/CUNY_DATA_608/master/module1/Data/inc5
```

And lets preview this data:

```
kable((head(inc, 10)), format = 'markdown')
```

Rank	Name	Growth_Rate	Revenue	Industry	Employees	City	State
1	Fuhu	421.48	1.179e+08	Consumer Products & Services	104	El Segundo	CA
2	FederalConference.com	248.31	4.960e+07	Government Services	51	Dumfries	VA
3	The HCI Group	245.45	2.550e+07	Health	132	Jacksonville	FL
4	Bridger	233.08	1.900e+09	Energy	50	Addison	TX
5	DataXu	213.37	8.700e+07	Advertising & Marketing	220	Boston	MA
6	MileStone Community Builders	179.38	4.570e+07	Real Estate	63	Austin	TX

Rank	Name	Growth_Rate	Revenue	Industry	Employees	City	State
7	Value Payment Systems	174.04	2.550e+07	Financial Services	27	Nashville	TN
8	Emerge Digital Group	170.64	2.390e+07	Advertising & Marketing	75	San Francisco	CA
9	Goal Zero	169.81	3.310e+07	Consumer Products & Services	97	Bluffdale	UT
10	Yagoozon	166.89	1.860e+07	Retail	15	Warwick	RI

```
summary(inc)
```

```
##       Rank          Name            Growth_Rate        Revenue
##  Min.   :   1   Length:5001        Min.   :  0.340   Min.   :2.000e+06
##  1st Qu.:1252   Class :character   1st Qu.:  0.770   1st Qu.:5.100e+06
##  Median :2502   Mode  :character   Median :  1.420   Median :1.090e+07
##  Mean   :2502                      Mean   :  4.612   Mean   :4.822e+07
##  3rd Qu.:3751                      3rd Qu.:  3.290   3rd Qu.:2.860e+07
##  Max.   :5000                      Max.   :421.480   Max.   :1.010e+10
##
##    Industry           Employees           City              State
##  Length:5001        Min.   :    1.0   Length:5001        Length:5001
##  Class :character   1st Qu.:   25.0   Class :character   Class :character
##  Mode  :character   Median :   53.0   Mode  :character   Mode  :character
##                     Mean   :  232.7
##                     3rd Qu.:  132.0
##                     Max.   :66803.0
##                     NA's   :12
```

Think a bit on what these summaries mean. Use the space below to add some more relevant non-visual exploratory information you think helps you understand this data:

Taking a look at the top 10 and bottom 10 ranked companies.

```
kable((head(inc, 10)), format = 'markdown')
```

Rank	Name	Growth_Rate	Revenue	Industry	Employees	City	State
1	Fuhu	421.48	1.179e+08	Consumer Products & Services	104	El Segundo	CA
2	FederalConference.com	248.31	4.960e+07	Government Services	51	Dumfries	VA
3	The HCI Group	245.45	2.550e+07	Health	132	Jacksonville	FL
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9	Goal Zero	169.81	3.310e+07	Consumer Products & Services	97	Bluffdale	UT

Rank	Name	Growth_Rate	Revenue	Industry	Employees	City	State
10	Yagoozon	166.89	1.860e+07	Retail	15	Warwick	RI

```r
kable((tail(inc, 10)), format = 'markdown')
```

	Rank	Name	Growth_Rate	Revenue	Industry	Employees	City	State
4992	4992	Salem Metal Fabricators	0.35	7.40e+06	Manufacturing	50	Middleton	MA
4993	4993	The PI Company	0.35	2.00e+06	Business Products & Services	6	North Little Rock	AR
4994	4994	RFB Holdings	0.35	7.20e+06	Human Resources	27	Downer Grove	IL
4995	4995	Sterling Computers	0.35	1.66e+08	Government Services	98	Norfolk	NE
4996	4996	cSubs	0.34	1.34e+07	Business Products & Services	19	Montvale	NJ
4997	4997	Dot Foods	0.34	4.50e+09	Food & Beverage	3919	Mt. Sterling	IL
4998	4998	Lethal Performance	0.34	6.80e+06	Retail	8	Wellington	FL
4999	4999	ArcaTech Systems	0.34	3.26e+07	Financial Services	63	Mebane	NC
5000	5000	INE	0.34	6.80e+06	IT Services	35	Bellevue	WA
5001	5000	ALL4	0.34	4.70e+06	Environmental Services	34	Kimberton	PA

A quick look at the locations of these companies and the frequency in each state. Only 134 in my current state of Colorado, and a mere 79 in my home state of Wisconsin.

