Homework 1

Prepare your answers as a **single PDF file**.
Group work: You may work in groups of 1-3. Include all group member names in the PDF file. You may work with students in both sections (375-01, -02). Only one person in the group should submit to Canvas.
Due: check on Canvas.

1. Use the in-built dataset, `mtcars`, for this problem. Write code to (**for each question, give (1) the code and (2) the output)**:

a. Get number of rows (Hint: nrow)

```
> nrow(mtcars)

[1] 32
```

b. Get number of columns (Hint: ncol)

```
> ncol(mtcars)
[1] 11
```

c. Get datatype of the `disp` column (Hint: class)

```
> class(mtcars$disp)
[1] "numeric"
```

d. What is the unit of the `disp` column? (Hint: see help)

```
help(mtcars)
```

```
[, 3] disp Displacement (cu.in.)
```

e. Show first 10 rows

```
> mtcars[1:10,]
                   mpg cyl  disp  hp drat    wt  qsec vs am gear carb
Mazda RX4         21.0   6 160.0 110 3.90 2.620 16.46  0  1    4    4
Mazda RX4 Wag     21.0   6 160.0 110 3.90 2.875 17.02  0  1    4    4
Datsun 710        22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
Hornet 4 Drive    21.4   6 258.0 110 3.08 3.215 19.44  1  0    3    1
Hornet Sportabout 18.7   8 360.0 175 3.15 3.440 17.02  0  0    3    2
Valiant           18.1   6 225.0 105 2.76 3.460 20.22  1  0    3    1
Duster 360        14.3   8 360.0 245 3.21 3.570 15.84  0  0    3    4
Merc 240D         24.4   4 146.7  62 3.69 3.190 20.00  1  0    4    2
Merc 230          22.8   4 140.8  95 3.92 3.150 22.90  1  0    4    2
Merc 280          19.2   6 167.6 123 3.92 3.440 18.30  1  0    4    4
```

f. Show every other row (i.e., 1st, 3rd, 5th, …) (Hint: seq)

```
> mtcars[seq(1,32,by=2),]
                                mpg cyl  disp  hp drat    wt  qsec vs am gear carb
```

```
Mazda RX4         21.0   6 160.0 110 3.90 2.620 16.46  0  1    4    4
Datsun 710        22.8   4 108.0  93 3.85 2.320 18.61  1  1    4    1
Hornet Sportabout  18.7   8 360.0 175 3.15 3.440 17.02  0  0    3    2
Duster 360        14.3   8 360.0 245 3.21 3.570 15.84  0  0    3    4
Merc 230          22.8   4 140.8  95 3.92 3.150 22.90  1  0    4    2
Merc 280C         17.8   6 167.6 123 3.92 3.440 18.90  1  0    4    4
Merc 450SL        17.3   8 275.8 180 3.07 3.730 17.60  0  0    3    3
Cadillac Fleetwood 10.4   8 472.0 205 2.93 5.250 17.98  0  0    3    4
Chrysler Imperial  14.7   8 440.0 230 3.23 5.345 17.42  0  0    3    4
Honda Civic       30.4   4  75.7  52 4.93 1.615 18.52  1  1    4    2
Toyota Corona      21.5   4 120.1  97 3.70 2.465 20.01  1  0    3    1
AMC Javelin       15.2   8 304.0 150 3.15 3.435 17.30  0  0    3    2
Pontiac Firebird   19.2   8 400.0 175 3.08 3.845 17.05  0  0    3    2
Porsche 914-2      26.0   4 120.3  91 4.43 2.140 16.70  0  1    5    2
Ford Pantera L     15.8   8 351.0 264 4.22 3.170 14.50  0  1    5    4
Maserati Bora      15.0   8 301.0 335 3.54 3.570 14.60  0  1    5    8
```

g. What is the mean `mpg` value

```
> mean(mtcars$mpg)
[1] 20.09062
```

h. Show all rows where the number of cylinders is 6

```
> which(mtcars$cyl==6,)
[1]  1  2  4  6 10 11 30
```

i. Show all rows where its mpg is lower than the mean mpg value

```
mn <-mean(mtcars$mpg)
> mn
[1] 20.09062
> which(mtcars$mpg < mn)
 [1]  5  6  7 10 11 12 13 14 15 16 17 22 23 24 25 29 30 31
```

j. What is the horsepower of the car with the highest mpg (code should show only the horsepower value)?

```
> max(mtcars$mpg)
[1] 33.9
mtcars$hp[which.max(mtcars$mpg)]
[1] 65
```

2. Consider the answer posted to Quora.com to "Why is R great for Data Science?. Answer **one** of the following questions.

