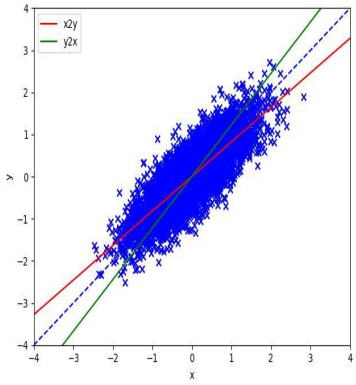
Coding Assignment 1

Q1_1>

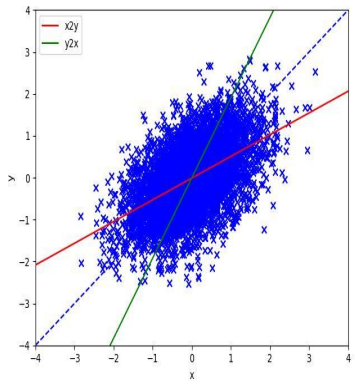
w_x2y: 0.5182482056672554 b_x2y:-0.009571493723327272
w_y2x :0.5226886399337702 b_y2x: 0.0023137516529113875

Q1_2>

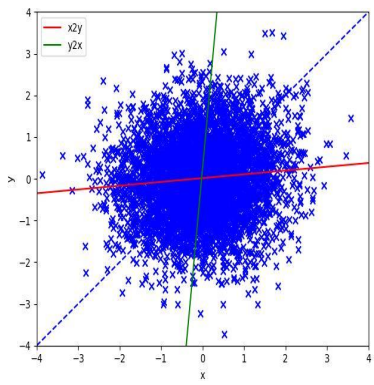
var=0.1,



var=0.3,



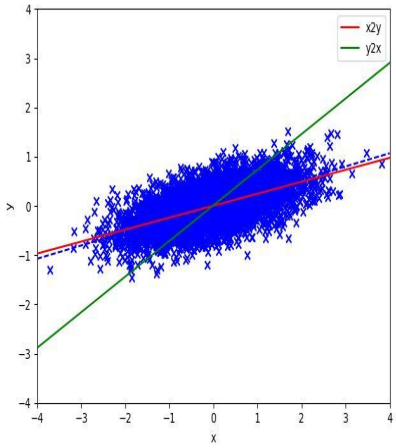
var=0.8



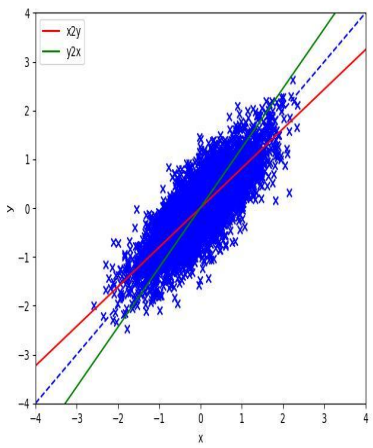
Q1_3>[5%] A description of the phenomena found in 1) and 2).
Output of the regression model is influenced by var_2, as var_2 gets larger, x2y and y2x deviate more from each other and fit data worse.Predicting y from x is closer to predicting x from y with smaller var_2.

