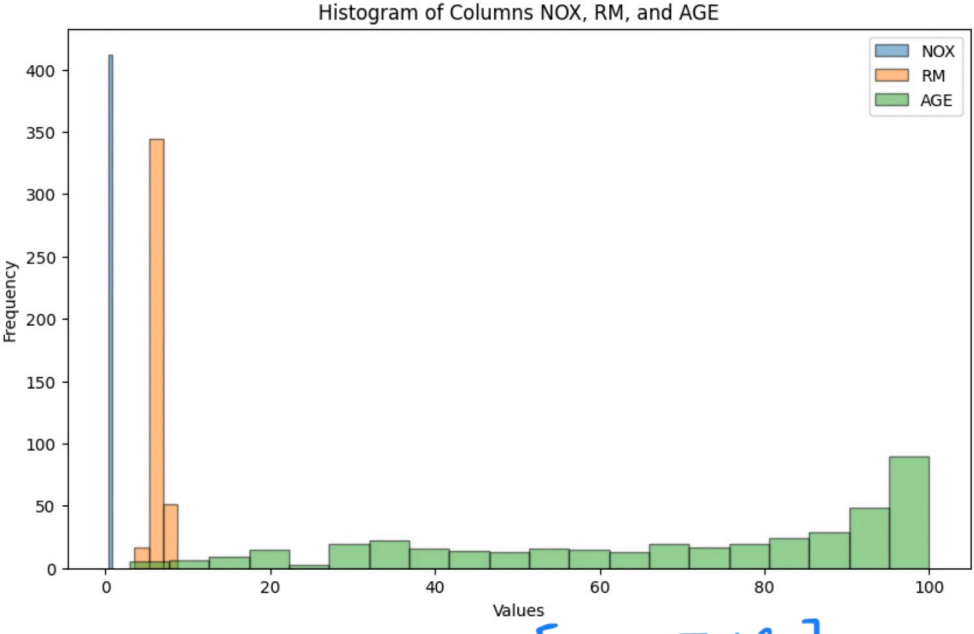
Experiment 1

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	MEDV
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	15.3	24.0
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	17.8	21.6
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	17.8	34.7
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	18.7	33.4
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	18.7	36.2
5	0.02985	0.0	2.18	0.0	0.458	6.430	58.7	6.0622	3.0	222.0	18.7	28.7
7	0.14455	12.5	7.87	0.0	0.524	6.172	96.1	5.9505	5.0	311.0	15.2	27.1
8	0.21124	12.5	7.87	0.0	0.524	5.631	100.0	6.0821	5.0	311.0	15.2	16.5
10	0.22489	12.5	7.87	0.0	0.524	6.377	94.3	6.3467	5.0	311.0	15.2	15.0
11	0.11747	12.5	7.87	0.0	0.524	6.009	82.9	6.2267	5.0	311.0	15.2	18.9

Exp-2 (Histo)

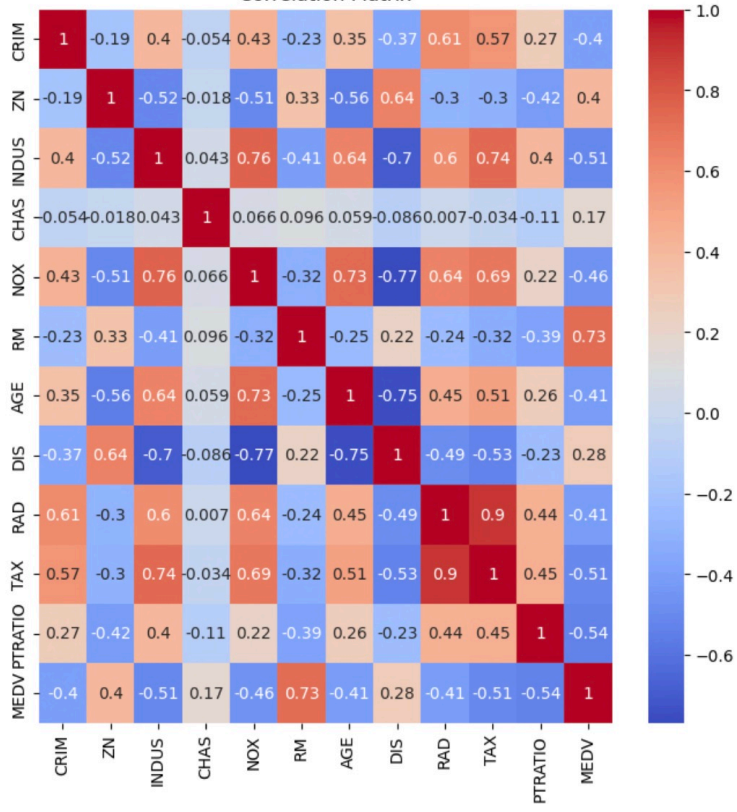


Exp 2 [Corr Table]

values

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE
CRIM	1.000000	-0.187914	0.399125	-0.053812	0.426892	-0.231273	0.347881
ZN	-0.187914	1.000000	-0.517127	-0.017860	-0.508431	0.334985	-0.556569
INDUS	0.399125	-0.517127	1.000000	0.042823	0.764716	-0.406520	0.639033
CHAS	-0.053812	-0.017860	0.042823	1.000000	0.066370	0.096277	0.059016
NOX	0.426892	-0.508431	0.764716	0.066370	1.000000	-0.317127	0.734957
RM	-0.231273	0.334985	-0.406520	0.096277	-0.317127	1.000000	-0.253154
AGE	0.347881	-0.556569	0.639033	0.059016	0.734957	-0.253154	1.000000
DIS	-0.369388	0.643411	-0.698102	-0.086243	-0.767751	0.221341	-0.747306
RAD	0.613026	-0.298081	0.600663	0.007043	0.639015	-0.236786	0.452883
TAX	0.566329	-0.303079	0.738828	-0.033658	0.687973	-0.322061	0.511233
PTRATIO	0.268360	-0.420645	0.397222	-0.109588	0.215724	-0.386630	0.263088
MEDV	-0.398374	0.395418	-0.511117	0.174342	-0.459843	0.728768	-0.411209

	DIS	RAD	TAX	PTRATIO	MEDV
CRIM	-0.369388	0.613026	0.566329	0.268360	-0.398374
ZN	0.643411	-0.298081	-0.303079	-0.420645	0.395418
INDUS	-0.698102	0.600663	0.738828	0.397222	-0.511117
CHAS	-0.086243	0.007043	-0.033658	-0.109588	0.174342
NOX	-0.767751	0.639015	0.687973	0.215724	-0.459843
RM	0.221341	-0.236786	-0.322061	-0.386630	0.728768
AGE	-0.747306	0.452883	0.511233	0.263088	-0.411209
DIS	1.000000	-0.485381	-0.532896	-0.229773	0.279111
RAD	-0.485381	1.000000	0.902564	0.440476	-0.411004
TAX	-0.532896	0.902564	1.000000	0.446342	-0.505214
PTRATIO	-0.229773	0.440476	0.446342	1.000000	-0.537074



Exp - 2

Heatmap

Exp 2

Inference

FINDINGS FROM THE CORRELATION MATRIX
1) The feature CHAS does'nt seem to have any correlation with any of the the other features. Completely Uncorrelated.
2) The feature INDUS has strong +ve correlation with feature NOX and TAX. strong −ve correlation with DIS
3) NOX has strong +ve correlation with INDUS, AGE and TAX. strong −ve correlation with DIS
4) The feature DIS, MEDV are mostly −vely correlated with most of the other features.
5) Mostly, the data is full of features which are kind of mildy related to each other (in +ve as well as −ve sense). strong +ve or strong −ve correlations are less.

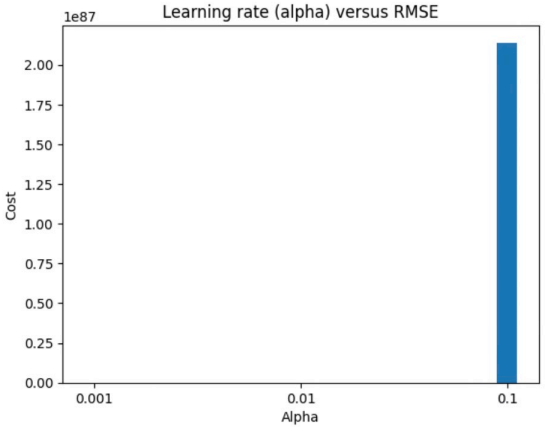
Exp(3)

```
Shape (X_train)= (370, 11)
Shape (X_test)= (42, 11)
Shape (y_train)= (370, 1)
Shape (y_test)= (42, 1)
```

Exp(4)

```
Parameters obtained:
Co-efficients:
[ 2.67138252e+01 -1.64988173e-01  3.73093490e-02 -9.87442617e-03
  3.21391436e+00 -2.27553707e+01  6.16182106e+00 -4.96702692e-02
 -1.48516544e+00  2.39856484e-01 -1.20609362e-02]
Intercept:
[-1.00154675]



Predictions for X_test:
[17.2248355  18.33989089 20.7798773  18.79433517 14.26957554 24.4456386
 28.51308516 12.03900717 15.0662882  44.61347666 21.07813478 20.46072767
 26.73483215 21.82625771 14.88433347 29.12428153 20.5295955  24.48768463
 22.1549186  21.02703379 23.34750175 37.42671036 16.99916963 23.54811373
 19.31099988 24.98186207 43.43638551 20.60520709 17.97427573 17.19361613
 26.51414583 20.7585238  30.30612713 21.71461164 34.91141292 16.84046354
 25.52709012 21.53935455 14.00176792 31.73748563 18.06589744 22.18205694]



RMSE error (predictions vs y_test): 3.7846529574645924
```

```
Cost for alpha= 0.001 : 7.733839671300573e+26
Cost for alpha= 0.01 : 2.120514509089805e+67
Cost for alpha= 0.1 : 2.1395570374965496e+87
```



It seems that the given values of learning rates are extremely large. The algorithm tends to overshoot as the number of iterations are increased. UNABLE TO PLOT BAR PLOT BCS OF LARGE DIFFERENCE BETWEEN ERRORS
I have tried to fit much smaller values of alpha to get some optimum value of alpha giving permissible error.

Optimum Result ↓ (Exp 5)

Here, I have tried to fit much smaller value of alpha i.e. 0.99 * 10^(-5). As the value of alpha is so small, i had to go over 10k iterations to converge which adds up very heavily to the computation cost.
Cost for iters= 10,000 and alpha= 0.99 * 10^(-5) : 7.9791802665645735

If we think of increasing the alpha to 1 * 10^(-5), the following result is obtained OVERSHOOT:
Cost for iters= 10,000 and alpha= 1 * 10^(-5) : 2.829379657908493e+61
Cost for iters= 10 and alpha= 1 * 10^(-5) : 26.21482801486573

Increasing the number of iterations to 1 lakh to increase the accuracy. Computationally very expensive but just for visualization
Cost for iters= 1 lalk and alpha= 0.99 * 10^(-5) : 5.152460776656065

Finally, the optimum value of alpha obtained is 0.99 * 10^(-5)
Weights: [-0.24008555 0.13620677 -0.2524867   0.04883391 0.02894395 0.85525383
  0.06902855 0.23404939 -0.10278254 -0.00282713 0.82129007]
Bias: 0.0837712031778443