The author lists 5 parts of the R ecosystem, the 5th being "community". Write 4-5 sentences about any one online community where members discuss R. (Include the

URL, how active is the community, what types of people post here, how “friendly” it is to newcomers, etc.)

According to “Why is R great for Data Science”, one of the main 5 benefits of using R is its’ pleasurable/social element of R users. By examining some communities, which discuss R language I found a Stack overflow “Questions tagged [r]” and realized that community is friendly in deed. There are lots of questions asked and answered in kindly manner, people try to help each other and make improvements. There are also plenty of tutorials for humans to get familiar with new features of R as well as plenty of code snippets on how to do the code correctly or/and fix your bugs.

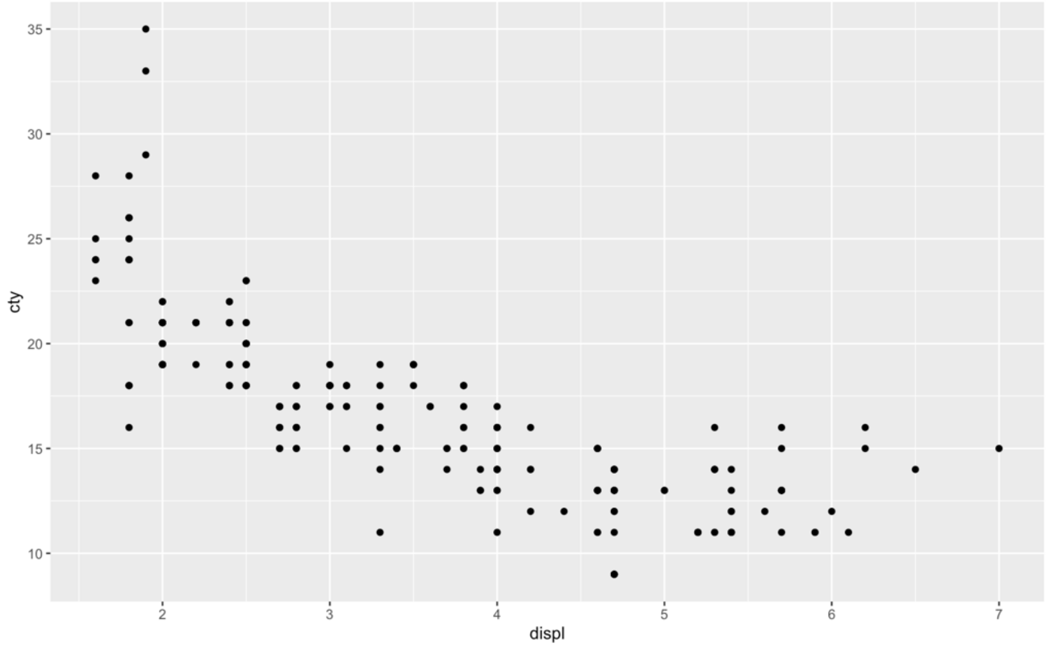
https://stackoverflow.com/questions/tagged/r?tab=Newest

OR (if you know Python)
The author says “Note that in python, data frame manipulation will require numpy and pandas external packages (and the syntax is more cumbersome)”. Do you agree with this statement? Justify your answer in 4-5 sentences.

3. Installing `ggplot2` also installs some datasets, including the `mpg` dataset (see help(mpg) for a description of the data). Generate the following graphs from the `mpg` dataset. All plots should use **`ggplot`**. Include **both** the R code and paste the plot as an image.

a. Plot a scatterplot of variables `displ` and `cty`.

