ASSIGNMENT 3

MACHINE LEARNING

QUESTION 2(b)

RANDOM FOREST:

ASSUMPTIONS:

1. The decision tree considered is a 2 layer decision tree. The program works for only 2 layered trees and does not scale up.
2. The algortithm used,selects one feature at random till the number of features considered is less than N = 10 and checks if the feature is already selected and chooses a new one till the value of N is reached . After 10 trees all the features are selected on one go without repetition.
   This is done to ignore the features on which splitting cannot be done that is in our case feature 2 has all zeros and splitting with that feature is not possible and hence the we have to eliminate such features when we are selecting only one feature at random and this condition is checked .
   For more than 1 class the information gain principle will not allow such a feature to be selected and hence the condition check can be ignored.
   The algorithm uses first described method till 10 variables and then resorts to the second method.
3. The results taken here are taken for 5 values at a time. This is done just for convinience and the size of vector B can be varied.
4. The graph plotted here are the mean and standard deviation plot done in excel. The plot is not done using MATLAB.

RESULTS

For first 5 Values: (1-5 samples)

>> myRForest2('ionoshpere3.txt',[1 2 3 4 5],10)

Train Error for fold 1 with 100 base class: 0.148148
Test Error for fold 1 with 100 base class: 0.216216
Train Error for fold 2 with 100 base class: 0.194444
Test Error for fold 2 with 100 base class: 0.270270
Train Error for fold 3 with 100 base class: 0.191358
Test Error for fold 3 with 100 base class: 0.243243
Train Error for fold 4 with 100 base class: 0.222222
Test Error for fold 4 with 100 base class: 0.216216
Train Error for fold 5 with 100 base class: 0.364198
Test Error for fold 5 with 100 base class: 0.216216
Train Error for fold 6 with 100 base class: 0.271605
Test Error for fold 6 with 100 base class: 0.189189
Train Error for fold 7 with 100 base class: 0.250000
Test Error for fold 7 with 100 base class: 0.351351
Train Error for fold 8 with 100 base class: 0.209877
Test Error for fold 8 with 100 base class: 0.216216
Train Error for fold 9 with 100 base class: 0.179012
Test Error for fold 9 with 100 base class: 0.216216
Train Error for fold 10 with 100 base class: 0.265432
Test Error for fold 10 with 100 base class: 0.189189

Mean Train error 10 fold 100 base class is 0.229630
Std Train error 10 fold 100 base class is 0.061388

Mean Test error 10 fold 100 base class is 0.232432
Std Test error 10 fold 100 base class is 0.048010

Train Error for fold 1 with 100 base class: 0.219136
Test Error for fold 1 with 100 base class: 0.270270
Train Error for fold 2 with 100 base class: 0.308642
Test Error for fold 2 with 100 base class: 0.270270
Train Error for fold 3 with 100 base class: 0.197531
Test Error for fold 3 with 100 base class: 0.162162
Train Error for fold 4 with 100 base class: 0.222222
Test Error for fold 4 with 100 base class: 0.054054
Train Error for fold 5 with 100 base class: 0.237654
Test Error for fold 5 with 100 base class: 0.324324
Train Error for fold 6 with 100 base class: 0.243827
Test Error for fold 6 with 100 base class: 0.216216
Train Error for fold 7 with 100 base class: 0.234568
Test Error for fold 7 with 100 base class: 0.324324
Train Error for fold 8 with 100 base class: 0.203704
Test Error for fold 8 with 100 base class: 0.243243
Train Error for fold 9 with 100 base class: 0.271605
Test Error for fold 9 with 100 base class: 0.216216
Train Error for fold 10 with 100 base class: 0.182099
Test Error for fold 10 with 100 base class: 0.189189

Mean Train error 10 fold 100 base class is 0.232099
Std Train error 10 fold 100 base class is 0.037060

Mean Test error 10 fold 100 base class is 0.227027
Std Test error 10 fold 100 base class is 0.080780

Train Error for fold 1 with 100 base class: 0.172840
Test Error for fold 1 with 100 base class: 0.216216
Train Error for fold 2 with 100 base class: 0.268519
Test Error for fold 2 with 100 base class: 0.270270
Train Error for fold 3 with 100 base class: 0.200617
Test Error for fold 3 with 100 base class: 0.243243
Train Error for fold 4 with 100 base class: 0.265432
Test Error for fold 4 with 100 base class: 0.135135
Train Error for fold 5 with 100 base class: 0.219136
Test Error for fold 5 with 100 base class: 0.216216
Train Error for fold 6 with 100 base class: 0.225309
Test Error for fold 6 with 100 base class: 0.243243
Train Error for fold 7 with 100 base class: 0.209877
Test Error for fold 7 with 100 base class: 0.135135
Train Error for fold 8 with 100 base class: 0.185185
Test Error for fold 8 with 100 base class: 0.297297
Train Error for fold 9 with 100 base class: 0.268519

Test Error for fold 9 with 100 base class: 0.216216
Train Error for fold 10 with 100 base class: 0.290123
Test Error for fold 10 with 100 base class: 0.216216

Mean Train error 10 fold 100 base class is 0.230556
Std Train error 10 fold 100 base class is 0.040164

Mean Test error 10 fold 100 base class is 0.218919
Std Test error 10 fold 100 base class is 0.051674

Train Error for fold 1 with 100 base class: 0.265432
Test Error for fold 1 with 100 base class: 0.216216
Train Error for fold 2 with 100 base class: 0.182099
Test Error for fold 2 with 100 base class: 0.108108
Train Error for fold 3 with 100 base class: 0.234568
Test Error for fold 3 with 100 base class: 0.162162
Train Error for fold 4 with 100 base class: 0.191358
Test Error for fold 4 with 100 base class: 0.216216
Train Error for fold 5 with 100 base class: 0.243827
Test Error for fold 5 with 100 base class: 0.270270
Train Error for fold 6 with 100 base class: 0.231481
Test Error for fold 6 with 100 base class: 0.135135
Train Error for fold 7 with 100 base class: 0.231481
Test Error for fold 7 with 100 base class: 0.216216
Train Error for fold 8 with 100 base class: 0.237654
Test Error for fold 8 with 100 base class: 0.297297
Train Error for fold 9 with 100 base class: 0.209877
Test Error for fold 9 with 100 base class: 0.270270
Train Error for fold 10 with 100 base class: 0.234568
Test Error for fold 10 with 100 base class: 0.216216

Mean Train error 10 fold 100 base class is 0.226235
Std Train error 10 fold 100 base class is 0.024949

Mean Test error 10 fold 100 base class is 0.210811
Std Test error 10 fold 100 base class is 0.060836

Train Error for fold 1 with 100 base class: 0.253086
Test Error for fold 1 with 100 base class: 0.189189
Train Error for fold 2 with 100 base class: 0.212963
Test Error for fold 2 with 100 base class: 0.162162
Train Error for fold 3 with 100 base class: 0.219136
Test Error for fold 3 with 100 base class: 0.162162
Train Error for fold 4 with 100 base class: 0.222222
Test Error for fold 4 with 100 base class: 0.270270
Train Error for fold 5 with 100 base class: 0.237654
Test Error for fold 5 with 100 base class: 0.189189
Train Error for fold 6 with 100 base class: 0.225309
Test Error for fold 6 with 100 base class: 0.243243
Train Error for fold 7 with 100 base class: 0.250000
Test Error for fold 7 with 100 base class: 0.135135

Train Error for fold 8 with 100 base class: 0.228395
Test Error for fold 8 with 100 base class: 0.324324
Train Error for fold 9 with 100 base class: 0.280864
Test Error for fold 9 with 100 base class: 0.243243
Train Error for fold 10 with 100 base class: 0.265432
Test Error for fold 10 with 100 base class: 0.270270

Mean Train error 10 fold 100 base class is 0.239506
Std Train error 10 fold 100 base class is 0.022171

Mean Test error 10 fold 100 base class is 0.218919
Std Test error 10 fold 100 base class is 0.060367

FOR Next 5 Values: (6- 10 Samples)
>> myRForest2('ionoshpere3.txt',[6 7 8 9 10],10)