```r
kable(inc %>%
        count(State, sort = TRUE),
      format = 'markdown')
```

State	n
CA	701
TX	387
NY	311
VA	283
FL	282
IL	273
GA	212
OH	186
MA	182
PA	164
NJ	158
NC	137
CO	134
MD	131
WA	130
MI	126

State	n
AZ	100
UT	95
MN	88
TN	82
WI	79
IN	69
MO	59
AL	51
CT	50
OR	49
SC	48
OK	46
DC	43
KY	40
KS	38
LA	37
IA	28
NE	27
NV	26
NH	24
ID	17
DE	16
RI	16
ME	13
MS	12
ND	10
AR	9
HI	7
VT	6
NM	5
MT	4
SD	3
AK	2
WV	2
WY	2
PR	1

Using similar code we can look at the most common industries on the ranking.

```r
kable(inc %>%
        count(Industry, sort = TRUE),
      format = 'markdown')
```

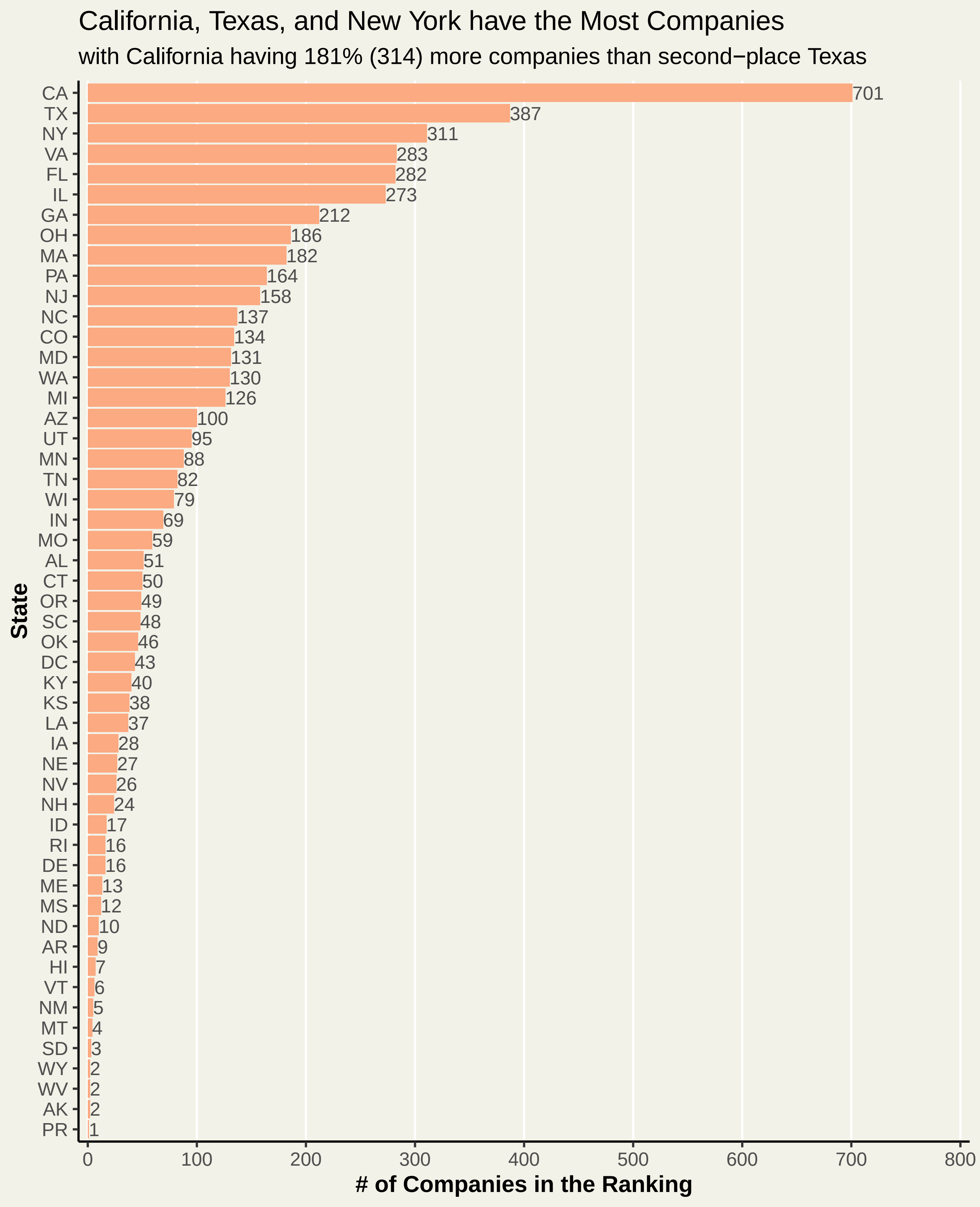
Industry	n
IT Services	733
Business Products & Services	482
Advertising & Marketing	471
Health	355
Software	342
Financial Services	260

Industry	n
Manufacturing	256
Consumer Products & Services	203
Retail	203
Government Services	202
Human Resources	196
Construction	187
Logistics & Transportation	155
Food & Beverage	131
Telecommunications	129
Energy	109
Real Estate	96
Education	83
Engineering	74
Security	73
Travel & Hospitality	62
Media	54
Environmental Services	51
Insurance	50
Computer Hardware	44

Question 1

Create a graph that shows the distribution of companies in the dataset by State (ie how many are in each state). There are a lot of States, so consider which axis you should use. This visualization is ultimately going to be consumed on a 'portrait' oriented screen (ie taller than wide), which should further guide your layout choices.

