Demo RStudio and EDA

Exercise 8 from ISLR Chapter 2

The following illustrate commands for exploring this exercise using R and various packages for the `Collage` data.

Libraries

Try to load the `ISLR` library

```
library(ISLR) #load the library
```

If it is not available you will need to install the library from CRAN. Click on *Packages* then *Install*. Enter the package name then click on the Install button.

You can also install from the console/command line using `install.packages("ISLR")`.

Ready?

Getting the College data

Next we will need to load the dataset. This is part of the library so we will not need to read it in using `read.csv` but rather we will use the `data` function to load it from the library.

```
data(College)
```

This loads the dataframe `College`. Note you can always see the content of any `R` object by simply typing its name.

For information about the variables, read the text or enter

```
help(College)
```

The info will appear in the `help` tab.

To see explore the data, you can use the command `View(College)`.

This will open a new tab, where you may scroll left and right to look at the rows and columns. In the `View` you should see that the first column is the College/University name. These can be extracted using `rownames(College)`. Let's print out the first 5

```
rownames(College)[1:5]
```

```
## [1] "Abilene Christian University" "Adelphi University"
## [3] "Adrian College"               "Agnes Scott College"
## [5] "Alaska Pacific University"
```

Summary

```
summary(College)
```

```
##  Private        Apps           Accept          Enroll       Top10perc
##  No :212   Min.   :   81   Min.   :   72   Min.   :  35   Min.   : 1.00
##  Yes:565   1st Qu.:  776   1st Qu.:  604   1st Qu.: 242   1st Qu.:15.00
```

```
##            Median : 1558   Median : 1110   Median : 434   Median :23.00
##            Mean   : 3002   Mean   : 2019   Mean   : 780   Mean   :27.56
##            3rd Qu.: 3624   3rd Qu.: 2424   3rd Qu.: 902   3rd Qu.:35.00
##            Max.   :48094   Max.   :26330   Max.   :6392   Max.   :96.00
##    Top25perc      F.Undergrad     P.Undergrad         Outstate
##  Min.   :  9.0   Min.   :  139   Min.   :    1.0   Min.   : 2340
##  1st Qu.: 41.0   1st Qu.:  992   1st Qu.:   95.0   1st Qu.: 7320
##  Median : 54.0   Median : 1707   Median :  353.0   Median : 9990
##  Mean   : 55.8   Mean   : 3700   Mean   :  855.3   Mean   :10441
##  3rd Qu.: 69.0   3rd Qu.: 4005   3rd Qu.:  967.0   3rd Qu.:12925
##  Max.   :100.0   Max.   :31643   Max.   :21836.0   Max.   :21700
##    Room.Board       Books           Personal         PhD
##  Min.   :1780   Min.   :  96.0   Min.   : 250   Min.   :  8.00
##  1st Qu.:3597   1st Qu.: 470.0   1st Qu.: 850   1st Qu.: 62.00
##  Median :4200   Median : 500.0   Median :1200   Median : 75.00
##  Mean   :4358   Mean   : 549.4   Mean   :1341   Mean   : 72.66
##  3rd Qu.:5050   3rd Qu.: 600.0   3rd Qu.:1700   3rd Qu.: 85.00
##  Max.   :8124   Max.   :2340.0   Max.   :6800   Max.   :103.00
##     Terminal       S.F.Ratio      perc.alumni        Expend
##  Min.   : 24.0   Min.   : 2.50   Min.   : 0.00   Min.   : 3186
##  1st Qu.: 71.0   1st Qu.:11.50   1st Qu.:13.00   1st Qu.: 6751
##  Median : 82.0   Median :13.60   Median :21.00   Median : 8377
##  Mean   : 79.7   Mean   :14.09   Mean   :22.74   Mean   : 9660
##  3rd Qu.: 92.0   3rd Qu.:16.50   3rd Qu.:31.00   3rd Qu.:10830
##  Max.   :100.0   Max.   :39.80   Max.   :64.00   Max.   :56233
##    Grad.Rate
##  Min.   : 10.00
##  1st Qu.: 53.00
##  Median : 65.00
##  Mean   : 65.46
##  3rd Qu.: 78.00
##  Max.   :118.00
```