Train Error for fold 1 with 100 base class: 0.179012
Test Error for fold 1 with 100 base class: 0.243243
Train Error for fold 2 with 100 base class: 0.320988
Test Error for fold 2 with 100 base class: 0.324324
Train Error for fold 3 with 100 base class: 0.237654
Test Error for fold 3 with 100 base class: 0.162162
Train Error for fold 4 with 100 base class: 0.240741
Test Error for fold 4 with 100 base class: 0.297297
Train Error for fold 5 with 100 base class: 0.237654
Test Error for fold 5 with 100 base class: 0.189189
Train Error for fold 6 with 100 base class: 0.243827
Test Error for fold 6 with 100 base class: 0.189189
Train Error for fold 7 with 100 base class: 0.253086
Test Error for fold 7 with 100 base class: 0.216216
Train Error for fold 8 with 100 base class: 0.246914
Test Error for fold 8 with 100 base class: 0.216216
Train Error for fold 9 with 100 base class: 0.222222
Test Error for fold 9 with 100 base class: 0.270270
Train Error for fold 10 with 100 base class: 0.209877
Test Error for fold 10 with 100 base class: 0.378378

Mean Train error 10 fold 100 base class is 0.239198
Std Train error 10 fold 100 base class is 0.036118

Mean Test error 10 fold 100 base class is 0.248649
Std Test error 10 fold 100 base class is 0.068374

Train Error for fold 1 with 100 base class: 0.268519
Test Error for fold 1 with 100 base class: 0.162162
Train Error for fold 2 with 100 base class: 0.259259
Test Error for fold 2 with 100 base class: 0.243243
Train Error for fold 3 with 100 base class: 0.283951
Test Error for fold 3 with 100 base class: 0.405405
Train Error for fold 4 with 100 base class: 0.197531

Test Error for fold 4 with 100 base class: 0.297297
Train Error for fold 5 with 100 base class: 0.237654
Test Error for fold 5 with 100 base class: 0.216216
Train Error for fold 6 with 100 base class: 0.290123
Test Error for fold 6 with 100 base class: 0.324324
Train Error for fold 7 with 100 base class: 0.277778
Test Error for fold 7 with 100 base class: 0.189189
Train Error for fold 8 with 100 base class: 0.172840
Test Error for fold 8 with 100 base class: 0.162162
Train Error for fold 9 with 100 base class: 0.200617
Test Error for fold 9 with 100 base class: 0.324324
Train Error for fold 10 with 100 base class: 0.287037
Test Error for fold 10 with 100 base class: 0.270270

Mean Train error 10 fold 100 base class is 0.247531
Std Train error 10 fold 100 base class is 0.042910

Mean Test error 10 fold 100 base class is 0.259459
Std Test error 10 fold 100 base class is 0.079769

Train Error for fold 1 with 100 base class: 0.283951
Test Error for fold 1 with 100 base class: 0.189189
Train Error for fold 2 with 100 base class: 0.320988
Test Error for fold 2 with 100 base class: 0.243243
Train Error for fold 3 with 100 base class: 0.234568
Test Error for fold 3 with 100 base class: 0.405405
Train Error for fold 4 with 100 base class: 0.283951
Test Error for fold 4 with 100 base class: 0.189189
Train Error for fold 5 with 100 base class: 0.228395
Test Error for fold 5 with 100 base class: 0.297297
Train Error for fold 6 with 100 base class: 0.253086
Test Error for fold 6 with 100 base class: 0.378378
Train Error for fold 7 with 100 base class: 0.203704
Test Error for fold 7 with 100 base class: 0.378378
Train Error for fold 8 with 100 base class: 0.277778
Test Error for fold 8 with 100 base class: 0.216216
Train Error for fold 9 with 100 base class: 0.250000
Test Error for fold 9 with 100 base class: 0.270270
Train Error for fold 10 with 100 base class: 0.231481
Test Error for fold 10 with 100 base class: 0.324324

Mean Train error 10 fold 100 base class is 0.256790
Std Train error 10 fold 100 base class is 0.034730

Mean Test error 10 fold 100 base class is 0.289189
Std Test error 10 fold 100 base class is 0.080629

Train Error for fold 1 with 100 base class: 0.290123
Test Error for fold 1 with 100 base class: 0.324324
Train Error for fold 2 with 100 base class: 0.216049
Test Error for fold 2 with 100 base class: 0.243243

Train Error for fold 3 with 100 base class: 0.231481
Test Error for fold 3 with 100 base class: 0.243243
Train Error for fold 4 with 100 base class: 0.243827
Test Error for fold 4 with 100 base class: 0.135135
Train Error for fold 5 with 100 base class: 0.219136
Test Error for fold 5 with 100 base class: 0.243243
Train Error for fold 6 with 100 base class: 0.246914
Test Error for fold 6 with 100 base class: 0.270270
Train Error for fold 7 with 100 base class: 0.203704
Test Error for fold 7 with 100 base class: 0.270270
Train Error for fold 8 with 100 base class: 0.246914
Test Error for fold 8 with 100 base class: 0.189189
Train Error for fold 9 with 100 base class: 0.240741
Test Error for fold 9 with 100 base class: 0.189189
Train Error for fold 10 with 100 base class: 0.209877
Test Error for fold 10 with 100 base class: 0.243243

Mean Train error 10 fold 100 base class is 0.234877
Std Train error 10 fold 100 base class is 0.025093

Mean Test error 10 fold 100 base class is 0.235135
Std Test error 10 fold 100 base class is 0.052608

Train Error for fold 1 with 100 base class: 0.123457
Test Error for fold 1 with 100 base class: 0.216216
Train Error for fold 2 with 100 base class: 0.101852
Test Error for fold 2 with 100 base class: 0.108108
Train Error for fold 3 with 100 base class: 0.129630
Test Error for fold 3 with 100 base class: 0.135135
Train Error for fold 4 with 100 base class: 0.080247
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.145062
Test Error for fold 5 with 100 base class: 0.135135
Train Error for fold 6 with 100 base class: 0.154321
Test Error for fold 6 with 100 base class: 0.189189
Train Error for fold 7 with 100 base class: 0.129630
Test Error for fold 7 with 100 base class: 0.081081
Train Error for fold 8 with 100 base class: 0.095679
Test Error for fold 8 with 100 base class: 0.189189
Train Error for fold 9 with 100 base class: 0.123457
Test Error for fold 9 with 100 base class: 0.216216
Train Error for fold 10 with 100 base class: 0.135802
Test Error for fold 10 with 100 base class: 0.189189

Mean Train error 10 fold 100 base class is 0.121914
Std Train error 10 fold 100 base class is 0.022924

Mean Test error 10 fold 100 base class is 0.156757
Std Test error 10 fold 100 base class is 0.049014

FOR Next 5 values : (11-15 Samples)
>> myRForest2('ionoshpere3.txt',[11 12 13 14 15],10)

Train Error for fold 1 with 100 base class: 0.083333
Test Error for fold 1 with 100 base class: 0.108108
Train Error for fold 2 with 100 base class: 0.104938
Test Error for fold 2 with 100 base class: 0.162162
Train Error for fold 3 with 100 base class: 0.092593
Test Error for fold 3 with 100 base class: 0.162162
Train Error for fold 4 with 100 base class: 0.092593
Test Error for fold 4 with 100 base class: 0.135135
Train Error for fold 5 with 100 base class: 0.117284
Test Error for fold 5 with 100 base class: 0.243243
Train Error for fold 6 with 100 base class: 0.095679
Test Error for fold 6 with 100 base class: 0.135135
Train Error for fold 7 with 100 base class: 0.089506
Test Error for fold 7 with 100 base class: 0.135135
Train Error for fold 8 with 100 base class: 0.067901
Test Error for fold 8 with 100 base class: 0.243243
Train Error for fold 9 with 100 base class: 0.070988
Test Error for fold 9 with 100 base class: 0.081081
Train Error for fold 10 with 100 base class: 0.067901
Test Error for fold 10 with 100 base class: 0.243243

Mean Train error 10 fold 100 base class is 0.088272
Std Train error 10 fold 100 base class is 0.016215

Mean Test error 10 fold 100 base class is 0.164865
Std Test error 10 fold 100 base class is 0.059007

