```
Python 3.12.4 (tags/v3.12.4:8e8a4ba, Jun  6 2024, 19:30:16) [MSC v.1940 64 bit (AMD64)]
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IPython  -- An enhanced Interactive Python.

Restarting kernel...
```

```
In [1]:         'C:/Users/Anushka Kadam/.spyder-py3/overall survival prediction.py'
    ='C:/Users/Anushka Kadam/.spyder-py3'
Best parameters for Random Forest: {'max_depth': 6, 'min_samples_leaf': 6,
'min_samples_split': 14, 'n_estimators': 94}
Best cross-validation score for Random Forest: 0.49279907084785135
Classification Report for Random Forest (Training Set):
              precision    recall  f1-score   support

       Short       0.76      0.83      0.79        69
      Medium       0.81      0.74      0.77        69
        Long       0.74      0.74      0.74        69

    accuracy                           0.77       207
   macro avg       0.77      0.77      0.77       207
weighted avg       0.77      0.77      0.77       207

Classification Report for Random Forest (Hold-out Validation Set):
              precision    recall  f1-score   support

       Short       0.67      0.40      0.50        15
      Medium       0.32      0.40      0.35        15
        Long       0.55      0.61      0.58        18

    accuracy                           0.48        48
   macro avg       0.51      0.47      0.48        48
weighted avg       0.51      0.48      0.48        48

Confusion Matrix for Hold-out Validation Set (Random Forest):
[[ 6  8  1]
 [ 1  6  8]
 [ 2  5 11]]
Accuracy for Hold-out Validation Set (Random Forest): 47.92%
Confusion Matrix for Hold-out Validation Set (Random Forest):
[[ 6  8  1]
 [ 1  6  8]
 [ 2  5 11]]
Best parameters for Gradient Boosting: {'learning_rate': 0.03539154139343447,
'max_depth': 6, 'min_samples_leaf': 18, 'min_samples_split': 11, 'n_estimators': 51}
Best cross-validation score for Gradient Boosting: 0.49802555168408824
Classification Report for Gradient Boosting (Training Set):
              precision    recall  f1-score   support

       Short       0.77      0.81      0.79        69
      Medium       0.80      0.71      0.75        69
        Long       0.73      0.77      0.75        69

    accuracy                           0.76       207
   macro avg       0.77      0.76      0.76       207
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weighted avg       0.77      0.76      0.76       207

Classification Report for Gradient Boosting (Hold-out Validation Set):
              precision    recall  f1-score   support

       Short       0.58      0.47      0.52        15
      Medium       0.44      0.47      0.45        15
        Long       0.55      0.61      0.58        18

    accuracy                           0.52        48
   macro avg       0.52      0.51      0.52        48
weighted avg       0.53      0.52      0.52        48

Confusion Matrix for Hold-out Validation Set (Gradient Boosting):
[[ 7  6  2]
 [ 1  7  7]
 [ 4  3 11]]
Accuracy for Hold-out Validation Set (Gradient Boosting): 52.08%
Confusion Matrix for Hold-out Validation Set (Gradient Boosting):
[[ 7  6  2]
 [ 1  7  7]
 [ 4  3 11]]
Best parameters for SVM: {'C': 0.155221171236024, 'gamma': 'scale', 'kernel': 'linear'}
Best cross-validation score for SVM: 0.43484320557491285
Classification Report for SVM (Training Set):
              precision    recall  f1-score   support

       Short       0.49      0.61      0.54        69
      Medium       0.39      0.17      0.24        69
        Long       0.46      0.59      0.52        69

    accuracy                           0.46       207
   macro avg       0.44      0.46      0.43       207
weighted avg       0.44      0.46      0.43       207

Classification Report for SVM (Hold-out Validation Set):
              precision    recall  f1-score   support

       Short       0.78      0.47      0.58        15
      Medium       0.18      0.13      0.15        15
        Long       0.50      0.78      0.61        18

    accuracy                           0.48        48
   macro avg       0.49      0.46      0.45        48
weighted avg       0.49      0.48      0.46        48

Confusion Matrix for Hold-out Validation Set (SVM):
[[ 7  6  2]
 [ 1  2 12]
 [ 1  3 14]]
Accuracy for Hold-out Validation Set (SVM): 47.92%
Confusion Matrix for Hold-out Validation Set (SVM):
[[ 7  6  2]
 [ 1  2 12]
 [ 1  3 14]]
Classification Report for Voting Classifier (Training Set):
              precision    recall  f1-score   support
```

```
       Short       0.72      0.77      0.74        69
      Medium       0.80      0.68      0.73        69
        Long       0.72      0.77      0.74        69

    accuracy                           0.74       207
   macro avg       0.74      0.74      0.74       207
weighted avg       0.74      0.74      0.74       207

Classification Report for Voting Classifier (Hold-out Validation Set):
              precision    recall  f1-score   support

       Short       0.70      0.47      0.56        15
      Medium       0.41      0.47      0.44        15
        Long       0.62      0.72      0.67        18

    accuracy                           0.56        48
   macro avg       0.58      0.55      0.55        48
weighted avg       0.58      0.56      0.56        48

Confusion Matrix for Hold-out Validation Set (Voting Classifier):
[[ 7  7  1]
 [ 1  7  7]
 [ 2  3 13]]
Accuracy for Hold-out Validation Set (Voting Classifier): 56.25%
Confusion Matrix for Hold-out Validation Set (Voting Classifier):
[[ 7  7  1]
 [ 1  7  7]
 [ 2  3 13]]
Classification Report for Dummy Classifier (Hold-out Validation Set):
              precision    recall  f1-score   support

       Short       0.31      1.00      0.48        15
      Medium       0.00      0.00      0.00        15
        Long       0.00      0.00      0.00        18

    accuracy                           0.31        48
   macro avg       0.10      0.33      0.16        48
weighted avg       0.10      0.31      0.15        48

Confusion Matrix for Hold-out Validation Set (Dummy Classifier):
[[15  0  0]
 [15  0  0]
 [18  0  0]]
C:\Users\Anushka Kadam\AppData\Local\Programs\Python\Python312\Lib\site-
packages\sklearn\metrics\_classification.py:1531: UndefinedMetricWarning: Precision is
ill-defined and being set to 0.0 in labels with no predicted samples. Use
`zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
C:\Users\Anushka Kadam\AppData\Local\Programs\Python\Python312\Lib\site-
packages\sklearn\metrics\_classification.py:1531: UndefinedMetricWarning: Precision is
ill-defined and being set to 0.0 in labels with no predicted samples. Use
`zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
C:\Users\Anushka Kadam\AppData\Local\Programs\Python\Python312\Lib\site-
packages\sklearn\metrics\_classification.py:1531: UndefinedMetricWarning: Precision is
ill-defined and being set to 0.0 in labels with no predicted samples. Use
`zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

In [2]: