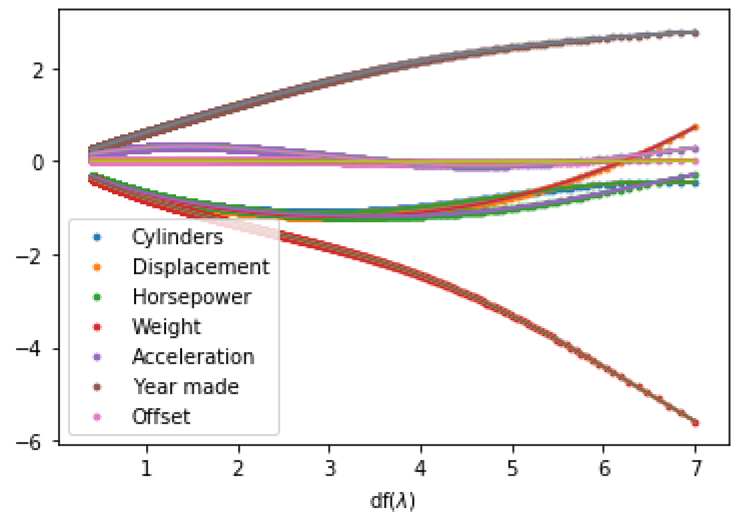
Problem 3 (coding)

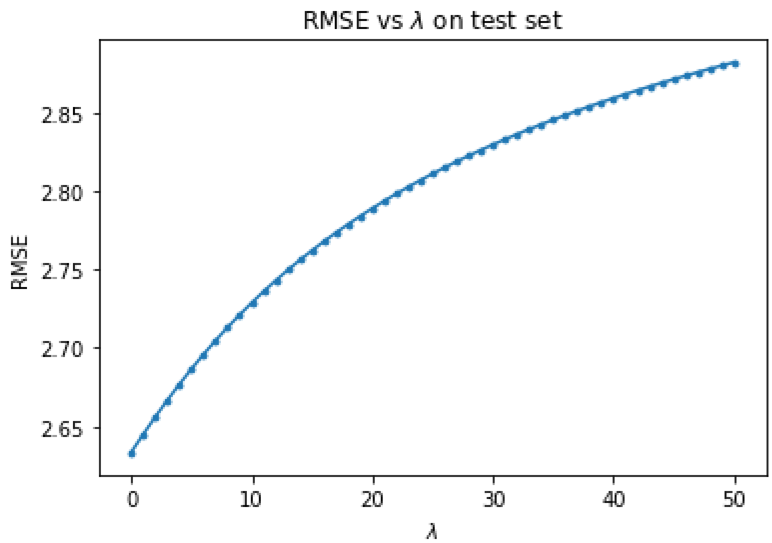
Part 1

(a) The plot is as follows:



(b) Inference from the plot:

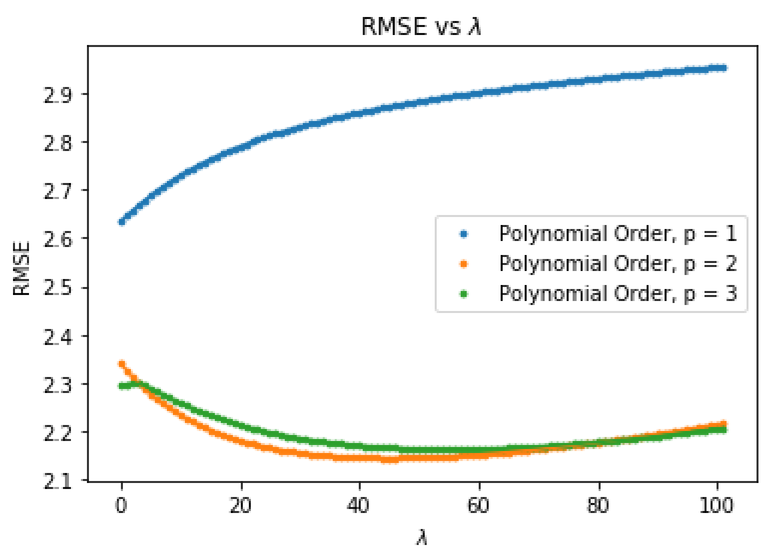
There are two features that stand out from the rest. These are ‘Year Made’ and ‘Weight’ of the car. When lambda is zero, df(lambda) takes the value of the number of dimensions. Which means that all the dimensions are allowed (contrary to when lambda is infinity (meaning infinity constraint) and df(lambda) is zero and no dimensions are allowed). The parameters 'weight' and 'year made' show the highest magnitude in the graph. This means that they are good indicators of the fuel efficiency of the car. We can also observe from this plot that since the line representing 'year made' is positive, the fuel efficiency increases with the increase in car years and as the dimension 'weight' is negative, it shows that the fuel efficiency decreases with the increase in car weight.



(c)

We notice that as the value of lambda increases, the RMSE also increases. Since the minimum RMSE value is obtained when lambda is zero, it implies that the least-squares solution of linear regression is appropriate for this dataset using polynomial order = 1. Therefore, we should use linear regression solved by least squares (lambda = 0) instead of ridge regression (lambda >0) for this problem.

Part 2



(d)

From this plot, we can notice that we get the lowest RMSE from polynomial order p = 2. Even though p = 3 obtains a similar RMSE value as the least value produced by p = 2, we should choose a simpler model. Hence, the choice of regression model from the plot would be the ridge regression model with polynomial order p = 2. When p = 2 or p = 3, at lower values of λ, the model fits the data better (may also be the case of overfitting) and gives the least RMSE values. On further increasing the λ values for higher order's of p, the RMSE values keep increasing and we still underfit the data.