Bayesian Modeling - Regression Homework

```
library(tidyverse)
library(rstan)
library(kableExtra)

rmse <- function(error)
{
  sqrt(mean(error^2))
}

set.seed(9)
```

Building a Simple Bayesian Regression Model

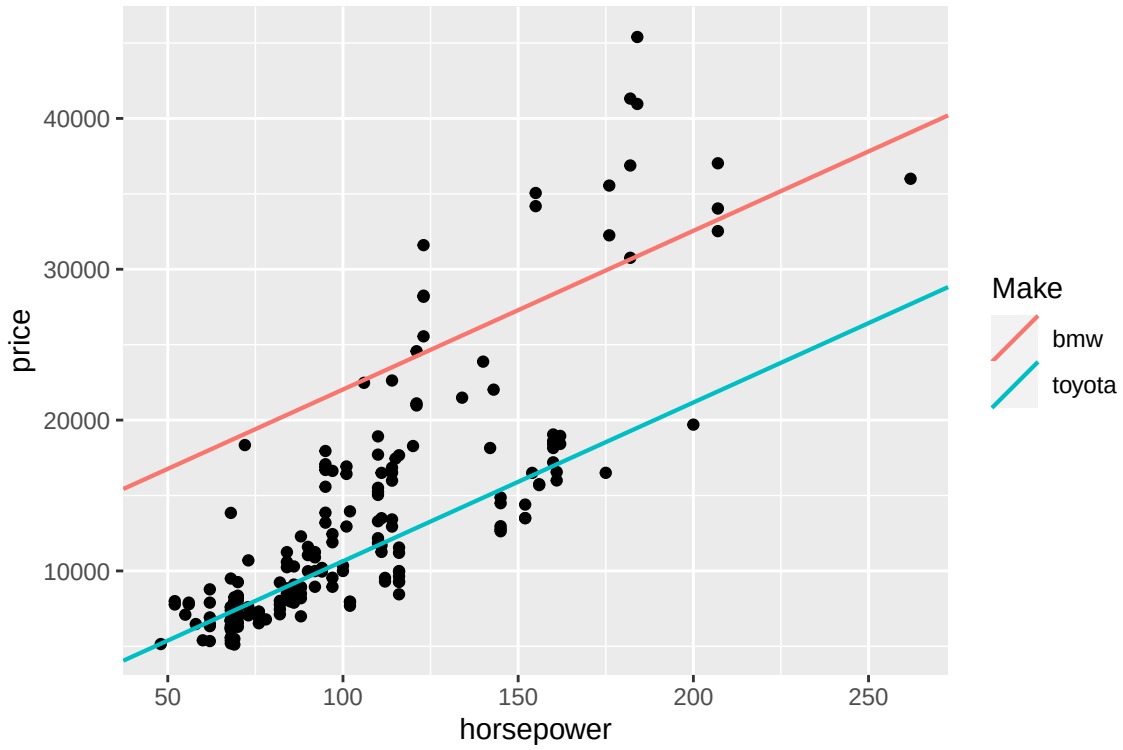
Submit an R file *(to circumvent Stan-Markdown technical issues)* with the following code: Using the Auto price data, create a linear model using lm *(we'll use these parameters for our initial priors)*. We'll narrow this down to 2 categories *(bmw and toyota)* to keep it manageable. The following code should work:

```
Autos <- read.csv("C:/Users/ellen/Documents/UH/Spring 2021/Section II/Bayes Intrro/Automobile Price Pred
Autos = Autos %>% select(price = price, make = make, horsepower = horsepower)
lmMod = lm(price~ make+ horsepower, Autos)
vBeta = as.numeric(lmMod$coefficients)
Intercept = lmMod$coefficients[1]
Slope = lmMod$coefficients[22]
bmw =lmMod$coefficients[3]
toyota =lmMod$coefficients[19]

lmCoef = data.frame(Make = c("bmw", "toyota"),
                    Intercept = c(
                      lmMod$coefficients[1]+ lmMod$coefficients[3],
                      lmMod$coefficients[1]+ lmMod$coefficients[19]),
                    Slope = c(lmMod$coefficients[22], lmMod$coefficients[22]))


knitr::kable(lmCoef) %>%
  kable_styling(full_width = F, bootstrap_options = "striped", font_size = 9)
```

Make	Intercept	Slope
bmw	11505.9340	105.2228
toyota	123.1098	105.2228

Then create a plot showing the regression line *(code shown for guidance)*:

