

# PSTAT 231 HW1

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## Answer1.

Supervised learning is one-to-one maps 1 inputs to 1 output

Unsupervised learning can discover patterns in data sets without human intervention(labeling)

The difference between them is that supervised learning needs labeling but unsupervised learning *doesn't* need labeling.

## Answer2.

Regression takes Quantitative data

Classification takes qualitative data

## Answer3.

For Regression ML, the metrics are MSE&RMSE

For Classification ML, the metrics are F-1 score and AUC-ROC

## Answer4.

Descriptive model: Chose model best emphasize trend visually

Inferentialmodel: To test theories, state relationship between outcome and predictor

Predicative model: Predict Y with minimal error

## Answer5.

-Mechanistic is parametric

Empirically-driven is non-parametric.

-Mechanistic has less flexibility and needs assumptions. Latter does not need those things both of them can be over fitting.

-Mechanistic can be easier to be understood b/c it has less flexibility.

-Bias-Variance trade off depends on flexibility of the methods, higher flexibility means low bias-variance trade off. One can expect mechanistic to have higher bias compare to empirically-driven model.

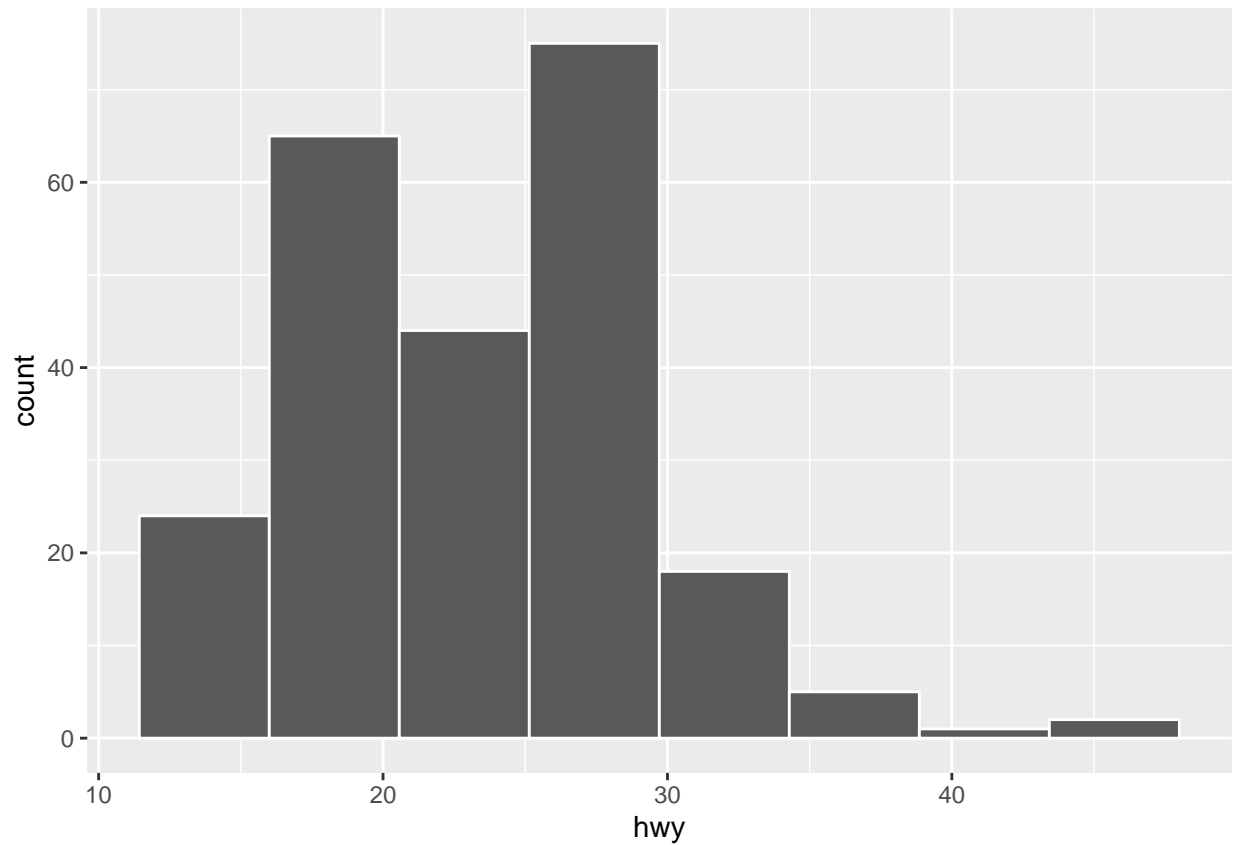
## Answer6.