Q_4>

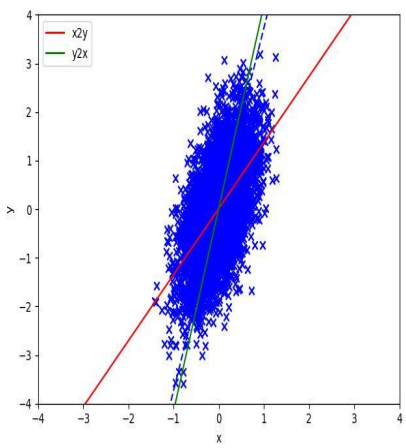
degree=15



degree=45

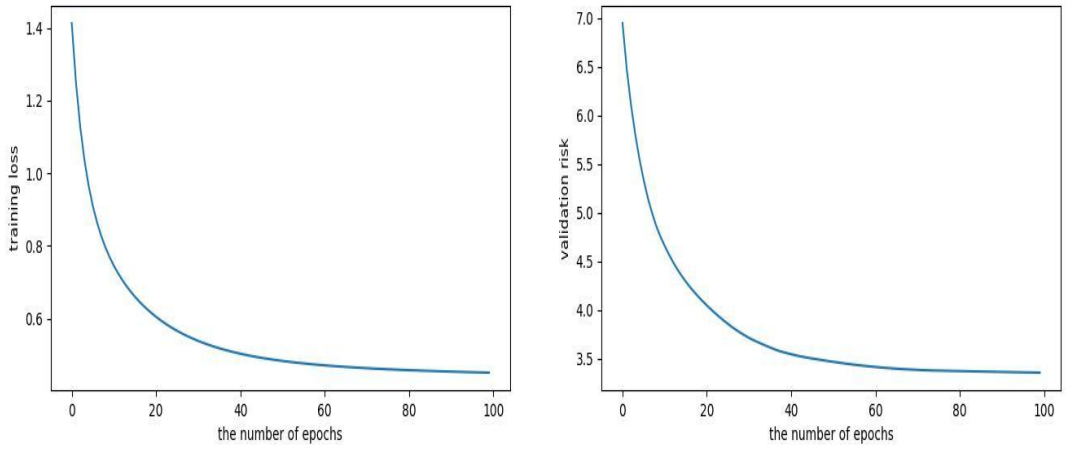


degree=75

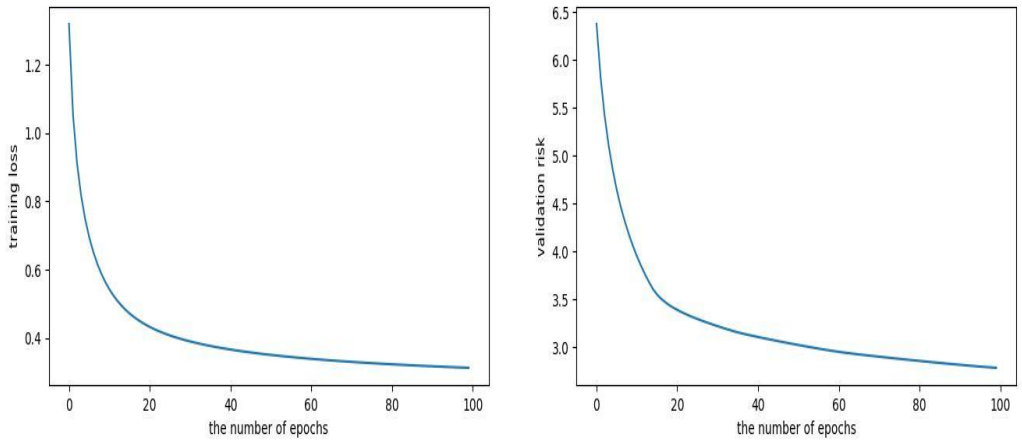


With var_1, var_2, M remaining the same, deviation between x2y and y2x does not change a lot as degree changes. X2y and y2x are closest to each other when degree is equal to 45. Distance between x2y and y2x looks the same when degree is at 15 and 75.

Q2_a>
Best validation performance: 99
The validation performance (risk) in that epoch: 3.3580816862888305
The test performance (risk) in that epoch: 3.237046307078403



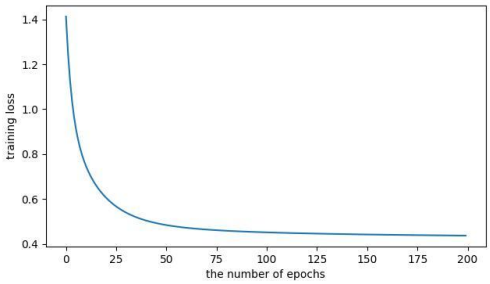
Q2_b>
Best hyperparameter: 0.01
Best validation performance: 99
The validation performance (risk) in that epoch: 2.781912727526617
The test performance (risk) in that epoch: 2.7724722186569686