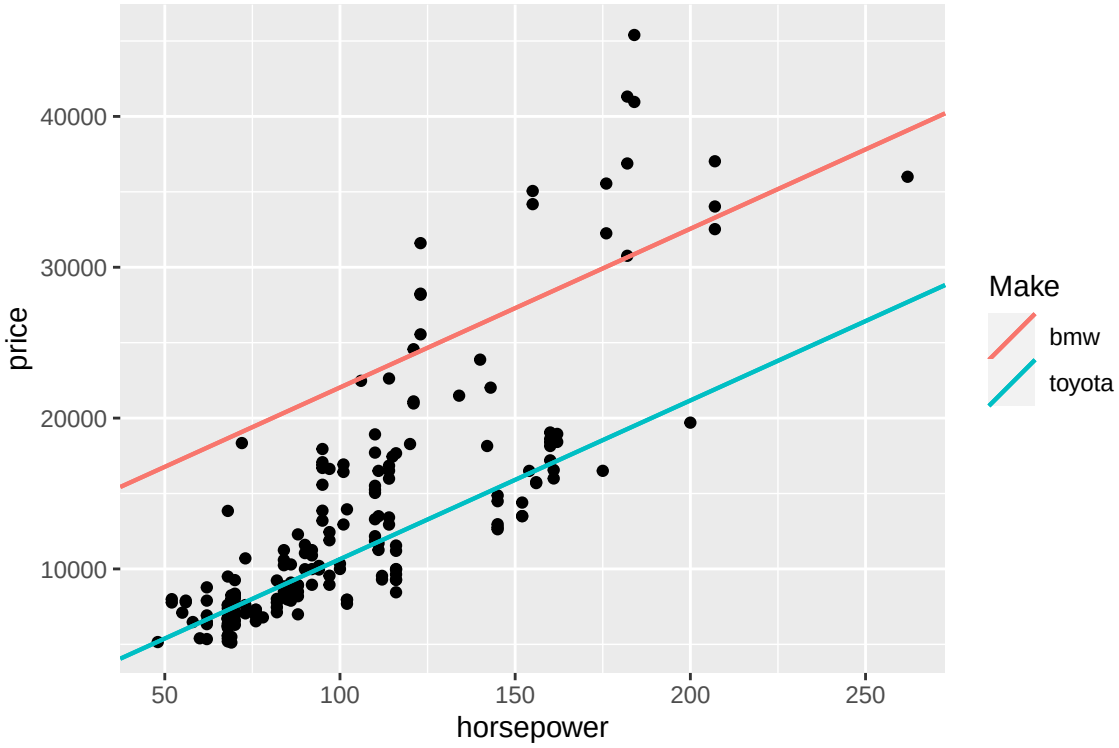
```
p = ggplot(Autos, aes(horsepower, price)) + geom_point() +
  geom_abline(data = lmCoef, aes(intercept = Intercept, slope = Slope, color = Make),
                    size = .75)
p
```



Now create a Baysian Model using Stan, using the lm parameters *(you need to use all of them - use vBeta)* for priors. *(hint, give the intercepts room to move - e.g., a sd of 50 or so, but give the slope little room to move - e.g., a sd of 1 or so)*

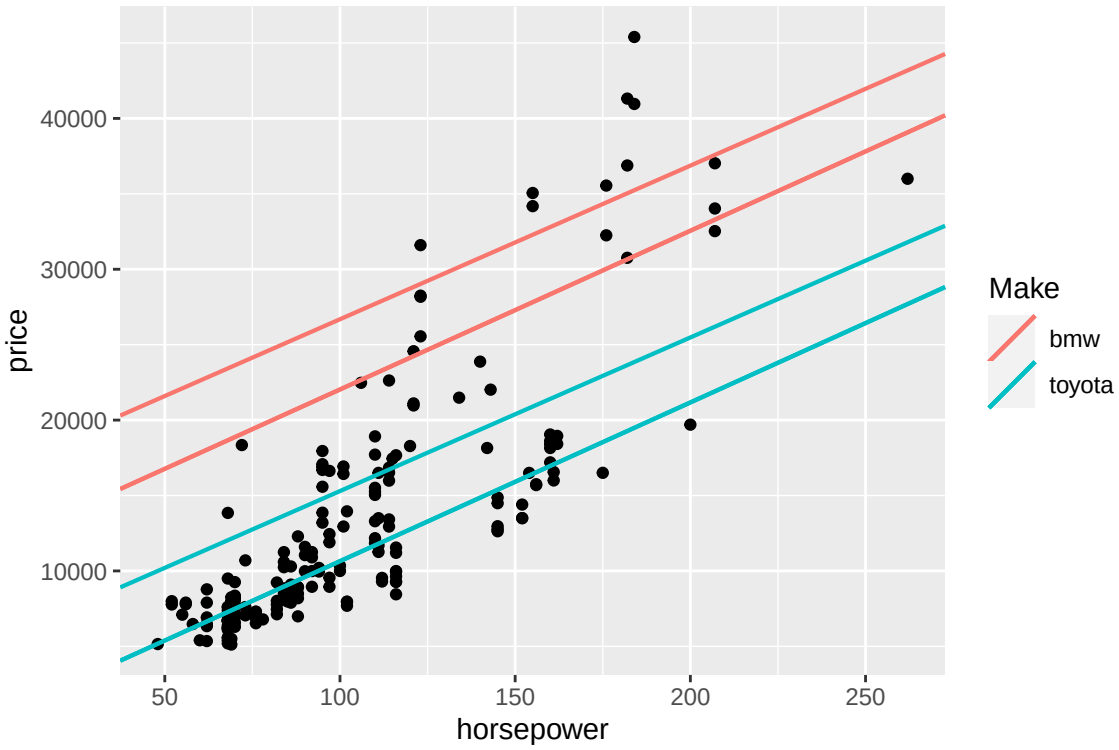
Make	Intercept	Slope
bmw	11507.3539	105.2333
toyota	123.3887	105.2333

And show the plot for the same models as lm as a visual check:



Now, say we have information that prices will increase by $5,000 next year. Update the priors and rerun the models. Show your new coefficients and plot the results:

Make	Intercept	Slope
bmw	16501.810	101.8422
toyota	5110.225	101.8422


40000
30000
20000
10000
price
50
100
150
200
250
horsepower
Make
bmw
toyota