-Inferential. Assume voters in favor of candidate then use informational method to test if we accept  $H_0$

-Predictive, b/c there is no assumption to be made.

## Exercise 1

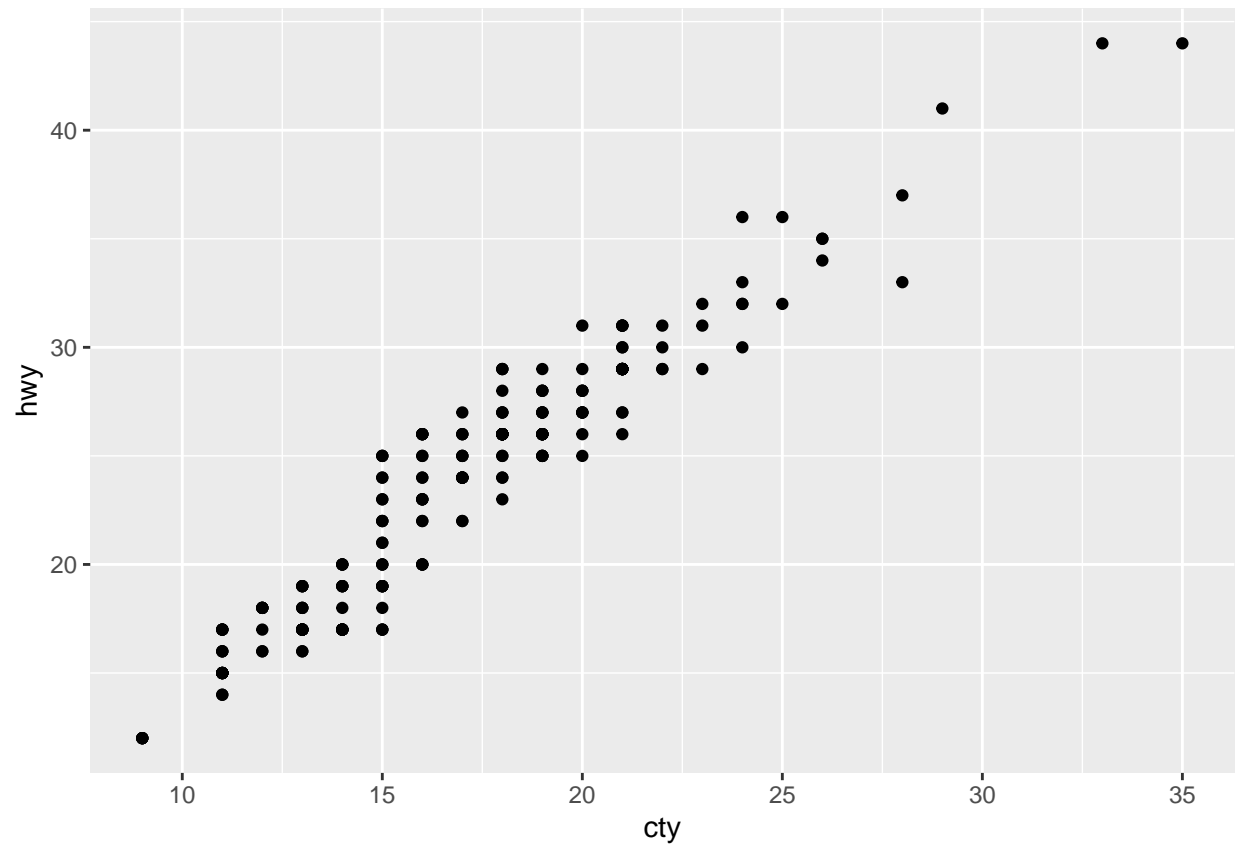
```
library(ggplot2)
ggplot(mpg, aes(hwy)) +
  geom_histogram(bins=8,color="white")
```