Dimensions of Data

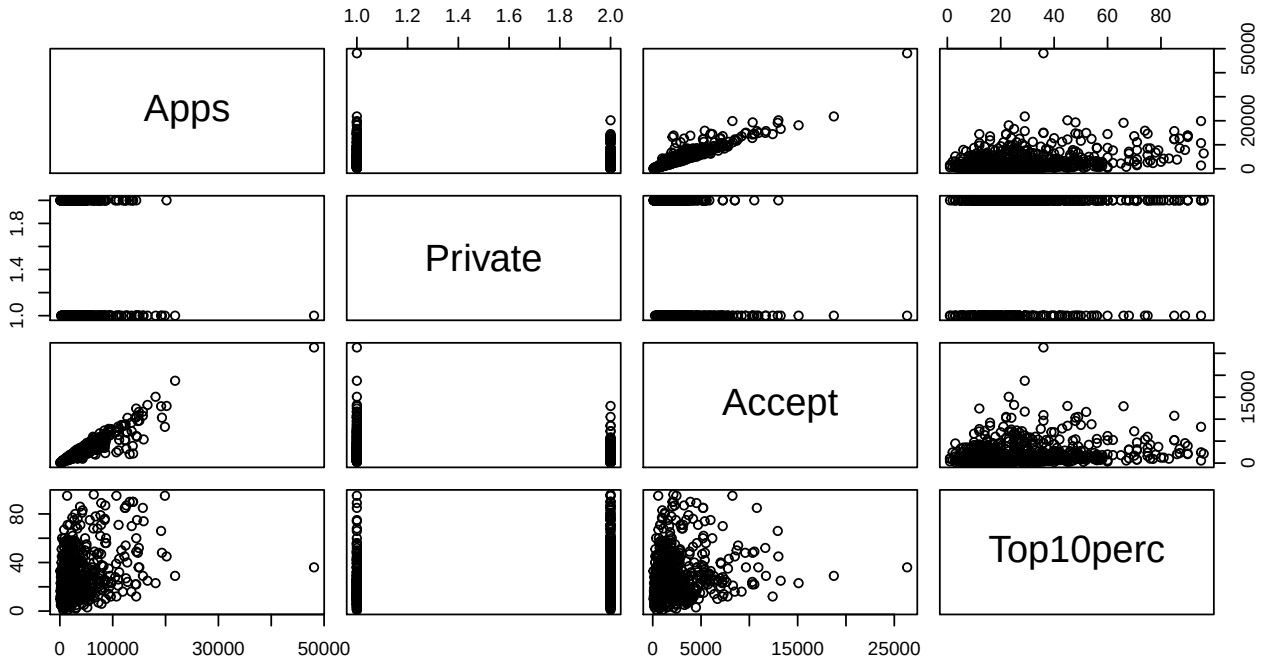
How many observations and variables are in the dataframe?

Suppose we want to refer to those numbers in the text. We can extract them using n = 777 and d = 18. Look at the code to see how we extracted them

Scatter plot matrices

There `base R` version of scatter plot matrices is obtained using the `pairs` function to plot all variables versus each other. We can use subsetting of columns of the dataframe to look at the first 5 columns.