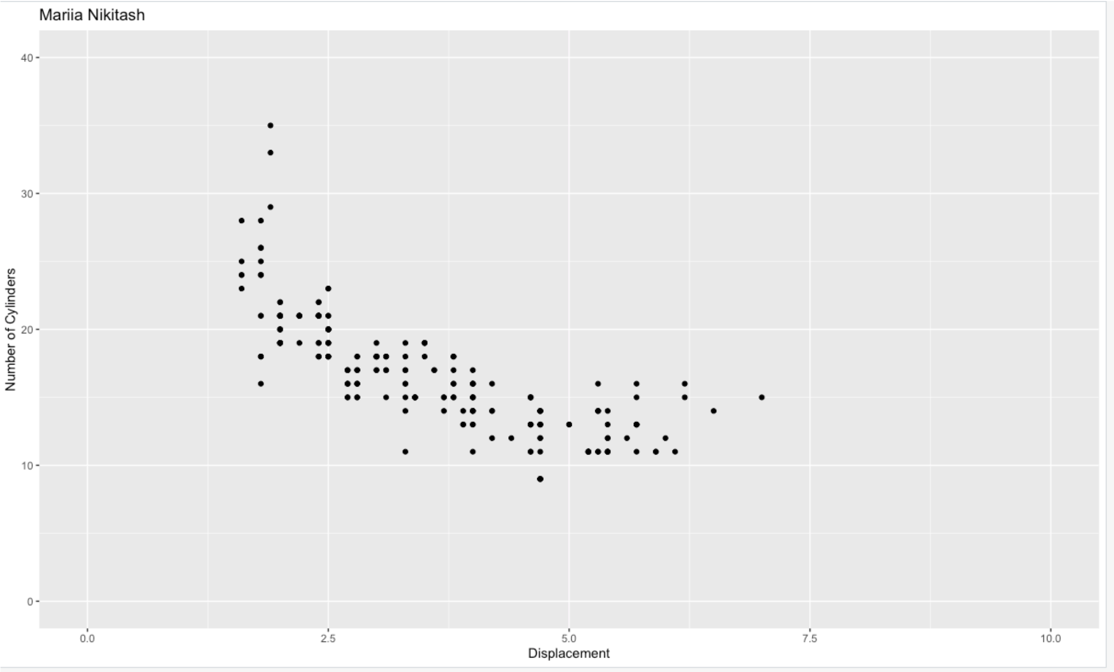
```
ggplot(mpg, aes(displ,cty)) + geom_point()
```



b. Redraw the previous scatterplot but also add all these:

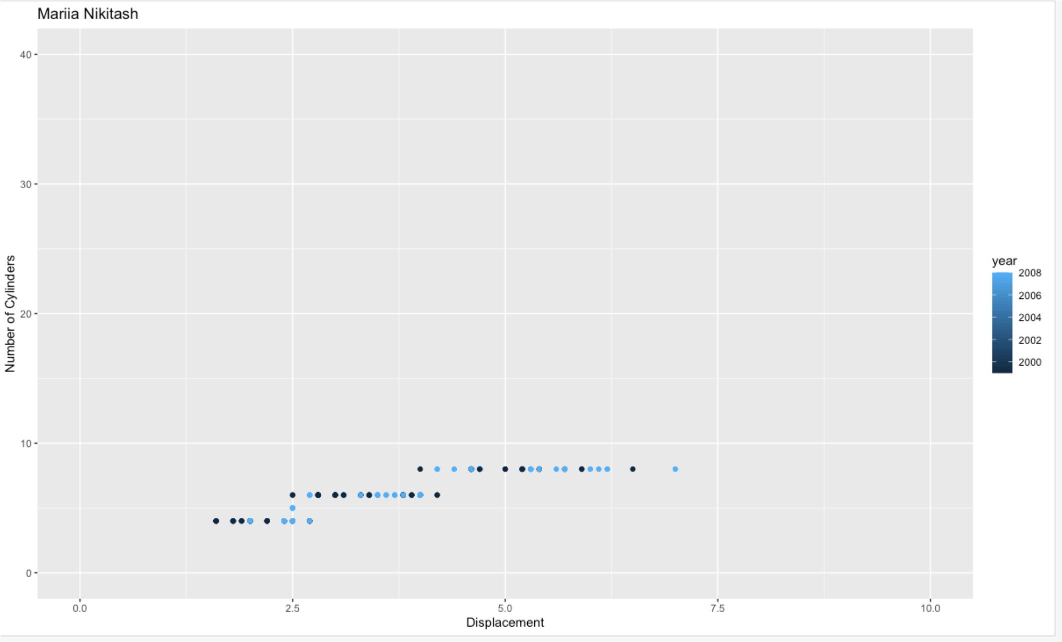
- more descriptive x and y-axis labels,
- a title that should be the names of all group members, and
- set `cty` limits to (0,40) and `displ` limits to (0,10).

```
ggplot(mpg)+geom_point(mapping=aes(displ,cty))+labs(x="Displacement",y="Number of Cylinders",title="Mariia Nikitash")+xlim(0,10)+ylim(0,40)
```



c. Plot a scatterplot of variables `displ` and `cty`. Show variable `year` also.