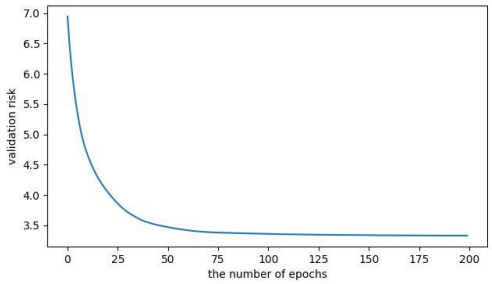


Q2_c>

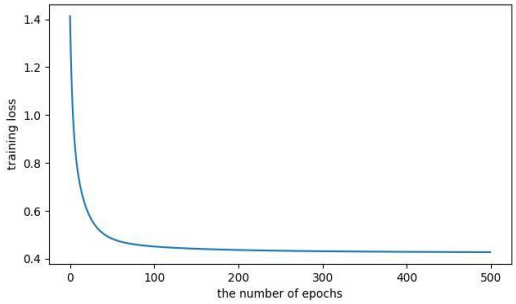
Keep the settings in Q2_a, how can changing MaxIter / batch size influence regression models?

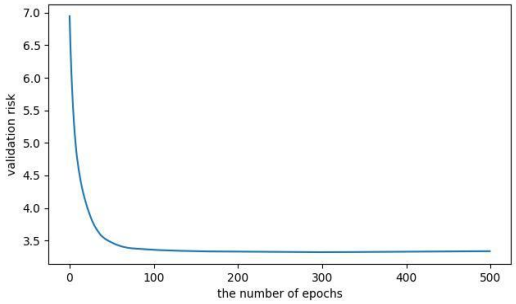
When change **MaxIter** from 100 to 200 without changing other settings
Best validation performance: 199
The validation performance (risk) in that epoch: 3.3290946723336647
The test performance (risk) in that epoch: 3.2960240600094672



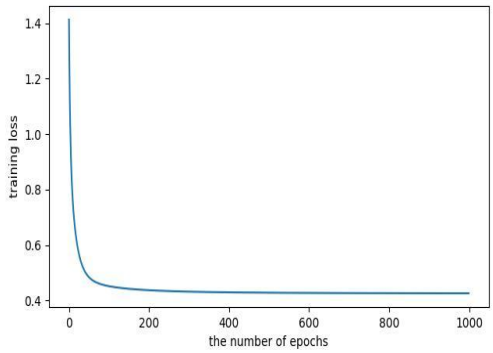


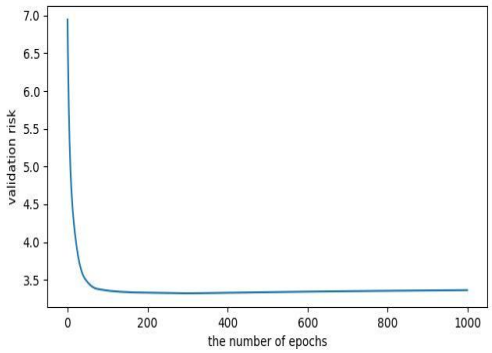
When change **MaxIter** from 100 to 500 without changing other settings:
Best validation performance: 297
The validation performance (risk) in that epoch: 3.3214314869053645
The test performance (risk) in that epoch: 3.3168529347613753





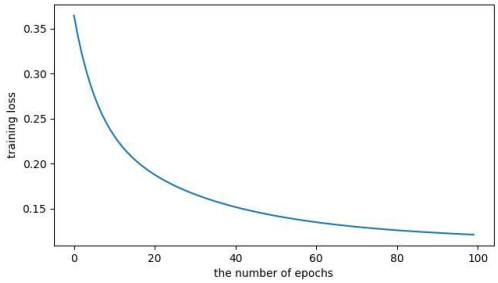
When change **MaxIter** from 100 to1000 without changing other settings:
Best validation performance: 297
The validation performance (risk) in that epoch: 3.3214314869053645
The test performance (risk) in that epoch: 3.3168529347613753