Train Error for fold 1 with 100 base class: 0.104938
Test Error for fold 1 with 100 base class: 0.081081
Train Error for fold 2 with 100 base class: 0.132716
Test Error for fold 2 with 100 base class: 0.135135
Train Error for fold 3 with 100 base class: 0.111111
Test Error for fold 3 with 100 base class: 0.108108
Train Error for fold 4 with 100 base class: 0.101852
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.108025
Test Error for fold 5 with 100 base class: 0.081081
Train Error for fold 6 with 100 base class: 0.095679
Test Error for fold 6 with 100 base class: 0.081081
Train Error for fold 7 with 100 base class: 0.098765
Test Error for fold 7 with 100 base class: 0.189189
Train Error for fold 8 with 100 base class: 0.117284
Test Error for fold 8 with 100 base class: 0.189189
Train Error for fold 9 with 100 base class: 0.117284
Test Error for fold 9 with 100 base class: 0.162162
Train Error for fold 10 with 100 base class: 0.086420
Test Error for fold 10 with 100 base class: 0.027027

Mean Train error 10 fold 100 base class is 0.107407
Std Train error 10 fold 100 base class is 0.013078

Mean Test error 10 fold 100 base class is 0.116216
Std Test error 10 fold 100 base class is 0.052608

Train Error for fold 1 with 100 base class: 0.135802
Test Error for fold 1 with 100 base class: 0.000000
Train Error for fold 2 with 100 base class: 0.080247
Test Error for fold 2 with 100 base class: 0.081081
Train Error for fold 3 with 100 base class: 0.111111
Test Error for fold 3 with 100 base class: 0.135135
Train Error for fold 4 with 100 base class: 0.098765
Test Error for fold 4 with 100 base class: 0.162162
Train Error for fold 5 with 100 base class: 0.120370
Test Error for fold 5 with 100 base class: 0.162162
Train Error for fold 6 with 100 base class: 0.120370
Test Error for fold 6 with 100 base class: 0.081081
Train Error for fold 7 with 100 base class: 0.092593
Test Error for fold 7 with 100 base class: 0.054054
Train Error for fold 8 with 100 base class: 0.080247
Test Error for fold 8 with 100 base class: 0.135135
Train Error for fold 9 with 100 base class: 0.080247
Test Error for fold 9 with 100 base class: 0.135135
Train Error for fold 10 with 100 base class: 0.098765
Test Error for fold 10 with 100 base class: 0.162162

Mean Train error 10 fold 100 base class is 0.101852
Std Train error 10 fold 100 base class is 0.019520

Mean Test error 10 fold 100 base class is 0.110811
Std Test error 10 fold 100 base class is 0.054726

Train Error for fold 1 with 100 base class: 0.111111
Test Error for fold 1 with 100 base class: 0.189189
Train Error for fold 2 with 100 base class: 0.104938
Test Error for fold 2 with 100 base class: 0.027027
Train Error for fold 3 with 100 base class: 0.092593
Test Error for fold 3 with 100 base class: 0.054054
Train Error for fold 4 with 100 base class: 0.117284
Test Error for fold 4 with 100 base class: 0.162162
Train Error for fold 5 with 100 base class: 0.077160
Test Error for fold 5 with 100 base class: 0.270270
Train Error for fold 6 with 100 base class: 0.077160
Test Error for fold 6 with 100 base class: 0.081081
Train Error for fold 7 with 100 base class: 0.098765
Test Error for fold 7 with 100 base class: 0.081081
Train Error for fold 8 with 100 base class: 0.086420
Test Error for fold 8 with 100 base class: 0.162162
Train Error for fold 9 with 100 base class: 0.108025
Test Error for fold 9 with 100 base class: 0.081081

Train Error for fold 10 with 100 base class: 0.077160
Test Error for fold 10 with 100 base class: 0.081081

Mean Train error 10 fold 100 base class is 0.095062
Std Train error 10 fold 100 base class is 0.015176

Mean Test error 10 fold 100 base class is 0.118919
Std Test error 10 fold 100 base class is 0.074508

Train Error for fold 1 with 100 base class: 0.135802
Test Error for fold 1 with 100 base class: 0.081081
Train Error for fold 2 with 100 base class: 0.086420
Test Error for fold 2 with 100 base class: 0.216216
Train Error for fold 3 with 100 base class: 0.108025
Test Error for fold 3 with 100 base class: 0.189189
Train Error for fold 4 with 100 base class: 0.120370
Test Error for fold 4 with 100 base class: 0.081081
Train Error for fold 5 with 100 base class: 0.098765
Test Error for fold 5 with 100 base class: 0.054054
Train Error for fold 6 with 100 base class: 0.101852
Test Error for fold 6 with 100 base class: 0.081081
Train Error for fold 7 with 100 base class: 0.098765
Test Error for fold 7 with 100 base class: 0.108108
Train Error for fold 8 with 100 base class: 0.083333
Test Error for fold 8 with 100 base class: 0.162162
Train Error for fold 9 with 100 base class: 0.104938
Test Error for fold 9 with 100 base class: 0.189189
Train Error for fold 10 with 100 base class: 0.126543
Test Error for fold 10 with 100 base class: 0.081081

Mean Train error 10 fold 100 base class is 0.106481
Std Train error 10 fold 100 base class is 0.016795

Mean Test error 10 fold 100 base class is 0.124324
Std Test error 10 fold 100 base class is 0.058662

FOR Next 5 values(16-20)
>> myRForest2('ionoshpere3.txt',[16 17 18 19 20],10)

Train Error for fold 1 with 100 base class: 0.104938
Test Error for fold 1 with 100 base class: 0.108108
Train Error for fold 2 with 100 base class: 0.129630
Test Error for fold 2 with 100 base class: 0.081081
Train Error for fold 3 with 100 base class: 0.098765
Test Error for fold 3 with 100 base class: 0.162162
Train Error for fold 4 with 100 base class: 0.077160
Test Error for fold 4 with 100 base class: 0.081081
Train Error for fold 5 with 100 base class: 0.077160
Test Error for fold 5 with 100 base class: 0.108108
Train Error for fold 6 with 100 base class: 0.077160
Test Error for fold 6 with 100 base class: 0.108108

Train Error for fold 7 with 100 base class: 0.111111
Test Error for fold 7 with 100 base class: 0.054054
Train Error for fold 8 with 100 base class: 0.123457
Test Error for fold 8 with 100 base class: 0.027027
Train Error for fold 9 with 100 base class: 0.086420
Test Error for fold 9 with 100 base class: 0.108108
Train Error for fold 10 with 100 base class: 0.141975
Test Error for fold 10 with 100 base class: 0.162162

Mean Train error 10 fold 100 base class is 0.102778
Std Train error 10 fold 100 base class is 0.023598

Mean Test error 10 fold 100 base class is 0.100000
Std Test error 10 fold 100 base class is 0.042352

Train Error for fold 1 with 100 base class: 0.104938
Test Error for fold 1 with 100 base class: 0.189189
Train Error for fold 2 with 100 base class: 0.067901
Test Error for fold 2 with 100 base class: 0.135135
Train Error for fold 3 with 100 base class: 0.083333
Test Error for fold 3 with 100 base class: 0.108108
Train Error for fold 4 with 100 base class: 0.080247
Test Error for fold 4 with 100 base class: 0.081081
Train Error for fold 5 with 100 base class: 0.095679
Test Error for fold 5 with 100 base class: 0.189189
Train Error for fold 6 with 100 base class: 0.126543
Test Error for fold 6 with 100 base class: 0.108108
Train Error for fold 7 with 100 base class: 0.083333
Test Error for fold 7 with 100 base class: 0.135135
Train Error for fold 8 with 100 base class: 0.092593
Test Error for fold 8 with 100 base class: 0.162162
Train Error for fold 9 with 100 base class: 0.092593
Test Error for fold 9 with 100 base class: 0.108108
Train Error for fold 10 with 100 base class: 0.098765
Test Error for fold 10 with 100 base class: 0.189189

Mean Train error 10 fold 100 base class is 0.092593
Std Train error 10 fold 100 base class is 0.015938

Mean Test error 10 fold 100 base class is 0.140541
Std Test error 10 fold 100 base class is 0.039885

Train Error for fold 1 with 100 base class: 0.098765
Test Error for fold 1 with 100 base class: 0.216216
Train Error for fold 2 with 100 base class: 0.120370
Test Error for fold 2 with 100 base class: 0.027027
Train Error for fold 3 with 100 base class: 0.070988
Test Error for fold 3 with 100 base class: 0.162162
Train Error for fold 4 with 100 base class: 0.104938
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.114198

