Output of Main Function:

```
===============Task 1===============
Model 1:
print the performance of learned model 1 on testing data here
[11.21885908 10.44552026 13.25501637 14.45166959 14.2814541   8.39037283
 13.74506554 13.70762655 13.43661971 12.42685668 14.49775309 13.67289625
 11.51110979 14.15496521 10.85945895  9.07706842 13.1250913  13.84232508
 13.24256715 10.06166578  9.29273701 12.17071836 12.91421688 13.49078007
 13.54225408  9.3611636  12.51675471 10.02939572 13.92599937 10.88298357
 11.74102651 12.85411428 14.9198578  12.87627312 13.21388144 15.46384598
 12.53501629 11.55615967 12.8632148  12.51004771 14.25608009 12.69089525
 12.26492881 12.07263341 11.27842527 14.45249401 12.33989777 13.22292051
 13.84123064 12.21739521 13.94736923 12.13210978 11.2432315  12.25381517
 10.56256651 11.13196774 12.97505159 12.15356726 13.54409835 12.25208589
 14.77057639 11.17939096 12.35733647 13.50686213]
Coefficients:
 [ 0.25421058  0.16253991  0.00617135  0.02326809  0.28959108 -1.21916566
  0.24764344  0.01600294 -0.18045482 -0.14643036 -0.0250767  -0.14626474
 -0.05585958  0.59753886 -0.59753886  0.47037448 -0.47037448  0.02505193
 -0.02505193 -0.04005356  0.04005356  0.06124211 -0.06124211 -0.4589058
  0.53728841 -0.31841091 -0.03270394  0.27273224  0.38727011 -0.44019773
 -0.14722707 -0.60756047  0.80771515 -0.09230268  0.05433697 -0.2560048
  0.29397052  0.11513289 -0.29702419  0.18189131  0.73793588  0.51971538
  0.86291573  1.13108013 -1.14217828 -0.19912818 -0.28947537 -1.62086529
  0.09143746 -0.09143746 -1.01451869  1.01451869 -0.0266722   0.0266722
  0.1859789  -0.1859789 ]
Mean squared error: 25.46
Variance score: 0.07
--------------------
Model 2:
print the performance of learned model 2 on testing data here
[10. 11. 10. 17. 17. 13. 16. 11. 13. 12.  8. 11. 11.  9. 11. 14. 17. 18.
 17. 11. 11. 12. 10. 11.  9.  9. 17.  8. 11. 10. 12. 17. 17. 18. 17. 16.
 17. 11. 16.  9. 16. 17.  9. 16. 18. 12. 17. 11. 18. 12. 14. 18. 14. 12.
 13. 13. 18. 12. 16. 10. 14. 13. 14. 17.]
mean cross validation score: -0.7721196410416723
score without cv: 1.0
Mean squared error: 38.88
Variance score: -0.43
===============Task 2===============
Model 1:
print the performance of learned model 1 on testing data here
mean:0.029223(std:0.072326)

The accuracy is: 0.015625
the confusion matrix is:
 [[61  0]
 [ 3  0]]
--------------------
Model 2:
print the performance of learned model 2 on testing data here
[0.13559322 0.16949153 0.23728814 0.13559322 0.3559322  0.12068966
 0.24137931 0.22413793 0.27586207 0.24137931]
```

```
cv_scores mean:0.21373465809468145
the accuracy is: 0.15625
the confusion matrix is:
 [[13  6  1  0]
 [12  7  0  0]
 [ 7  7  0  0]
 [ 7  2  0  2]]
===============Task 3===============
Model 1:
print the performance of learned model 1 on testing data here
mean:0.316306(std:0.162313)

The accuracy of matrix is: 0.078125
The confusion matrix  is:
 [[56  5  0]
 [ 0  0  0]
 [ 3  0  0]]
--------------------
Model 2:
print the performance of learned model 2 on testing data here
[0.38983051 0.23728814 0.33898305 0.50847458 0.3220339  0.44827586
 0.44827586 0.44827586 0.44827586 0.46551724]
cv_scores mean:0.4055230859146698
The accuracy of the matrix: 0.28125
The confusion matrix is:
  [[14  0  6  0  0]
 [ 4  0  1  0  0]
 [27  0 10  0  0]
 [ 0  0  1  0  0]
 [ 0  0  1  0  0]]
```

Task 1:

The final grade is chosen as the goal variable, while all the attributes are chosen as input variables (1-27). (28). If you cross-validate after performing feature selection on all the data, the test data in each fold of the cross-validation technique was also used to identify the features, which biases the performance analysis.

Task 2:

Features chosen and reasons for those features—all resting qualities (1-8, 10-28) were picked as features, and attribute 9 was predicted. The model is then fitted to the dataset's x train and y train. The model is then used to forecast the class of samples after it has been fitted. CV=10 is used for cross validation. The tree's depth is taken to be 2.

Task 3:

Features picked and why they were chosen- The target variable is Attribute 16, which asks what kind of extra educational support students receive. Other Attributes are input attributes (1-15,17-28). The model is then fitted to the dataset's x train and y train. The model is then used to forecast the class of samples after it has been fitted. CV=10 is used for cross validation. The tree's depth is taken to be 2.

Task 1:

Model 1: Liner Regression

In the output I have obtained values predicted on the test data. The coefficients of the linear model. The Mean Squared error and the Variance score. There is no correct value for MSE or for Variance score.
MSE Value obtained was 25.46.
Variance Score (r2 score)-variance Is a measure of how far observed values differ from the average of predicted values, i.e., their difference from the predicted value mean. The goal is to have a value that is low. R2 score is defined as the proportion of the variance in the dependent variable that is predictable from the independent variable.
The Variance score for our model was 0.07.

Model 2: Decision Tree Regression

Mean cross validation score for our model was -0.7721 Score without CV was 1.0
MSE=38.88
Variance Score=-0.43
Here the metric of evaluations is Mean squared error, variance score and mean cv score.

Task 2:

Model 1: Decision Tree classifier

Mean and standard deviation for the model is obtained. Output of predicted samples are obtained. Accuracy and confusion matrix is calculated for the model.
Mean=0.029223
Standard deviation=0.072326
Accuracy=0.015625
cm = [[61 0]
[3 0]]

Model 2: KNN Classifier

Accuracy of the model is calculated. Confusion Matrix is also obtained.
cv_scores mean=0.21890
accuracy=0.15625
cm = [[13 6 1 0] [12 7 0 0]
[7 7 0 0]
[7 2 0 2]]
Here the metric of evaluation is cv_scores, accuracy, confusion matrix

Task 3:

Model 1: Decision Tree classifier

Mean and standard deviation for the model is obtained. Output of predicted samples are obtained. Accuracy and confusion matrix is calculated for the model.
Mean=0.316306
Standard deviation=0.162313

Accuracy=0.078125

cm = [[56 5 0]

[0 0 0] [3 0 0]]

Hamming loss = (1-Accuracy) = 1-0.078125 = 0.921875

Model 2: KNN Classifier

Accuracy of the model is calculated. Confusion Matrix is also obtained.
cv_scores mean=0.4020748100526008
accuracy=0.296875
cm = [[14 0 6 0 0]
[4 0 1 0 0] [27 0 10 0 0] [0 0 1 0 0]
[0 0 1 0 0]]

Hamming loss = (1-Accuracy) = 1-0.296875 = 0.703125