Most cars have highway fuel efficiency around 25~30mpg

##Exercise 2

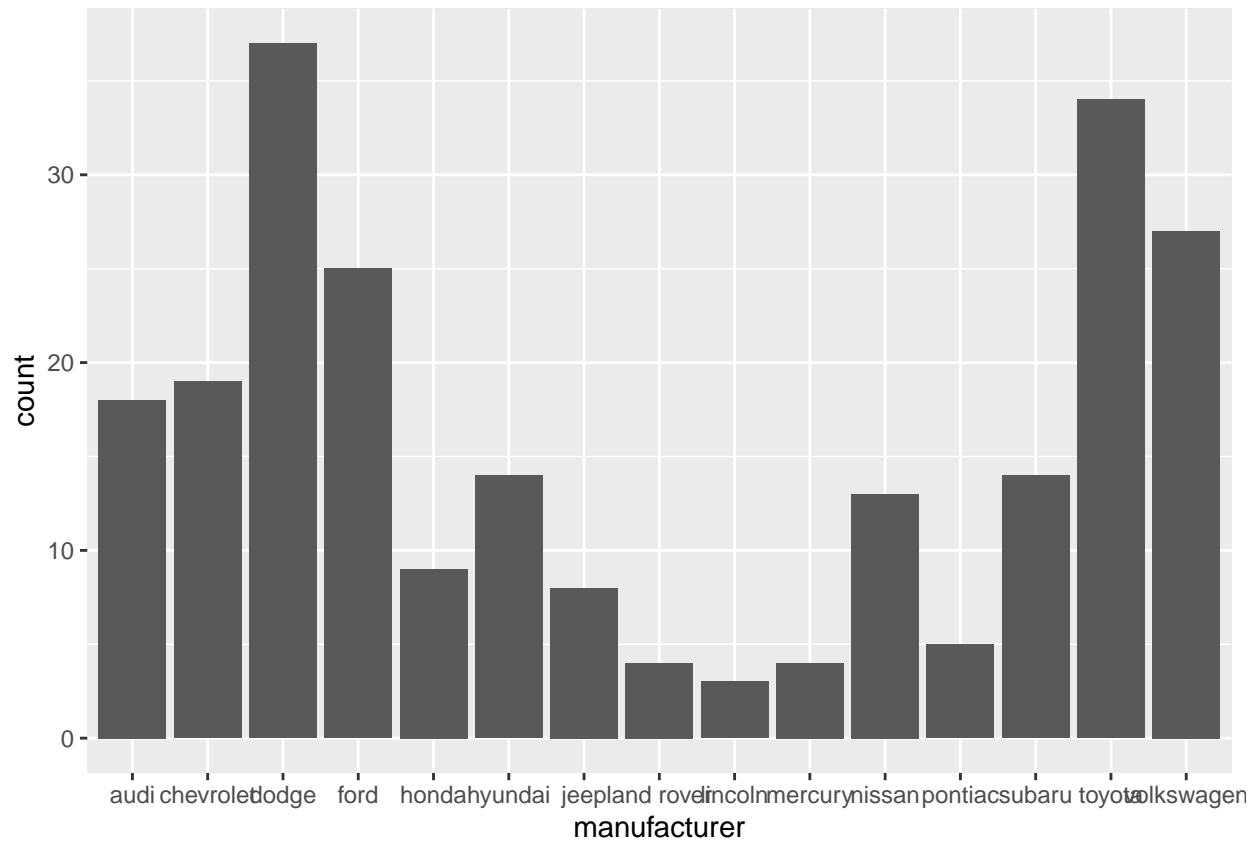
```
library(ggplot2)
ggplot(data = mpg) +
  geom_point(mapping = aes(x = cty, y = hwy))
```