Test Error for fold 5 with 100 base class: 0.108108
Train Error for fold 6 with 100 base class: 0.108025
Test Error for fold 6 with 100 base class: 0.135135
Train Error for fold 7 with 100 base class: 0.098765
Test Error for fold 7 with 100 base class: 0.000000
Train Error for fold 8 with 100 base class: 0.067901
Test Error for fold 8 with 100 base class: 0.108108
Train Error for fold 9 with 100 base class: 0.120370
Test Error for fold 9 with 100 base class: 0.027027
Train Error for fold 10 with 100 base class: 0.145062
Test Error for fold 10 with 100 base class: 0.135135

Mean Train error 10 fold 100 base class is 0.104938
Std Train error 10 fold 100 base class is 0.023051

Mean Test error 10 fold 100 base class is 0.102703
Std Test error 10 fold 100 base class is 0.067176

Train Error for fold 1 with 100 base class: 0.117284
Test Error for fold 1 with 100 base class: 0.135135
Train Error for fold 2 with 100 base class: 0.108025
Test Error for fold 2 with 100 base class: 0.162162
Train Error for fold 3 with 100 base class: 0.098765
Test Error for fold 3 with 100 base class: 0.243243
Train Error for fold 4 with 100 base class: 0.114198
Test Error for fold 4 with 100 base class: 0.054054
Train Error for fold 5 with 100 base class: 0.108025
Test Error for fold 5 with 100 base class: 0.162162
Train Error for fold 6 with 100 base class: 0.104938
Test Error for fold 6 with 100 base class: 0.054054
Train Error for fold 7 with 100 base class: 0.117284
Test Error for fold 7 with 100 base class: 0.162162
Train Error for fold 8 with 100 base class: 0.064815
Test Error for fold 8 with 100 base class: 0.243243
Train Error for fold 9 with 100 base class: 0.104938
Test Error for fold 9 with 100 base class: 0.108108
Train Error for fold 10 with 100 base class: 0.117284
Test Error for fold 10 with 100 base class: 0.162162

Mean Train error 10 fold 100 base class is 0.105556
Std Train error 10 fold 100 base class is 0.015657

Mean Test error 10 fold 100 base class is 0.148649
Std Test error 10 fold 100 base class is 0.065276

Train Error for fold 1 with 100 base class: 0.052469
Test Error for fold 1 with 100 base class: 0.108108
Train Error for fold 2 with 100 base class: 0.080247
Test Error for fold 2 with 100 base class: 0.162162
Train Error for fold 3 with 100 base class: 0.172840
Test Error for fold 3 with 100 base class: 0.081081

Train Error for fold 4 with 100 base class: 0.108025
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.126543
Test Error for fold 5 with 100 base class: 0.162162
Train Error for fold 6 with 100 base class: 0.083333
Test Error for fold 6 with 100 base class: 0.135135
Train Error for fold 7 with 100 base class: 0.111111
Test Error for fold 7 with 100 base class: 0.108108
Train Error for fold 8 with 100 base class: 0.104938
Test Error for fold 8 with 100 base class: 0.108108
Train Error for fold 9 with 100 base class: 0.114198
Test Error for fold 9 with 100 base class: 0.054054
Train Error for fold 10 with 100 base class: 0.089506
Test Error for fold 10 with 100 base class: 0.135135

Mean Train error 10 fold 100 base class is 0.104321
Std Train error 10 fold 100 base class is 0.032101

Mean Test error 10 fold 100 base class is 0.116216
Std Test error 10 fold 100 base class is 0.033829

FOR Next 5 Values: (21-25)

>> myRForest2('ionoshpere3.txt',[21 22 23 24 25],10)

Train Error for fold 1 with 100 base class: 0.095679
Test Error for fold 1 with 100 base class: 0.135135
Train Error for fold 2 with 100 base class: 0.141975
Test Error for fold 2 with 100 base class: 0.108108
Train Error for fold 3 with 100 base class: 0.126543
Test Error for fold 3 with 100 base class: 0.108108
Train Error for fold 4 with 100 base class: 0.086420
Test Error for fold 4 with 100 base class: 0.081081
Train Error for fold 5 with 100 base class: 0.117284
Test Error for fold 5 with 100 base class: 0.108108
Train Error for fold 6 with 100 base class: 0.108025
Test Error for fold 6 with 100 base class: 0.081081
Train Error for fold 7 with 100 base class: 0.111111
Test Error for fold 7 with 100 base class: 0.081081
Train Error for fold 8 with 100 base class: 0.104938
Test Error for fold 8 with 100 base class: 0.189189
Train Error for fold 9 with 100 base class: 0.135802
Test Error for fold 9 with 100 base class: 0.081081
Train Error for fold 10 with 100 base class: 0.104938
Test Error for fold 10 with 100 base class: 0.189189

Mean Train error 10 fold 100 base class is 0.113272
Std Train error 10 fold 100 base class is 0.017402

Mean Test error 10 fold 100 base class is 0.116216
Std Test error 10 fold 100 base class is 0.042352

Train Error for fold 1 with 100 base class: 0.117284
Test Error for fold 1 with 100 base class: 0.108108
Train Error for fold 2 with 100 base class: 0.145062
Test Error for fold 2 with 100 base class: 0.054054
Train Error for fold 3 with 100 base class: 0.101852
Test Error for fold 3 with 100 base class: 0.135135
Train Error for fold 4 with 100 base class: 0.086420
Test Error for fold 4 with 100 base class: 0.081081
Train Error for fold 5 with 100 base class: 0.086420
Test Error for fold 5 with 100 base class: 0.162162
Train Error for fold 6 with 100 base class: 0.111111
Test Error for fold 6 with 100 base class: 0.108108
Train Error for fold 7 with 100 base class: 0.080247
Test Error for fold 7 with 100 base class: 0.108108
Train Error for fold 8 with 100 base class: 0.120370
Test Error for fold 8 with 100 base class: 0.027027
Train Error for fold 9 with 100 base class: 0.129630
Test Error for fold 9 with 100 base class: 0.135135
Train Error for fold 10 with 100 base class: 0.089506
Test Error for fold 10 with 100 base class: 0.108108

Mean Train error 10 fold 100 base class is 0.106790
Std Train error 10 fold 100 base class is 0.021492

Mean Test error 10 fold 100 base class is 0.102703
Std Test error 10 fold 100 base class is 0.039885

Train Error for fold 1 with 100 base class: 0.135802
Test Error for fold 1 with 100 base class: 0.135135
Train Error for fold 2 with 100 base class: 0.114198
Test Error for fold 2 with 100 base class: 0.108108
Train Error for fold 3 with 100 base class: 0.092593
Test Error for fold 3 with 100 base class: 0.135135
Train Error for fold 4 with 100 base class: 0.067901
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.126543
Test Error for fold 5 with 100 base class: 0.081081
Train Error for fold 6 with 100 base class: 0.117284
Test Error for fold 6 with 100 base class: 0.135135
Train Error for fold 7 with 100 base class: 0.154321
Test Error for fold 7 with 100 base class: 0.162162
Train Error for fold 8 with 100 base class: 0.111111
Test Error for fold 8 with 100 base class: 0.081081
Train Error for fold 9 with 100 base class: 0.098765
Test Error for fold 9 with 100 base class: 0.135135
Train Error for fold 10 with 100 base class: 0.120370
Test Error for fold 10 with 100 base class: 0.081081

Mean Train error 10 fold 100 base class is 0.113889
Std Train error 10 fold 100 base class is 0.023883

Mean Test error 10 fold 100 base class is 0.116216
Std Test error 10 fold 100 base class is 0.028631

Train Error for fold 1 with 100 base class: 0.083333
Test Error for fold 1 with 100 base class: 0.162162
Train Error for fold 2 with 100 base class: 0.104938
Test Error for fold 2 with 100 base class: 0.135135
Train Error for fold 3 with 100 base class: 0.126543
Test Error for fold 3 with 100 base class: 0.108108
Train Error for fold 4 with 100 base class: 0.101852
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.148148
Test Error for fold 5 with 100 base class: 0.027027
Train Error for fold 6 with 100 base class: 0.123457
Test Error for fold 6 with 100 base class: 0.189189
Train Error for fold 7 with 100 base class: 0.098765
Test Error for fold 7 with 100 base class: 0.189189
Train Error for fold 8 with 100 base class: 0.123457
Test Error for fold 8 with 100 base class: 0.189189
Train Error for fold 9 with 100 base class: 0.132716
Test Error for fold 9 with 100 base class: 0.162162
Train Error for fold 10 with 100 base class: 0.101852
Test Error for fold 10 with 100 base class: 0.162162