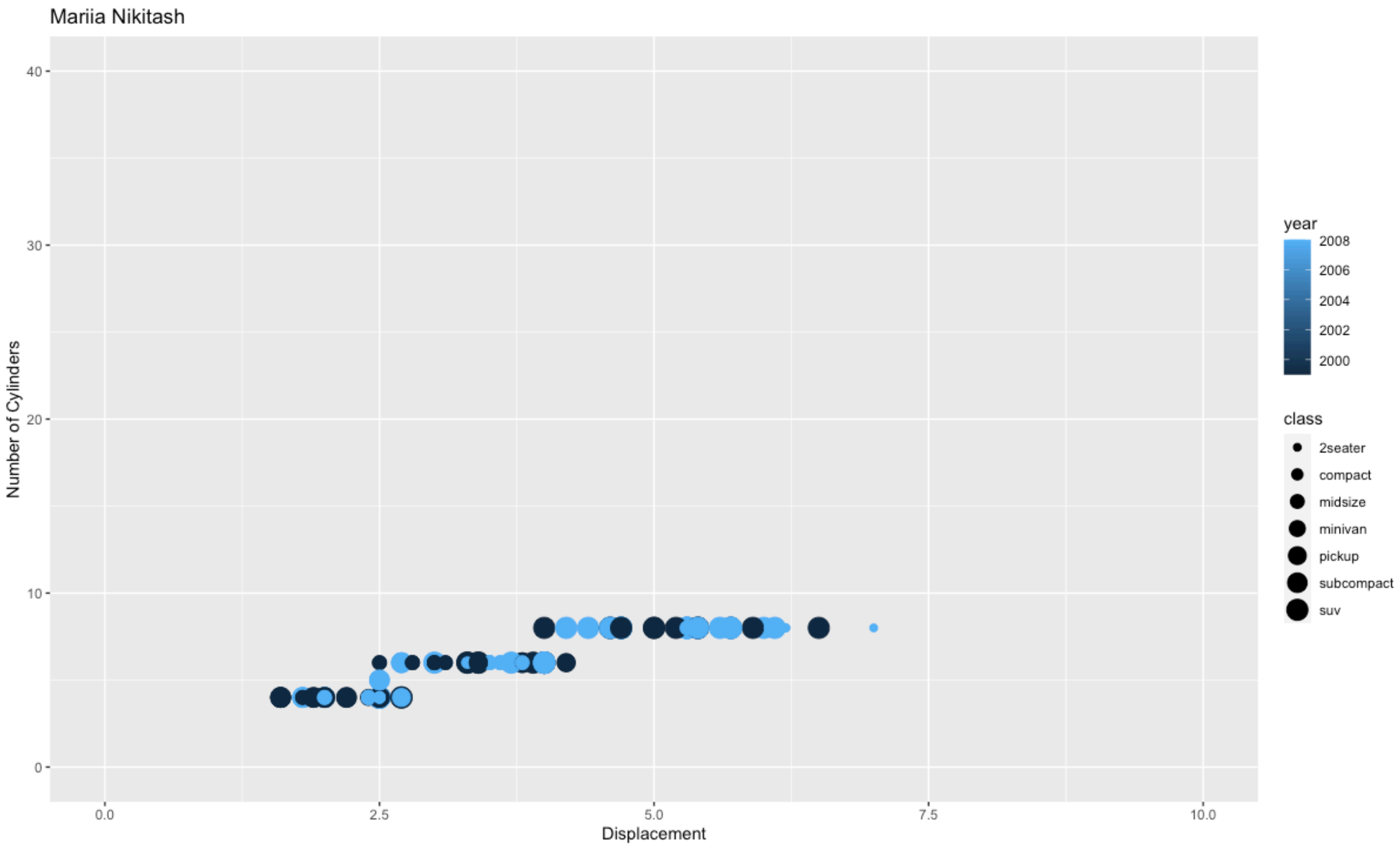
```
ggplot(mpg)+geom_point(mapping=aes(x = displ, y = cyl, color=year))+labs(x="Displacement",y="Number of Cylinders",color="year",title="Mariia Nikitash")+xlim(0,10)+ylim(0,40)
```



d. Plot a scatterplot of variables `displ` and `cty`. Show variables `year` and `class` also.

- Hint: There are different ways of doing this using the multiple “aesthetics” of geom_point

```
ggplot(mpg)+geom_point(mapping=aes(x = displ, y = cyl, color=year,
size=class))+labs(x="Displacement",y="Number of Cylinders",color="year",title="Mariia
Nikitash")+xlim(0,10)+ylim(0,40)
```


Mariia Nikitash
Number of Cylinders
40
30
20
10
0
0.0
2.5
5.0
7.5
10.0
Displacement
year
2008
2006
2004
2002
2000
class
● 2seater
● compact
● midsize
● minivan
● pickup
● subcompact
● suv