higher city fuel efficiency higher highway efficiency

### Exercise 3

```
ggplot(data = mpg) +  
  stat_count(mapping = aes(x = manufacturer))
```



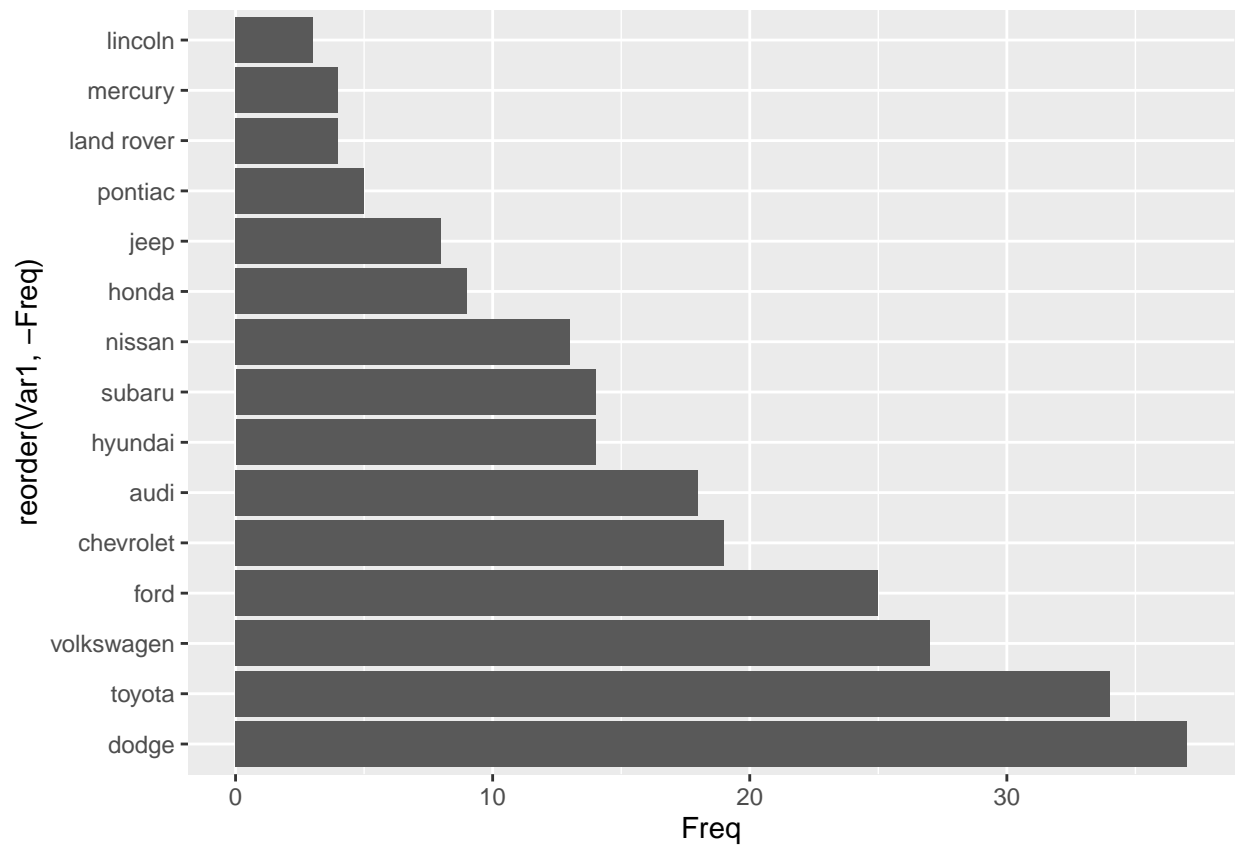
## Exercise 4

```
a <- ggplot2::mpg
a <- as.data.frame(table(a$manufacturer))

a$Var1 = as.character(a$Var1)
a
```

```
##      Var1 Freq
## 1     audi   18
## 2  chevrolet  19
## 3     dodge  37
## 4      ford  25
## 5     honda   9
## 6   hyundai  14
## 7     jeep   8
## 8 land rover   4
## 9   lincoln   3
## 10  mercury   4
## 11    nissan  13
## 12  pontiac   5
## 13   subaru  14
## 14   toyota  34
## 15 volkswagen 27
```

