Statistical Learning - Homework 5 (Conceptual)

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Chapter 6 - Exercise 2

a) The lass, relative to least squares, is **less flexible and hence will give improved prediction accuracy when its increase in bias is less than its decrease in variance**.

b) The ridge regression, relative to least squares, is **less flexible and hence will give improved prediction accuracy when its increase in bias is less than its decrease in variance**.

c) The non-linear methods, relative to least squares, is **more flexible and hence will give improved prediction accuracy when its increase in variance is less than its decrease in bias**.

Chapter 6 - Exercise 3

a) As we increase s from 0, the training RSS will **steadily decrease, since increasing s leads to restricting the coefficients to a lesser extent, and hence making the model more flexible**.

b) As we increase s from 0, the test RSS will **decrease initially, and then eventually start increasing in a U shape since the model becomes more flexible and then overestimates/overfits due to extra parameters being involved**.

c) As we increase s from 0, the variance will **steadily increase because a more flexible model results in higher variance**.

d) As we increase s from 0, the squared bias will **steadily decrease since the model variance will increase and as variance increases, bias decreases due to the bias-variance tradeoff**.

e) As we increase s from 0, the irreducible error will **remain constant because the definition of irreducible error means it will remain independent of the chosen model; it's just some small offset showing us that the model isn't the true model**.

Chapter 6 - Exercise 4

a) As we increase λ from 0, the training RSS will **steadily increase since the model becomes more flexible as λ increases, naturally leading to a higher RSS**.

b) As we increase λ from 0, the test RSS will **decrease initially, and then eventually start increasing in a U shape because the model becomes more flexible, leading to more overestimation/overfitting due to extra parameters being involved**.

c) As we increase λ from 0, the variance will **steadily decrease because the model is becoming less flexible since the coefficients are being restricted more and more, leading to lower variance**.

d) As we increase λ from 0, the squared bias RSS will **steadily increase because we will be restricting the coefficients to smaller and smaller values, thus the model will become more flexible, leading to higher bias, due to the bias-variance tradeoff**.

e) As we increase λ from 0, the irreducible error will **remains constant since the definition of irreducible error means it will be independent of the chosen model**.