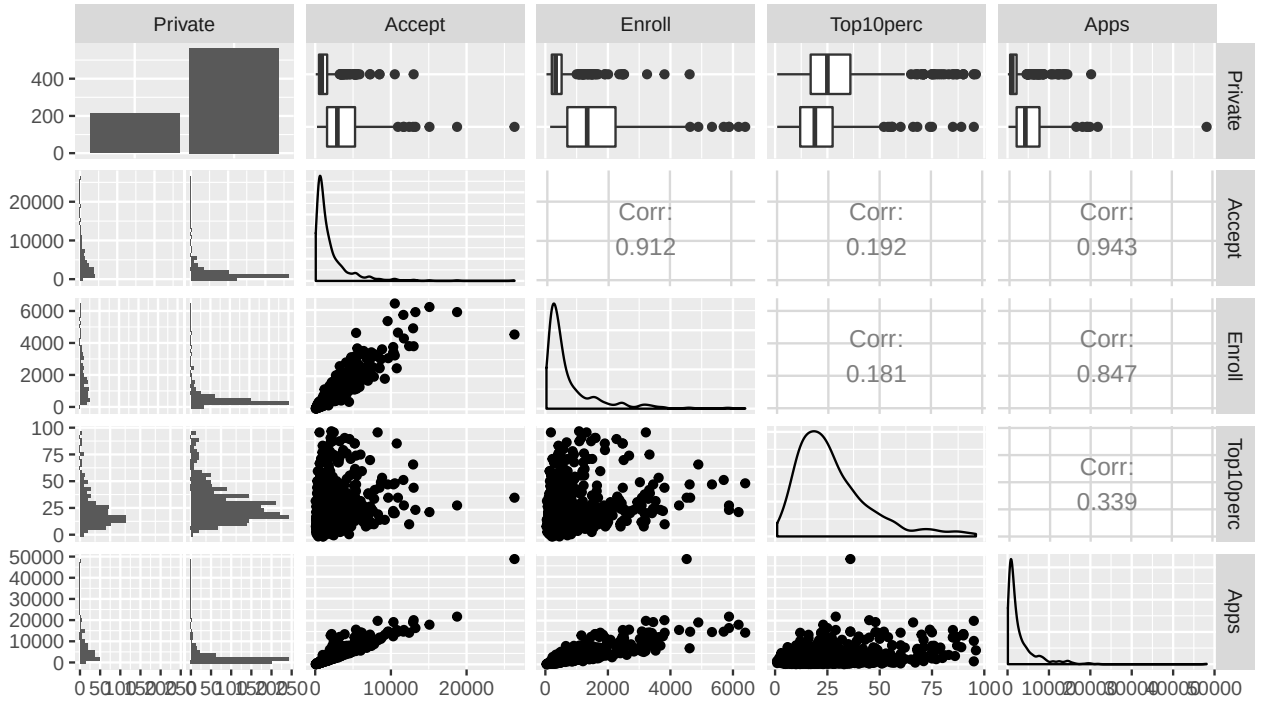
```
pairs(College[, c(2,1,3,5)])
```




```
#pairs(Apps ~ Private + Accept + Enroll + Top10perc, data~college)
```

We can also look at this using the `ggpairs` function. Install the library `GGally` if it is not available (and any dependent libraries) and load it.

```
library(GGally)
ggpairs(College, columns= c(1,3:5, 2))
```



Energetic Students: how do I suppress the message output so that it does not appear in my document ? Post

on Piazza if you know or make a pull request!

The `ggpairs` function realizes that the variable `Private` is categorial and plots side by side histograms. The density plots are also useful for seeing the skewness in the marginal distributions.

What other features do these plots indicate? *(Think about assumptions for linear regression)*

New variables

Let's create a new variable `Elite` by binning the `Top10perc` variable. We are going to divide universities into two groups based on whether or not the proportion of students coming from the top 10% of their high school classes exceeds 50 %. We will use the library `dplyr` to illustrate some of the possible transformations and the idea of pipes, which are quite powerful once you get the hang of them!

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following object is masked from 'package:GGally':
##
##     nasa
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:lubridate':
##
##     intersect, setdiff, union
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
College = College %>%
  mutate(Elite = factor(Top10perc > 50)) %>%
  mutate(Elite =
           recode(Elite, 'TRUE' = "Yes", 'FALSE'="No"))
```

What is the above doing? Document the code here.

Compare to the base `R` code:

```
Elite=rep("No",nrow(College))
Elite[College$Top10perc >50]="Yes"
Elite=as.factor(Elite)
college=data.frame(College ,Elite)
```

How many Elite universities are there?

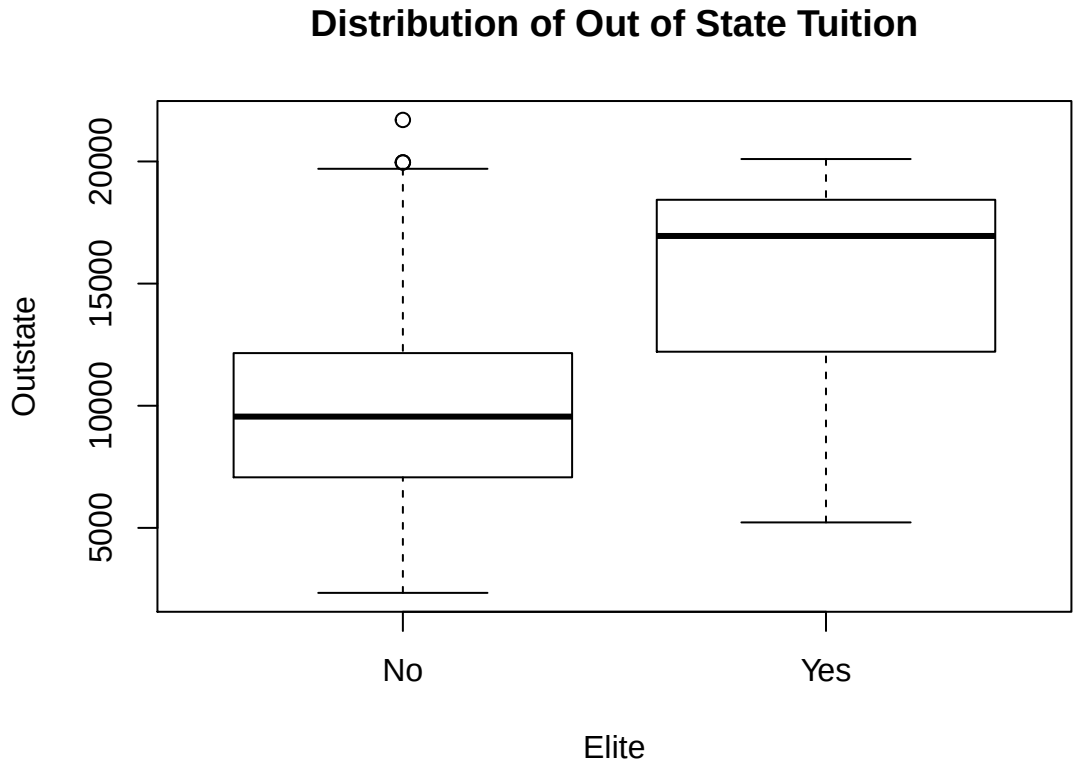
```
summary(College$Elite)
```