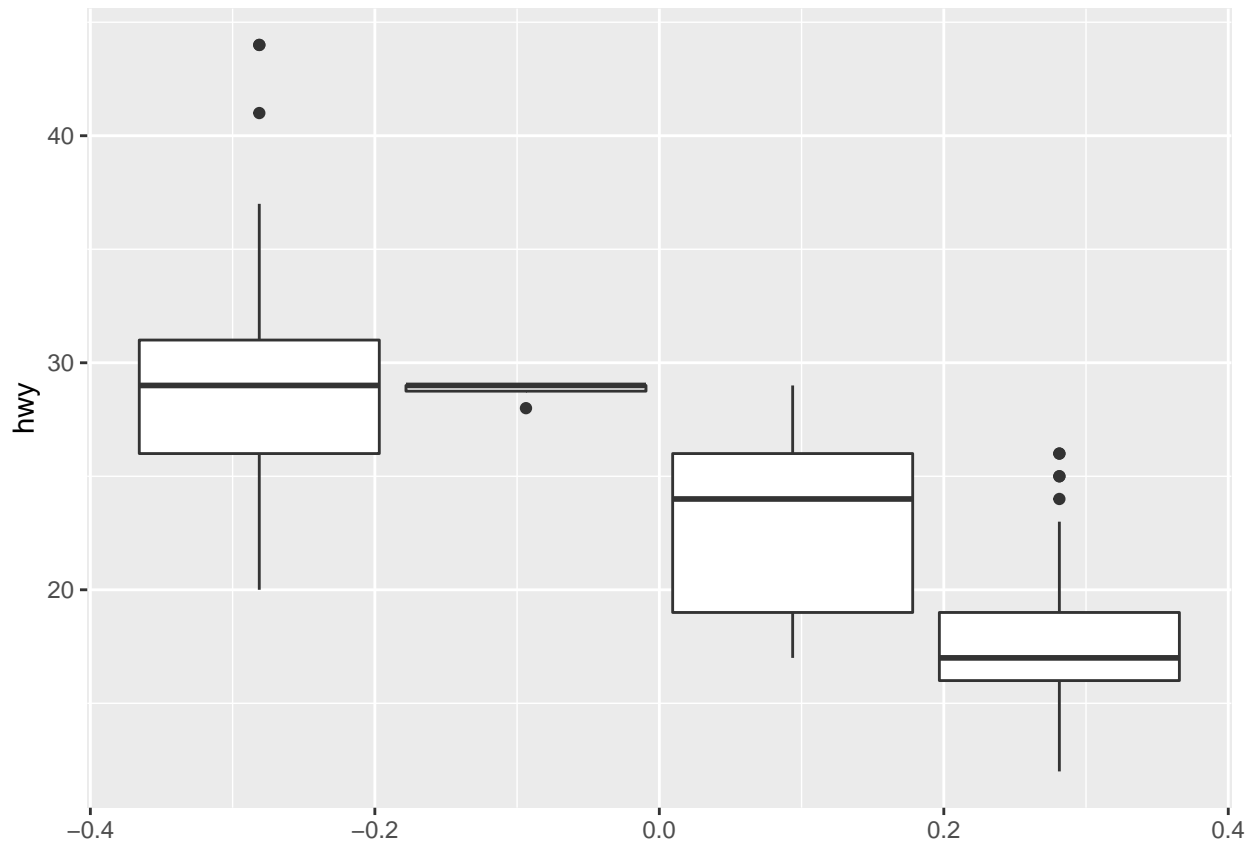
```
p2 <- ggplot(a, aes(x = reorder(Var1, -Freq), y = Freq)) +  
  geom_bar(stat = 'identity')+coord_flip()  
p2
```



Dodge makes most car

## Exercise 5

```
ggplot(data = mpg, mapping = aes(group=cyl, y = hwy)) +  
  geom_boxplot()
```



less number of cyl , higher mpg on highway

### Exercise 6

```
library(tidyverse)

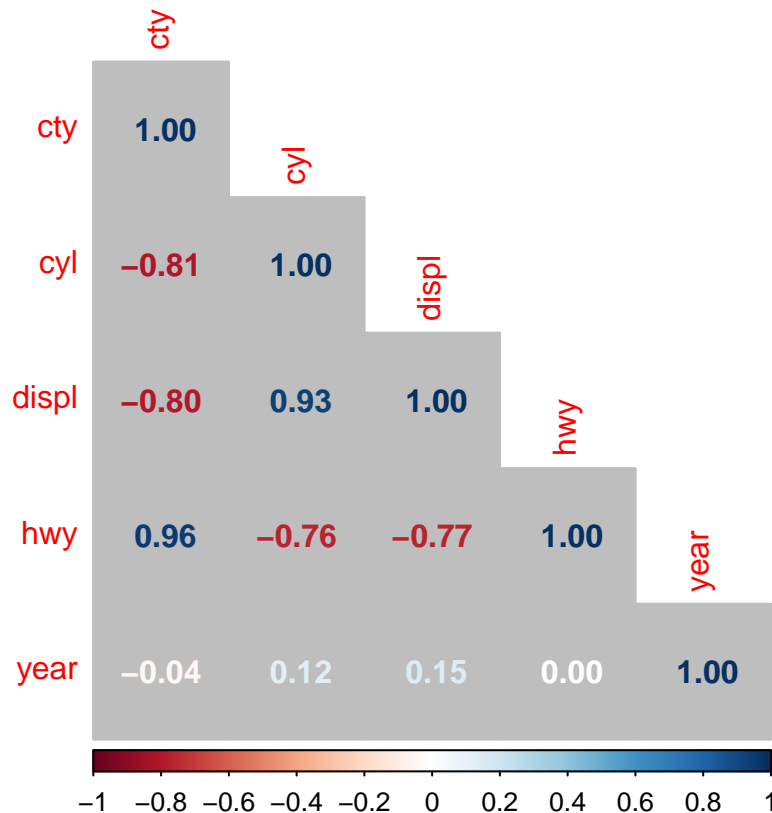
## -- Attaching packages ----- tidyverse 1.3.2 --
## v tibble 3.1.8      v dplyr 1.0.9
## v tidyr 1.2.0       v stringr 1.4.0
## v readr 2.1.2       v forcats 0.5.1
## v purrr 0.3.4
## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()     masks stats::lag()

Matrix <- ggplot2::mpg %>%
  select_if(is.numeric) %>%
  cor(.)

library(corrplot)

## corrplot 0.92 loaded

corrplot(Matrix, method = 'number', type="lower", order = 'alphabet', bg = "grey")
```