Mean Train error 10 fold 100 base class is 0.114506
Std Train error 10 fold 100 base class is 0.019436

Mean Test error 10 fold 100 base class is 0.143243
Std Test error 10 fold 100 base class is 0.051042

Train Error for fold 1 with 100 base class: 0.129630
Test Error for fold 1 with 100 base class: 0.162162
Train Error for fold 2 with 100 base class: 0.101852
Test Error for fold 2 with 100 base class: 0.243243
Train Error for fold 3 with 100 base class: 0.114198
Test Error for fold 3 with 100 base class: 0.108108
Train Error for fold 4 with 100 base class: 0.135802
Test Error for fold 4 with 100 base class: 0.081081
Train Error for fold 5 with 100 base class: 0.092593
Test Error for fold 5 with 100 base class: 0.108108
Train Error for fold 6 with 100 base class: 0.157407
Test Error for fold 6 with 100 base class: 0.081081
Train Error for fold 7 with 100 base class: 0.117284
Test Error for fold 7 with 100 base class: 0.108108
Train Error for fold 8 with 100 base class: 0.095679
Test Error for fold 8 with 100 base class: 0.108108
Train Error for fold 9 with 100 base class: 0.104938
Test Error for fold 9 with 100 base class: 0.135135
Train Error for fold 10 with 100 base class: 0.111111
Test Error for fold 10 with 100 base class: 0.135135

Mean Train error 10 fold 100 base class is 0.116049
Std Train error 10 fold 100 base class is 0.020013

Mean Test error 10 fold 100 base class is 0.127027
Std Test error 10 fold 100 base class is 0.047756

FOR Next 5 Values: (26-30)
>> myRForest2('ionoshpere3.txt',[26 27 28 29 30],10)

Train Error for fold 1 with 100 base class: 0.114198
Test Error for fold 1 with 100 base class: 0.189189
Train Error for fold 2 with 100 base class: 0.067901
Test Error for fold 2 with 100 base class: 0.270270
Train Error for fold 3 with 100 base class: 0.145062
Test Error for fold 3 with 100 base class: 0.081081
Train Error for fold 4 with 100 base class: 0.086420
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.114198
Test Error for fold 5 with 100 base class: 0.270270
Train Error for fold 6 with 100 base class: 0.114198
Test Error for fold 6 with 100 base class: 0.135135
Train Error for fold 7 with 100 base class: 0.114198
Test Error for fold 7 with 100 base class: 0.081081
Train Error for fold 8 with 100 base class: 0.064815
Test Error for fold 8 with 100 base class: 0.027027
Train Error for fold 9 with 100 base class: 0.098765
Test Error for fold 9 with 100 base class: 0.135135
Train Error for fold 10 with 100 base class: 0.120370
Test Error for fold 10 with 100 base class: 0.108108

Mean Train error 10 fold 100 base class is 0.104012
Std Train error 10 fold 100 base class is 0.024822

Mean Test error 10 fold 100 base class is 0.140541
Std Test error 10 fold 100 base class is 0.080377

Train Error for fold 1 with 100 base class: 0.061728
Test Error for fold 1 with 100 base class: 0.189189
Train Error for fold 2 with 100 base class: 0.104938
Test Error for fold 2 with 100 base class: 0.135135
Train Error for fold 3 with 100 base class: 0.172840
Test Error for fold 3 with 100 base class: 0.135135
Train Error for fold 4 with 100 base class: 0.092593
Test Error for fold 4 with 100 base class: 0.135135
Train Error for fold 5 with 100 base class: 0.089506
Test Error for fold 5 with 100 base class: 0.108108
Train Error for fold 6 with 100 base class: 0.077160
Test Error for fold 6 with 100 base class: 0.108108
Train Error for fold 7 with 100 base class: 0.077160
Test Error for fold 7 with 100 base class: 0.189189
Train Error for fold 8 with 100 base class: 0.141975

Test Error for fold 8 with 100 base class: 0.135135
Train Error for fold 9 with 100 base class: 0.135802
Test Error for fold 9 with 100 base class: 0.243243
Train Error for fold 10 with 100 base class: 0.111111
Test Error for fold 10 with 100 base class: 0.162162

Mean Train error 10 fold 100 base class is 0.106481
Std Train error 10 fold 100 base class is 0.034561

Mean Test error 10 fold 100 base class is 0.154054
Std Test error 10 fold 100 base class is 0.042352

Train Error for fold 1 with 100 base class: 0.111111
Test Error for fold 1 with 100 base class: 0.135135
Train Error for fold 2 with 100 base class: 0.080247
Test Error for fold 2 with 100 base class: 0.135135
Train Error for fold 3 with 100 base class: 0.098765
Test Error for fold 3 with 100 base class: 0.108108
Train Error for fold 4 with 100 base class: 0.108025
Test Error for fold 4 with 100 base class: 0.054054
Train Error for fold 5 with 100 base class: 0.108025
Test Error for fold 5 with 100 base class: 0.189189
Train Error for fold 6 with 100 base class: 0.080247
Test Error for fold 6 with 100 base class: 0.081081
Train Error for fold 7 with 100 base class: 0.126543
Test Error for fold 7 with 100 base class: 0.081081
Train Error for fold 8 with 100 base class: 0.104938
Test Error for fold 8 with 100 base class: 0.135135
Train Error for fold 9 with 100 base class: 0.141975
Test Error for fold 9 with 100 base class: 0.162162
Train Error for fold 10 with 100 base class: 0.117284
Test Error for fold 10 with 100 base class: 0.108108

Mean Train error 10 fold 100 base class is 0.107716
Std Train error 10 fold 100 base class is 0.018940

Mean Test error 10 fold 100 base class is 0.118919
Std Test error 10 fold 100 base class is 0.040690

Train Error for fold 1 with 100 base class: 0.126543
Test Error for fold 1 with 100 base class: 0.135135
Train Error for fold 2 with 100 base class: 0.135802
Test Error for fold 2 with 100 base class: 0.135135
Train Error for fold 3 with 100 base class: 0.089506
Test Error for fold 3 with 100 base class: 0.189189
Train Error for fold 4 with 100 base class: 0.104938
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.095679
Test Error for fold 5 with 100 base class: 0.189189
Train Error for fold 6 with 100 base class: 0.117284
Test Error for fold 6 with 100 base class: 0.108108

Train Error for fold 7 with 100 base class: 0.135802
Test Error for fold 7 with 100 base class: 0.216216
Train Error for fold 8 with 100 base class: 0.111111
Test Error for fold 8 with 100 base class: 0.054054
Train Error for fold 9 with 100 base class: 0.120370
Test Error for fold 9 with 100 base class: 0.162162
Train Error for fold 10 with 100 base class: 0.123457
Test Error for fold 10 with 100 base class: 0.000000

Mean Train error 10 fold 100 base class is 0.116049
Std Train error 10 fold 100 base class is 0.015751

Mean Test error 10 fold 100 base class is 0.129730
Std Test error 10 fold 100 base class is 0.065957

Train Error for fold 1 with 100 base class: 0.120370
Test Error for fold 1 with 100 base class: 0.135135
Train Error for fold 2 with 100 base class: 0.108025
Test Error for fold 2 with 100 base class: 0.081081
Train Error for fold 3 with 100 base class: 0.117284
Test Error for fold 3 with 100 base class: 0.189189
Train Error for fold 4 with 100 base class: 0.111111
Test Error for fold 4 with 100 base class: 0.081081
Train Error for fold 5 with 100 base class: 0.157407
Test Error for fold 5 with 100 base class: 0.108108
Train Error for fold 6 with 100 base class: 0.080247
Test Error for fold 6 with 100 base class: 0.108108
Train Error for fold 7 with 100 base class: 0.074074
Test Error for fold 7 with 100 base class: 0.054054
Train Error for fold 8 with 100 base class: 0.101852
Test Error for fold 8 with 100 base class: 0.162162
Train Error for fold 9 with 100 base class: 0.126543
Test Error for fold 9 with 100 base class: 0.108108
Train Error for fold 10 with 100 base class: 0.138889
Test Error for fold 10 with 100 base class: 0.081081

