**Question 1.**

**Why would you want to use:**

1. **Ridge regression instead of Linear regression.**

Advantages of ridge regression over linear regression:

1. **Handles multicollinearity:**

It introduces a regularization term that prevents overfitting by shrinking coefficients, making the model more stable and reduce the impact of multicollinearity

1. **Stabilizes model performance**:

The regularization term in ridge regression minimizes the variance in the model, which can lead to more consistent and stable predictions on new or unseen data. This improves the generalization capability of the model.

1. **Works well with datasets of high dimensionality**:

Ridge regression is advantageous in cases where there are more predictors than observations or dealing with high-dimensional data.

1. **Lasso instead of Ridge regression:**

Advantages of Lasso over Ridge regression:

1. **Feature selection**:

Lasso performs feature selections by shrinking the coefficients of the less important features to exactly zero effectively eliminating those features from the model. Ridge regression on the other hand shrinks coefficients towards zero but does not usually zero them out completely.

1. **Automatic variable selection**:

The Lasso’s feature selection property makes it particularly useful in situations where there is a large number of predictions as it automatically selects the most relevant variables and discards the less important ones hence reducing overfitting.

1. **Deals better with correlated predictors**:

When dealing with strongly correlated predictors, Lasso tends to select one and zero out the others effectively choosing one representative variable from the group which can be beneficial in some scenarios

1. **Elastic net instead of Lasso**

Advantages of Elastic Nets over Lasso:

1. Address limitations of Lasso:

When dealing with highly correlated predictors, Elastic Net can include groups of correlated variables together by using both Lasso and Ridge regression penalties. This helps capturing predictive power of both correlated predictions more effectively.

1. Stability and robustness:

Elastic Net strikes a balance between Lasso and Ridge regression by combining their penalties.

**Question 2**

Suppose you are using polynomial regression. You plot the learning curve and you notice that there is a large gap between the training error and validation error.

**What is happening?**

Overfitting

The model has learned the training data too well, capturing noise and irrelevant patterns which lead to poor generalization to unseen data.

**What are the three ways to solve this?**

1. Decrease polynomial degree:

A lower degree polynomial might generalize and prevent overfitting

1. Regularization:

Apply regularization techniques such as ridge regression and Lasso to penalize large coefficients and prevent overfitting.

1. Increase training data:

A larger and more diverse dataset can improve the model’s ability and to generalize unseen data.