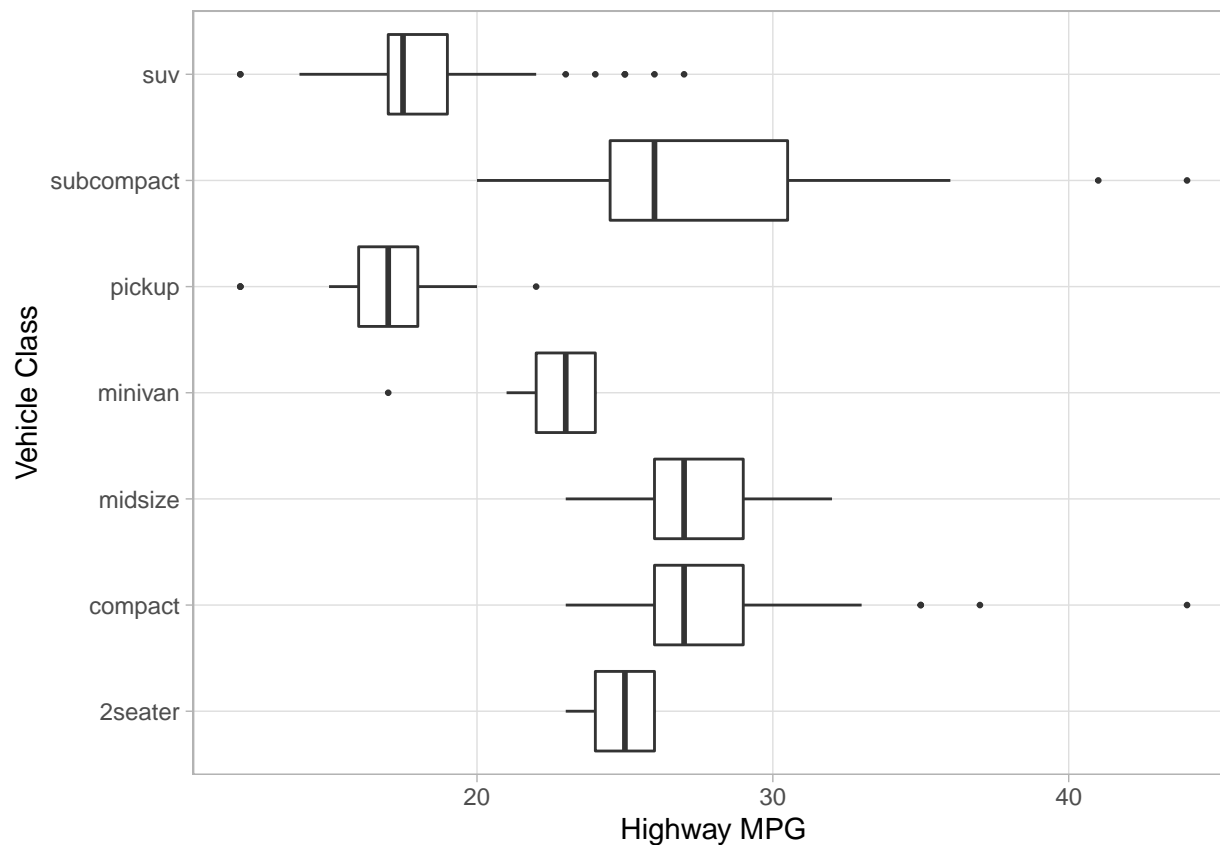
hwy are positively correlated with cty displ is positively correlated with cyl year is positively correlated with cyl and displ

cyl is negatively correlated with cty displ is negatively correlated with cty hwy is negatively correlated with cyl and displ year is negatively correlated with cty

These relationship make sense to me as it follows law of physics. No superise here.