Mean Train error 10 fold 100 base class is 0.113580
Std Train error 10 fold 100 base class is 0.025023

Mean Test error 10 fold 100 base class is 0.110811
Std Test error 10 fold 100 base class is 0.041186

For 31,32 and 33:

>> myRForest2('ionoshpere3.txt',[31 32 33],10)

Train Error for fold 1 with 100 base class: 0.120370
Test Error for fold 1 with 100 base class: 0.054054
Train Error for fold 2 with 100 base class: 0.111111
Test Error for fold 2 with 100 base class: 0.189189
Train Error for fold 3 with 100 base class: 0.104938
Test Error for fold 3 with 100 base class: 0.270270
Train Error for fold 4 with 100 base class: 0.108025

Test Error for fold 4 with 100 base class: 0.216216
Train Error for fold 5 with 100 base class: 0.179012
Test Error for fold 5 with 100 base class: 0.054054
Train Error for fold 6 with 100 base class: 0.108025
Test Error for fold 6 with 100 base class: 0.162162
Train Error for fold 7 with 100 base class: 0.117284
Test Error for fold 7 with 100 base class: 0.135135
Train Error for fold 8 with 100 base class: 0.108025
Test Error for fold 8 with 100 base class: 0.108108
Train Error for fold 9 with 100 base class: 0.141975
Test Error for fold 9 with 100 base class: 0.135135
Train Error for fold 10 with 100 base class: 0.132716
Test Error for fold 10 with 100 base class: 0.135135

Mean Train error 10 fold 100 base class is 0.123148
Std Train error 10 fold 100 base class is 0.023026

Mean Test error 10 fold 100 base class is 0.145946
Std Test error 10 fold 100 base class is 0.067658

Train Error for fold 1 with 100 base class: 0.117284
Test Error for fold 1 with 100 base class: 0.108108
Train Error for fold 2 with 100 base class: 0.086420
Test Error for fold 2 with 100 base class: 0.108108
Train Error for fold 3 with 100 base class: 0.141975
Test Error for fold 3 with 100 base class: 0.081081
Train Error for fold 4 with 100 base class: 0.163580
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.145062
Test Error for fold 5 with 100 base class: 0.108108
Train Error for fold 6 with 100 base class: 0.104938
Test Error for fold 6 with 100 base class: 0.189189
Train Error for fold 7 with 100 base class: 0.120370
Test Error for fold 7 with 100 base class: 0.108108
Train Error for fold 8 with 100 base class: 0.101852
Test Error for fold 8 with 100 base class: 0.189189
Train Error for fold 9 with 100 base class: 0.104938
Test Error for fold 9 with 100 base class: 0.162162
Train Error for fold 10 with 100 base class: 0.108025
Test Error for fold 10 with 100 base class: 0.108108

Mean Train error 10 fold 100 base class is 0.119444
Std Train error 10 fold 100 base class is 0.023732

Mean Test error 10 fold 100 base class is 0.127027
Std Test error 10 fold 100 base class is 0.038328

Train Error for fold 1 with 100 base class: 0.114198
Test Error for fold 1 with 100 base class: 0.027027
Train Error for fold 2 with 100 base class: 0.111111
Test Error for fold 2 with 100 base class: 0.216216

Train Error for fold 3 with 100 base class: 0.138889
Test Error for fold 3 with 100 base class: 0.135135
Train Error for fold 4 with 100 base class: 0.117284
Test Error for fold 4 with 100 base class: 0.108108
Train Error for fold 5 with 100 base class: 0.141975
Test Error for fold 5 with 100 base class: 0.135135
Train Error for fold 6 with 100 base class: 0.101852
Test Error for fold 6 with 100 base class: 0.135135
Train Error for fold 7 with 100 base class: 0.123457
Test Error for fold 7 with 100 base class: 0.135135
Train Error for fold 8 with 100 base class: 0.141975
Test Error for fold 8 with 100 base class: 0.081081
Train Error for fold 9 with 100 base class: 0.129630
Test Error for fold 9 with 100 base class: 0.189189
Train Error for fold 10 with 100 base class: 0.108025
Test Error for fold 10 with 100 base class: 0.081081

Mean Train error 10 fold 100 base class is 0.122840
Std Train error 10 fold 100 base class is 0.014680

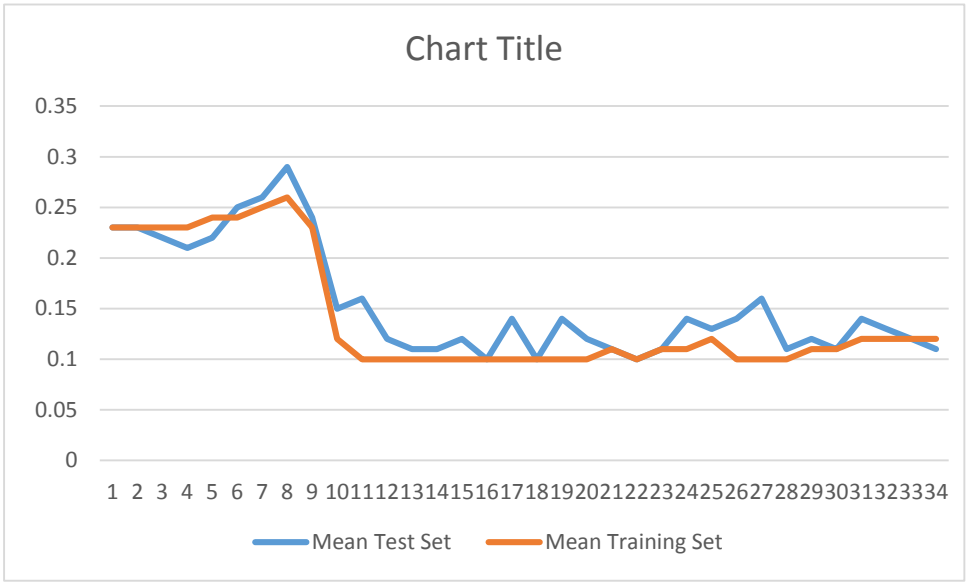
Mean Test error 10 fold 100 base class is 0.124324
Std Test error 10 fold 100 base class is 0.054354

For the last value 34
>> myRForest2('ionoshpere3.txt',[34],10)
Train Error for fold 1 with 100 base class: 0.129630
Test Error for fold 1 with 100 base class: 0.108108
Train Error for fold 2 with 100 base class: 0.151235
Test Error for fold 2 with 100 base class: 0.189189
Train Error for fold 3 with 100 base class: 0.114198
Test Error for fold 3 with 100 base class: 0.081081
Train Error for fold 4 with 100 base class: 0.089506
Test Error for fold 4 with 100 base class: 0.216216
Train Error for fold 5 with 100 base class: 0.111111
Test Error for fold 5 with 100 base class: 0.189189
Train Error for fold 6 with 100 base class: 0.117284
Test Error for fold 6 with 100 base class: 0.108108
Train Error for fold 7 with 100 base class: 0.108025
Test Error for fold 7 with 100 base class: 0.189189
Train Error for fold 8 with 100 base class: 0.095679
Test Error for fold 8 with 100 base class: 0.108108
Train Error for fold 9 with 100 base class: 0.123457
Test Error for fold 9 with 100 base class: 0.216216
Train Error for fold 10 with 100 base class: 0.132716
Test Error for fold 10 with 100 base class: 0.162162