```
##  No Yes
## 699  78
```

Side by Side Boxplots

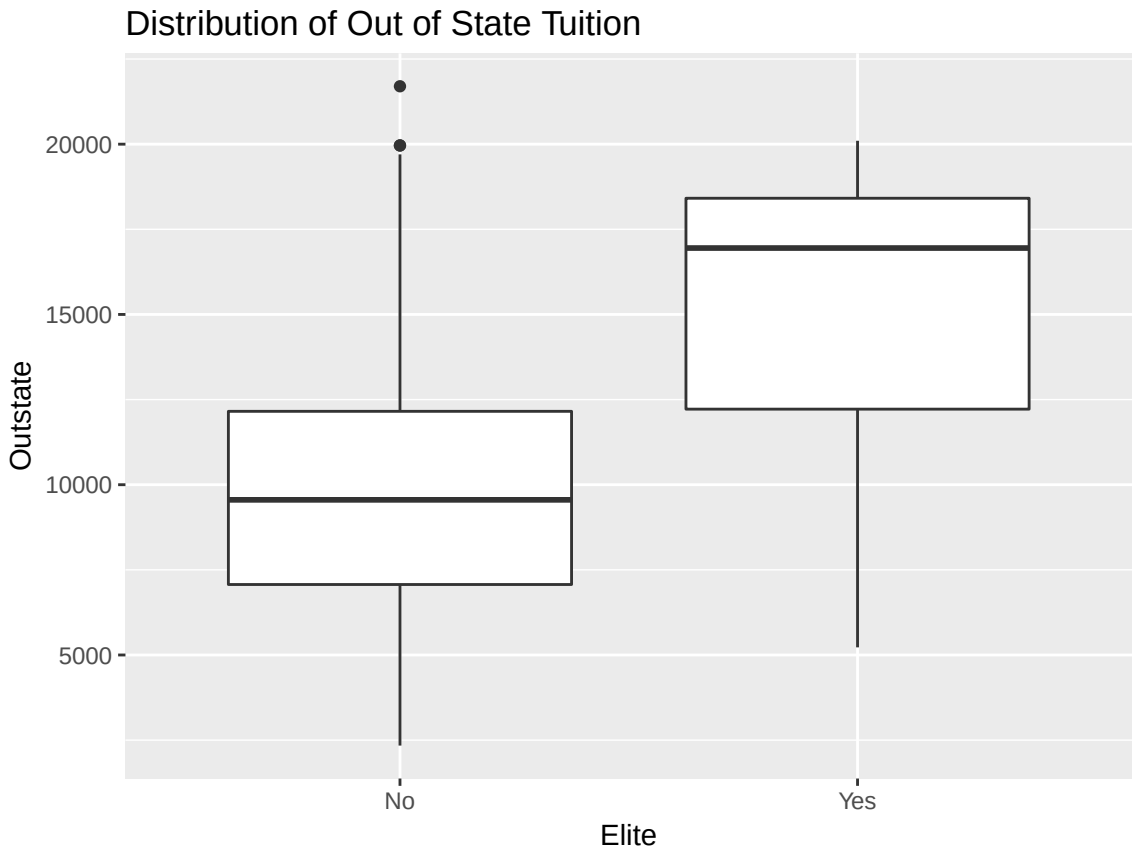
Let's plot the variable `Outstate` versus `Elite` using side-by-side boxplots. Using `base R` we would enter