```r
# create 2-variable df of States & counts
state_freq <- inc %>% count(State, sort = TRUE)

# sort df by count so graph displays ordered and not alphabetically
state_freq$State <- factor(state_freq$State,
                  levels = state_freq$State[order(state_freq$n, decreasing = FALSE)])

# plot generation
ggplot(data = state_freq, aes(x = n, y = State)) +
  geom_col(fill=mpeach) +
  labs(title = "California, Texas, and New York have the Most Companies",
       subtitle = "with California having 181% (314) more companies than second-place Texas",
       x="# of Companies in the Ranking",
       y="State") +
  scale_x_continuous(limits = c(0, 800),
                     expand = c(.01, 0.5),
                     breaks = seq(0, 800, 100)) +
  geom_text(
    aes(x = n, label = n),
    size = 3,
    color = mgray, hjust = 0) +
  my_plot_theme
```

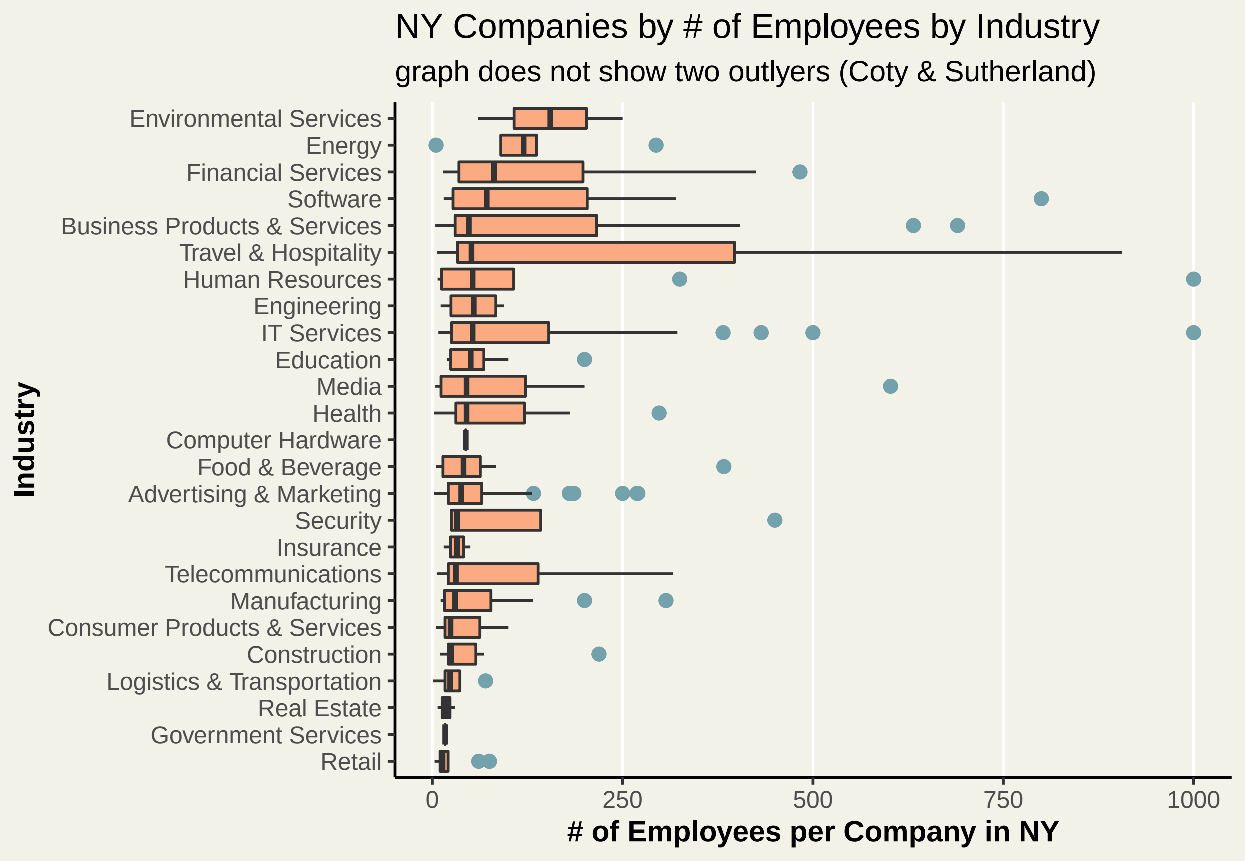


Quesiton 2

Lets dig in on the state with the 3rd most companies in the data set. Imagine you work for the state and are interested in how many people are employed by companies in different industries. Create a plot that shows the average and/or median employment by industry for companies in this state (only use cases with full data, use R's `complete.cases()` function.) In addition to this, your graph should show how variable the ranges are, and you should deal with outliers.

Showing a boxplot for each industry is the best way to see the median employment level as well as the range. This dataset had one moderate outlier and one extreme outlier that I acknowledged were cutoff in the subtitle to the graph. I'd argue a healthy supplement to this graph would be a table showing the n's for each industry, which I produced below. For example, while Environmental Services appears to have the highest median number of employees, it's from a sample of only 2 companies.