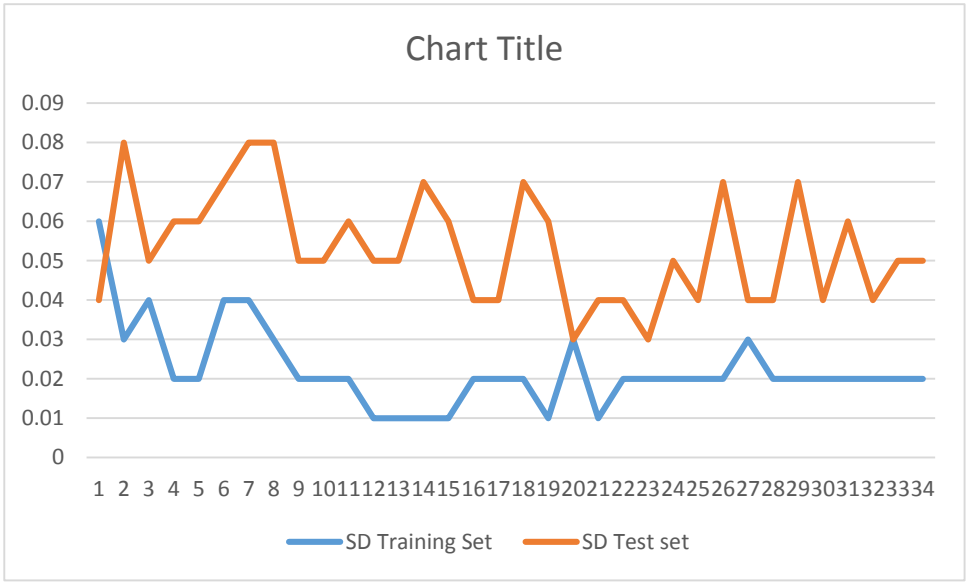
Mean Train error 10 fold 100 base class is 0.117284
Std Train error 10 fold 100 base class is 0.018114

Mean Test error 10 fold 100 base class is 0.156757
Std Test error 10 fold 100 base class is 0.050643

GRAPH PLOTTED FOR ALL MEAN VALUES:



GRAPH PLOTTED FOR ALL STANDARD DEVIATION:



ANALYSIS :

From the graph we can see that the mean value of the test errors is always greter than that of the training error this makes sense because the training error is the data that is used to derive the results .
The errors start falls as the number of features are increased that is true because if I have access to all features I will choose the best 3 but if I made to choose at random the probability that we will end up selecting the best feature is less.
The error rate stabliizes after some value this is because as the number of samples increase the probability of selecting the best three features also increases.

2(a) BAGGING :

The values are taken in two batch that is 1ST five values are run first and then the next 5 are run. The algorithm will work for any vectro size this was done for convinience.

RESULTS
FOR 5,10,15,20, 25

```
>> myBagging2('ionoshpere3.txt',[5 10 15 20 25],10)
Train Error for fold 1 with 5 base class: 0.129630
 Test Error for fold 1 with 5 base class: 0.162162
 Train Error for fold 2 with 5 base class: 0.114198
 Test Error for fold 2 with 5 base class: 0.135135
 Train Error for fold 3 with 5 base class: 0.129630
 Test Error for fold 3 with 5 base class: 0.243243
 Train Error for fold 4 with 5 base class: 0.086420
 Test Error for fold 4 with 5 base class: 0.135135
 Train Error for fold 5 with 5 base class: 0.135802
 Test Error for fold 5 with 5 base class: 0.081081
 Train Error for fold 6 with 5 base class: 0.129630
 Test Error for fold 6 with 5 base class: 0.135135
 Train Error for fold 7 with 5 base class: 0.132716
 Test Error for fold 7 with 5 base class: 0.081081
 Train Error for fold 8 with 5 base class: 0.154321
 Test Error for fold 8 with 5 base class: 0.081081
 Train Error for fold 9 with 5 base class: 0.101852
 Test Error for fold 9 with 5 base class: 0.108108
 Train Error for fold 10 with 5 base class: 0.077160
 Test Error for fold 10 with 5 base class: 0.162162

Mean Train error 10 fold 5 base class is 0.119136
Std Train error 10 fold 5 base class is 0.024005

Mean Test error 10 fold 5 base class is 0.132432
Std Test error 10 fold 5 base class is 0.050079
```

```
Train Error for fold 1 with 10 base class: 0.089506
 Test Error for fold 1 with 10 base class: 0.108108
 Train Error for fold 2 with 10 base class: 0.120370
 Test Error for fold 2 with 10 base class: 0.054054
 Train Error for fold 3 with 10 base class: 0.095679
 Test Error for fold 3 with 10 base class: 0.162162
 Train Error for fold 4 with 10 base class: 0.095679
 Test Error for fold 4 with 10 base class: 0.081081
 Train Error for fold 5 with 10 base class: 0.114198
 Test Error for fold 5 with 10 base class: 0.000000
 Train Error for fold 6 with 10 base class: 0.111111
 Test Error for fold 6 with 10 base class: 0.216216
 Train Error for fold 7 with 10 base class: 0.074074
 Test Error for fold 7 with 10 base class: 0.162162
 Train Error for fold 8 with 10 base class: 0.111111
 Test Error for fold 8 with 10 base class: 0.054054
```

Train Error for fold 9 with 10 base class: 0.074074
Test Error for fold 9 with 10 base class: 0.189189
Train Error for fold 10 with 10 base class: 0.148148
Test Error for fold 10 with 10 base class: 0.108108

Mean Train error 10 fold 10 base class is 0.103395
Std Train error 10 fold 10 base class is 0.022505

Mean Test error 10 fold 10 base class is 0.113514
Std Test error 10 fold 10 base class is 0.068374

Train Error for fold 1 with 15 base class: 0.163580
Test Error for fold 1 with 15 base class: 0.081081
Train Error for fold 2 with 15 base class: 0.104938
Test Error for fold 2 with 15 base class: 0.081081
Train Error for fold 3 with 15 base class: 0.120370
Test Error for fold 3 with 15 base class: 0.162162
Train Error for fold 4 with 15 base class: 0.129630
Test Error for fold 4 with 15 base class: 0.189189
Train Error for fold 5 with 15 base class: 0.120370
Test Error for fold 5 with 15 base class: 0.081081
Train Error for fold 6 with 15 base class: 0.101852
Test Error for fold 6 with 15 base class: 0.162162
Train Error for fold 7 with 15 base class: 0.132716
Test Error for fold 7 with 15 base class: 0.081081
Train Error for fold 8 with 15 base class: 0.117284
Test Error for fold 8 with 15 base class: 0.135135
Train Error for fold 9 with 15 base class: 0.117284
Test Error for fold 9 with 15 base class: 0.108108
Train Error for fold 10 with 15 base class: 0.083333
Test Error for fold 10 with 15 base class: 0.054054

Mean Train error 10 fold 15 base class is 0.119136
Std Train error 10 fold 15 base class is 0.021244

Mean Test error 10 fold 15 base class is 0.113514
Std Test error 10 fold 15 base class is 0.045582

Train Error for fold 1 with 20 base class: 0.123457
Test Error for fold 1 with 20 base class: 0.162162
Train Error for fold 2 with 20 base class: 0.104938
Test Error for fold 2 with 20 base class: 0.135135
Train Error for fold 3 with 20 base class: 0.111111
Test Error for fold 3 with 20 base class: 0.216216
Train Error for fold 4 with 20 base class: 0.098765
Test Error for fold 4 with 20 base class: 0.162162
Train Error for fold 5 with 20 base class: 0.086420
Test Error for fold 5 with 20 base class: 0.081081
Train Error for fold 6 with 20 base class: 0.083333
Test Error for fold 6 with 20 base class: 0.027027
Train Error for fold 7 with 20 base class: 0.104938

Test Error for fold 7 with 20 base class: 0.135135
Train Error for fold 8 with 20 base class: 0.129630
Test Error for fold 8 with 20 base class: 0.216216
Train Error for fold 9 with 20 base class: 0.083333
Test Error for fold 9 with 20 base class: 0.189189
Train Error for fold 10 with 20 base class: 0.160494
Test Error for fold 10 with 20 base class: 0.108108

Mean Train error 10 fold 20 base class is 0.108642
Std Train error 10 fold 20 base class is 0.024163

Mean Test error 10 fold 20 base class is 0.143243
Std Test error 10 fold 20 base class is 0.059827

Train Error for fold 1 with 25 base class: 0.101852
Test Error for fold 1 with 25 base class: 0.162162
Train Error for fold 2 with 25 base class: 0.111111
Test Error for fold 2 with 25 base class: 0.054054
Train Error for fold 3 with 25 base class: 0.145062
Test Error for fold 3 with 25 base class: 0.081081
Train Error for fold 4 with 25 base class: 0.070988
Test Error for fold 4 with 25 base class: 0.108108
Train Error for fold 5 with 25 base class: 0.148148
Test Error for fold 5 with 25 base class: 0.216216
Train Error for fold 6 with 25 base class: 0.101852
Test Error for fold 6 with 25 base class: 0.135135
Train Error for fold 7 with 25 base class: 0.111111
Test Error for fold 7 with 25 base class: 0.081081
Train Error for fold 8 with 25 base class: 0.154321
Test Error for fold 8 with 25 base class: 0.108108
Train Error for fold 9 with 25 base class: 0.117284
Test Error for fold 9 with 25 base class: 0.216216
Train Error for fold 10 with 25 base class: 0.101852
Test Error for fold 10 with 25 base class: 0.189189