```r
boxplot(Outstate ~ Elite, data=College,
        ylab="Outstate", xlab="Elite")
title("Distribution of Out of State Tuition")
```



Now for the ggplot version:

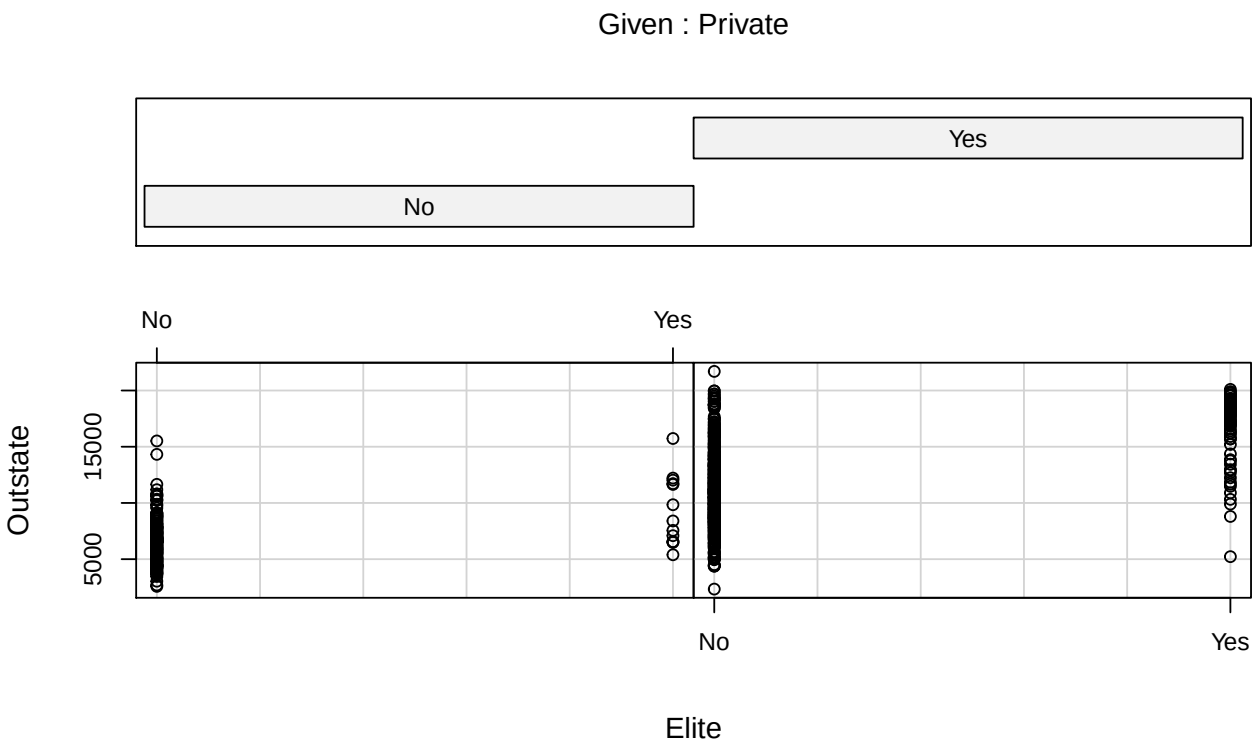
```r
library(ggplot2)
my.bp <<-ggplot(data=College, aes(y= Outstate, x=Elite)) # Creates boxplots
my.bp <- my.bp + geom_boxplot() # Adds color
my.bp <- my.bp + ggtitle("Distribution of Out of State Tuition") # Adds a title
my.bp <- my.bp +  ylab("Outstate") + xlab("Elite") # Adds lables for axes
my.bp # displays the boxplots
```



Conditional Plots

Let's look at the distribution of Out of state tuition versus Elite status for Private versun Public universities using *conditional plots*

```
coplot(Outstate ~ Elite | Private, data=College)
```



Energetic Student: Please improve upone the above plot using ggplot and post to Piazza or issue a pull request

Next Steps

Update this document and explore the other variables thinking about the objective of predicting `Apps`. Provide a brief summary of what you discover thinking about models to predict `Apps`.