Part 1:

Linear Kernel Results:
Confusion Matrix and Statistics

```
          Reference
Prediction  1  2  3
         1 16  2  0
         2  1 19  0
         3  0  0 14
```

Overall Statistics

```
               Accuracy : 0.9423
                 95% CI : (0.8405, 0.9879)
    No Information Rate : 0.4038
    P-Value [Acc > NIR] : 2.471e-16

                  Kappa : 0.9125

 Mcnemar's Test P-Value : NA
```

Statistics by Class:

```
                     Class: 1 Class: 2 Class: 3
Sensitivity            0.9412   0.9048   1.0000
Specificity            0.9429   0.9677   1.0000
Pos Pred Value         0.8889   0.9500   1.0000
Neg Pred Value         0.9706   0.9375   1.0000
Prevalence             0.3269   0.4038   0.2692
Detection Rate         0.3077   0.3654   0.2692
Detection Prevalence   0.3462   0.3846   0.2692
Balanced Accuracy      0.9420   0.9363   1.0000
```

Radial Kernel Results:
Confusion Matrix and Statistics

```
          Reference
Prediction  1  2  3
         1 17  2  0
         2  0 18  0
         3  0  1 14
```

Overall Statistics

```
               Accuracy : 0.9423
                 95% CI : (0.8405, 0.9879)
    No Information Rate : 0.4038
    P-Value [Acc > NIR] : 2.471e-16

                  Kappa : 0.913

 Mcnemar's Test P-Value : NA
```

Statistics by Class:

```
                     Class: 1 Class: 2 Class: 3
Sensitivity            1.0000   0.8571   1.0000
Specificity            0.9429   1.0000   0.9737
Pos Pred Value         0.8947   1.0000   0.9333
Neg Pred Value         1.0000   0.9118   1.0000
Prevalence             0.3269   0.4038   0.2692
Detection Rate         0.3269   0.3462   0.2692
Detection Prevalence   0.3654   0.3462   0.2885
Balanced Accuracy      0.9714   0.9286   0.9868
```

kNN Results (k = 5):
Confusion Matrix and Statistics

```
          Reference
Prediction  1  2  3
         1 17  1  0
         2  0 20  0
         3  0  0 14
```

Overall Statistics

```
               Accuracy : 0.9808
                 95% CI : (0.8974, 0.9995)
    No Information Rate : 0.4038
    P-Value [Acc > NIR] : < 2.2e-16

                  Kappa : 0.9708

 Mcnemar's Test P-Value : NA
```

Statistics by Class:

```
                     Class: 1 Class: 2 Class: 3
Sensitivity            1.0000   0.9524   1.0000
Specificity            0.9714   1.0000   1.0000
Pos Pred Value         0.9444   1.0000   1.0000
Neg Pred Value         1.0000   0.9687   1.0000
Prevalence             0.3269   0.4038   0.2692
Detection Rate         0.3269   0.3846   0.2692
Detection Prevalence   0.3462   0.3846   0.2692
Balanced Accuracy      0.9857   0.9762   1.0000
```

Result Comparison:
Based on the results of the classification models, the k-Nearest Neighbors (kNN) classifier outperformed both SVM models (linear and radial kernels) in terms of overall accuracy, precision, recall, and F1-score. The kNN model achieved an accuracy of 98.08%, compared to 94.23% for both SVM models. Precision was highest for kNN across all classes, with particularly notable values of 0.9444 for Class 1 and 1.0000 for Classes 2 and 3, indicating its strong ability to correctly identify positive predictions across all wine types. Similarly, recall values for kNN were consistently high, reaching 1.0000 for Classes 1 and 3 and 0.9524 for Class 2, demonstrating excellent sensitivity.

In contrast, the SVM with a radial kernel slightly outperformed the linear kernel in terms of balanced accuracy and precision for some classes. For instance, the radial kernel achieved a precision of 1.0000 for Class 2, compared to 0.9500 for the linear kernel. However, the linear kernel achieved slightly better recall for Class 2 (0.9048) than the radial kernel (0.8571).

While both SVM models performed well and similarly, kNN consistently delivered superior results, with balanced accuracy values exceeding 0.97 for all classes and perfect F1-scores for Classes 1 and 3. This suggests that kNN, is the most effective model for predicting wine type in this dataset.

Part 2:

Model Performance Comparison:
SVM Regression RMSE: 6614453
Linear Regression RMSE: 6196661