## Exercise 7

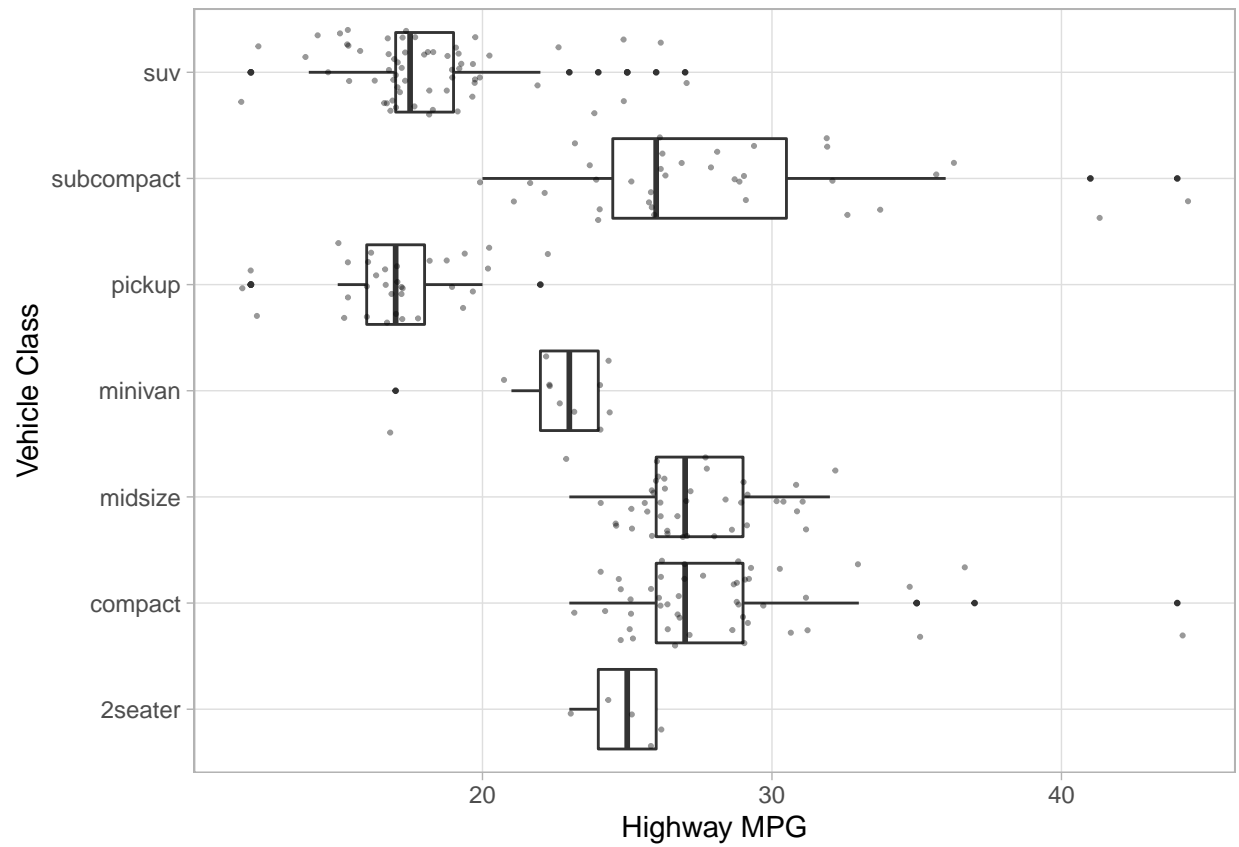
```
ggplot(data = mpg, mapping = aes(x=hwy, y = class)) +
  geom_boxplot(outlier.size = 0.5)+
  #geom_point( position = position_jitterdodge(self))+
  theme_light()+
  xlab("Highway MPG")+
  ylab("Vehicle Class")+
  theme(panel.grid.minor = element_blank())
```



```
ggplot(data = mpg, mapping = aes(x=hwy, y = class)) +
  geom_boxplot(outlier.size = 0.5)+
  theme_light()+
  geom_jitter(color="black", size=0.4, alpha=0.4,stackdir = 'center')+
  xlab("Highway MPG")+
  ylab("Vehicle Class")+
  theme(panel.grid.minor = element_blank())
```