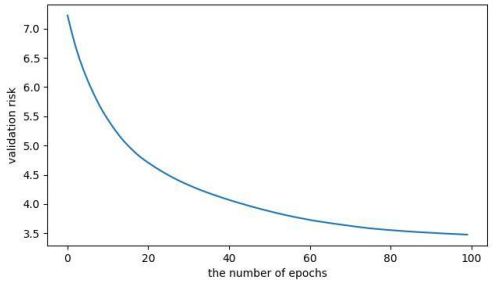




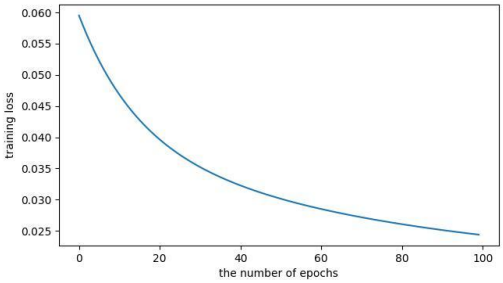
After increasing the MaxIter (number of epochs), the validation and test risk does not change a lot. There is a slight decrease in validation risk performance. Best validation performance stays at 297 when the number of epochs is larger than 297.
Overall, MazIter (number of epochs) does not have a significant influence on either plot or validation and test performance.

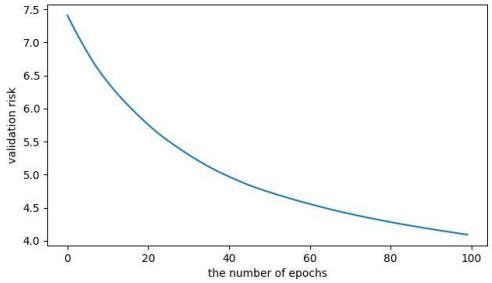
When change **Batch size** from 10 to 20 without changing other settings
Best validation performance: 99
The validation performance (risk) in that epoch: 3.4759200879061676
The test performance (risk) in that epoch: 3.165742375983161



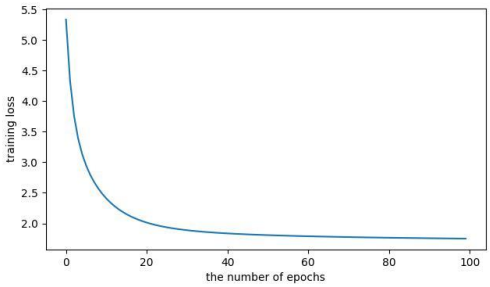


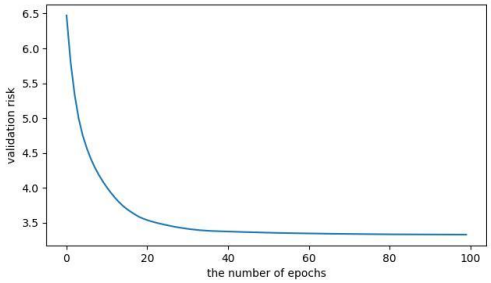
When change **Batch size** from 10 to 50 without changing other settings
Best validation performance: 99
The validation performance (risk) in that epoch: 4.092628619878822
The test performance (risk) in that epoch: 3.3279608549828508





When change **Batch size** from 10 to 5 without changing other settings
Best validation performance: 99
The validation performance (risk) in that epoch: 3.3286684579639165
The test performance (risk) in that epoch: 3.2959484119256452





Increasing batch size leads to a bad performance of our model. Validation risk grows higher when increasing the batch size.However, decreasing the batch size to a small number from the original setting does not influence a lot.