```
# filter for just NY data
# filter for complete cases (they all were w/o NAs)
# plot to show median across industries in NY

inc %>%
  filter(State == "NY", complete.cases(.)) %>%
  ggplot(aes(x = reorder(Industry, Employees, median), y = Employees)) +
    geom_boxplot(fill = mpeach, outlier.color = mteal, outlier.size = 2) +
    coord_flip() +
    labs(title = "NY Companies by # of Employees by Industry",
       subtitle = "graph does not show two outlyers (Coty & Sutherland)",
       x="Industry",
       y="# of Employees per Company in NY") +
    ylim(NA, 1000) +
    my_plot_theme
```



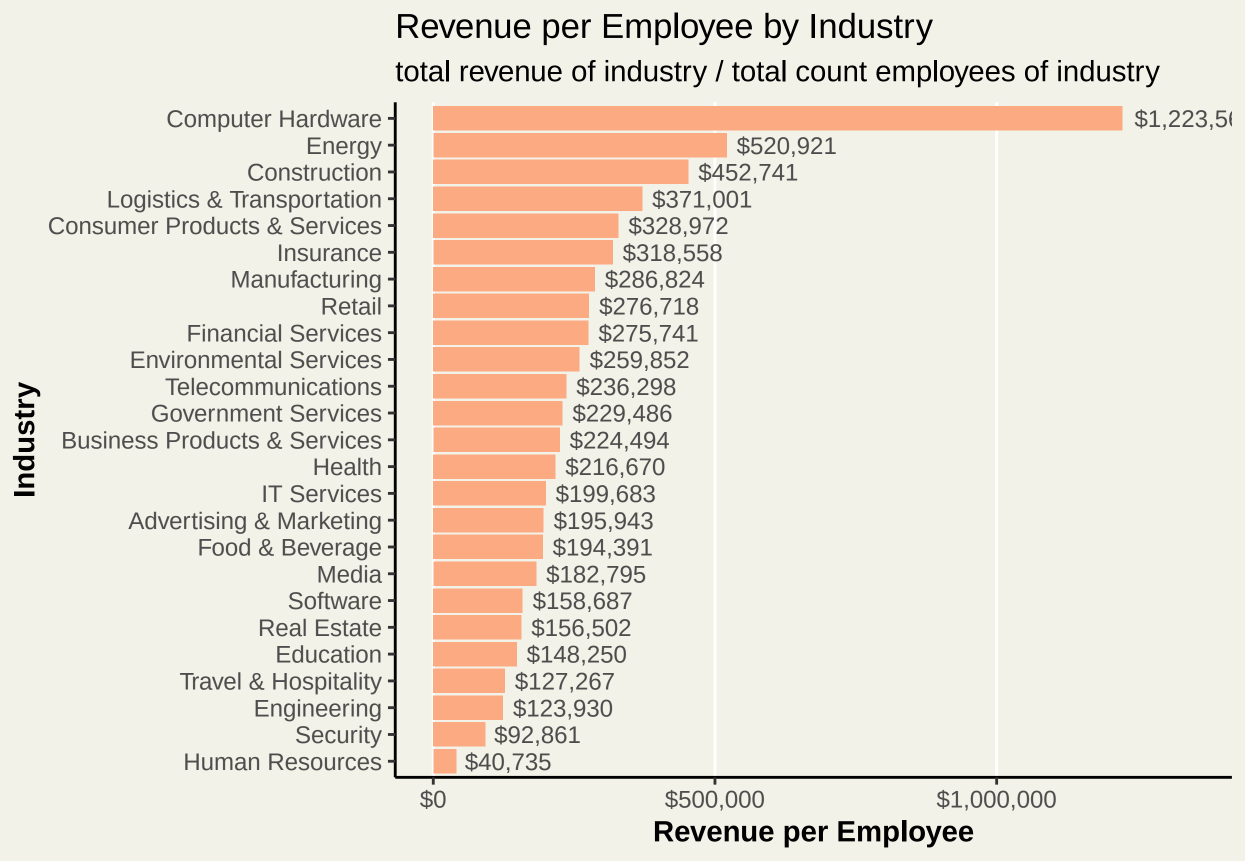
```
# show counts sorted high to low of companies within each industry in NY