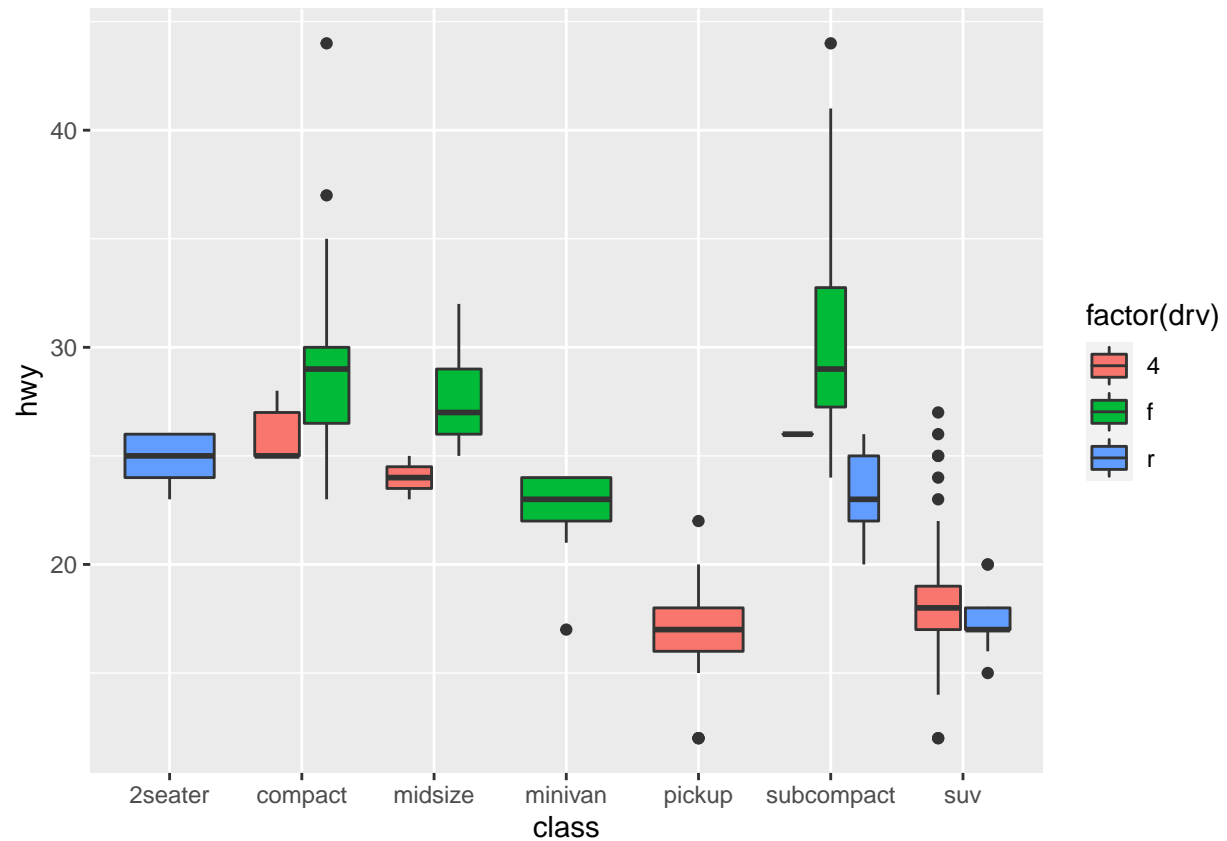
```
## Warning: Ignoring unknown parameters: stackdir
```





## Exercise 8

```
p <- ggplot(mpg, aes(x = class, y = hwy, fill = factor(drv)))  
p + geom_boxplot()
```



*#cite from [https://ggplot2.tidyverse.org/reference/position\\_dodge.html](https://ggplot2.tidyverse.org/reference/position_dodge.html) with modification*

## Exercise 9

```
ggplot(mpg, aes(x = displ, y = hwy)) +
  geom_point(aes(colour = drv)) +
  geom_smooth(aes(linetype = drv), se = FALSE)
```

## `geom\_smooth()` using method = 'loess' and formula 'y ~ x'