kable(inc %>%
  filter(State == "NY") %>%
  count(Industry, sort = TRUE),
  format = 'markdown')
```

Industry	n
Advertising & Marketing	57
IT Services	43
Business Products & Services	26
Consumer Products & Services	17
Telecommunications	17
Education	14
Retail	14
Financial Services	13
Health	13
Manufacturing	13
Software	13
Human Resources	11
Media	11
Food & Beverage	9
Travel & Hospitality	7
Construction	6
Energy	5
Engineering	4
Logistics & Transportation	4
Real Estate	4
Security	4
Environmental Services	2
Insurance	2
Computer Hardware	1
Government Services	1

Question 3

Now imagine you work for an investor and want to see which industries generate the most revenue per employee. Create a chart that makes this information clear. Once again, the distribution per industry should be shown.

```
inc %>%
  filter(complete.cases(.)) %>%
  group_by(Industry) %>%
    summarize(rev_tot = sum(Revenue), emp_tot = sum(Employees)) %>%
    mutate(rev_per_emp = rev_tot/emp_tot) %>%
  ggplot(aes(x = reorder(Industry, rev_per_emp), y = rev_per_emp)) +
    geom_bar(stat = "identity", fill = mpeach) +
    coord_flip() +
    labs(title = "Revenue per Employee by Industry",
       subtitle = "total revenue of industry / total count employees of industry",
       x = "Industry",
       y = "Revenue per Employee") +
    scale_y_continuous(limits = c(0, 1350000),
                       labels = scales::label_dollar()) +
    geom_text(aes(label = currency(rev_per_emp, digits = 0L)),
              size=3,
              color = mgray,
              hjust = -0.1) +
    my_plot_theme
```


Revenue per Employee by Industry
total revenue of industry / total count employees of industry
Industry
Computer Hardware
Energy
Construction
Logistics & Transportation
Consumer Products & Services
Insurance
Manufacturing
Retail
Financial Services
Environmental Services
Telecommunications
Government Services
Business Products & Services
Health
IT Services
Advertising & Marketing
Food & Beverage
Media
Software
Real Estate
Education
Travel & Hospitality
Engineering
Security
Human Resources
$1,223,5
$520,921
$452,741
$371,001
$328,972
$318,558
$286,824
$276,718
$275,741
$259,852
$236,298
$229,486
$224,494
$216,670
$199,683
$195,943
$194,391
$182,795
$158,687
$156,502
$148,250
$127,267
$123,930
$92,861
$40,735
$0
$500,000
$1,000,000
Revenue per Employee