Mean Train error 10 fold 25 base class is 0.116358
Std Train error 10 fold 25 base class is 0.025866

Mean Test error 10 fold 25 base class is 0.135135
Std Test error 10 fold 25 base class is 0.058385

NEXT SET OF CLASSIFIERS

>> myBagging2('ionoshpere3.txt',[30 35 40 45 50],10)
Train Error for fold 1 with 30 base class: 0.098765
Test Error for fold 1 with 30 base class: 0.162162
Train Error for fold 2 with 30 base class: 0.123457
Test Error for fold 2 with 30 base class: 0.108108
Train Error for fold 3 with 30 base class: 0.089506
Test Error for fold 3 with 30 base class: 0.162162
Train Error for fold 4 with 30 base class: 0.135802

Test Error for fold 4 with 30 base class: 0.135135
Train Error for fold 5 with 30 base class: 0.120370
Test Error for fold 5 with 30 base class: 0.108108
T0rain Error for fold 6 with 30 base class: 0.098765
Test Error for fold 6 with 30 base class: 0.081081
Train Error for fold 7 with 30 base class: 0.101852
Test Error for fold 7 with 30 base class: 0.108108
Train Error for fold 8 with 30 base class: 0.098765
Test Error for fold 8 with 30 base class: 0.054054
Train Error for fold 9 with 30 base class: 0.129630
Test Error for fold 9 with 30 base class: 0.108108
Train Error for fold 10 with 30 base class: 0.114198
Test Error for fold 10 with 30 base class: 0.108108

Mean Train error 10 fold 30 base class is 0.111111
Std Train error 10 fold 30 base class is 0.015670

Mean Test error 10 fold 30 base class is 0.113514
Std Test error 10 fold 30 base class is 0.033224

Train Error for fold 1 with 35 base class: 0.141975
Test Error for fold 1 with 35 base class: 0.054054
Train Error for fold 2 with 35 base class: 0.129630
Test Error for fold 2 with 35 base class: 0.081081
Train Error for fold 3 with 35 base class: 0.098765
Test Error for fold 3 with 35 base class: 0.081081
Train Error for fold 4 with 35 base class: 0.163580
Test Error for fold 4 with 35 base class: 0.162162
Train Error for fold 5 with 35 base class: 0.098765
Test Error for fold 5 with 35 base class: 0.054054
Train Error for fold 6 with 35 base class: 0.111111
Test Error for fold 6 with 35 base class: 0.081081
Train Error for fold 7 with 35 base class: 0.117284
Test Error for fold 7 with 35 base class: 0.216216
Train Error for fold 8 with 35 base class: 0.148148
Test Error for fold 8 with 35 base class: 0.108108
Train Error for fold 9 with 35 base class: 0.126543
Test Error for fold 9 with 35 base class: 0.135135
Train Error for fold 10 with 35 base class: 0.120370
Test Error for fold 10 with 35 base class: 0.135135

Mean Train error 10 fold 35 base class is 0.125617
Std Train error 10 fold 35 base class is 0.021037

Mean Test error 10 fold 35 base class is 0.110811
Std Test error 10 fold 35 base class is 0.051674

Train Error for fold 1 with 40 base class: 0.108025
Test Error for fold 1 with 40 base class: 0.135135
Train Error for fold 2 with 40 base class: 0.117284
Test Error for fold 2 with 40 base class: 0.162162

Train Error for fold 3 with 40 base class: 0.111111
Test Error for fold 3 with 40 base class: 0.054054
Train Error for fold 4 with 40 base class: 0.148148
Test Error for fold 4 with 40 base class: 0.081081
Train Error for fold 5 with 40 base class: 0.077160
Test Error for fold 5 with 40 base class: 0.162162
Train Error for fold 6 with 40 base class: 0.095679
Test Error for fold 6 with 40 base class: 0.162162
Train Error for fold 7 with 40 base class: 0.083333
Test Error for fold 7 with 40 base class: 0.135135
Train Error for fold 8 with 40 base class: 0.120370
Test Error for fold 8 with 40 base class: 0.135135
Train Error for fold 9 with 40 base class: 0.077160
Test Error for fold 9 with 40 base class: 0.081081
Train Error for fold 10 with 40 base class: 0.132716
Test Error for fold 10 with 40 base class: 0.108108

Mean Train error 10 fold 40 base class is 0.107099
Std Train error 10 fold 40 base class is 0.023865

Mean Test error 10 fold 40 base class is 0.121622
Std Test error 10 fold 40 base class is 0.038749

Train Error for fold 1 with 45 base class: 0.135802
Test Error for fold 1 with 45 base class: 0.135135
Train Error for fold 2 with 45 base class: 0.104938
Test Error for fold 2 with 45 base class: 0.108108
Train Error for fold 3 with 45 base class: 0.101852
Test Error for fold 3 with 45 base class: 0.189189
Train Error for fold 4 with 45 base class: 0.089506
Test Error for fold 4 with 45 base class: 0.189189
Train Error for fold 5 with 45 base class: 0.101852
Test Error for fold 5 with 45 base class: 0.243243
Train Error for fold 6 with 45 base class: 0.080247
Test Error for fold 6 with 45 base class: 0.054054
Train Error for fold 7 with 45 base class: 0.104938
Test Error for fold 7 with 45 base class: 0.135135
Train Error for fold 8 with 45 base class: 0.135802
Test Error for fold 8 with 45 base class: 0.135135
Train Error for fold 9 with 45 base class: 0.098765
Test Error for fold 9 with 45 base class: 0.135135
Train Error for fold 10 with 45 base class: 0.117284
Test Error for fold 10 with 45 base class: 0.108108

Mean Train error 10 fold 45 base class is 0.107099
Std Train error 10 fold 45 base class is 0.018000

Mean Test error 10 fold 45 base class is 0.143243
Std Test error 10 fold 45 base class is 0.052608

Train Error for fold 1 with 50 base class: 0.089506

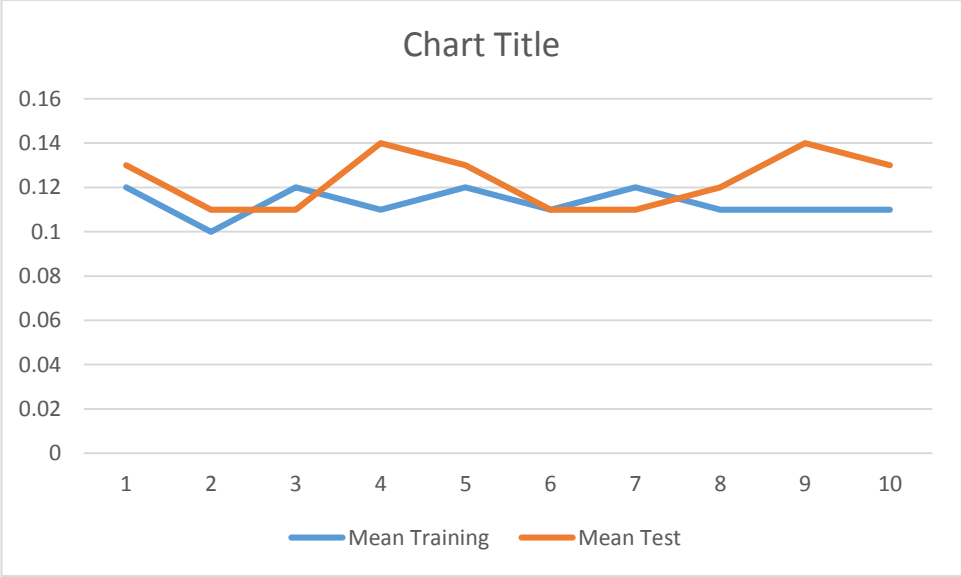
Test Error for fold 1 with 50 base class: 0.108108
Train Error for fold 2 with 50 base class: 0.083333
Test Error for fold 2 with 50 base class: 0.135135
Train Error for fold 3 with 50 base class: 0.095679
Test Error for fold 3 with 50 base class: 0.162162
Train Error for fold 4 with 50 base class: 0.129630
Test Error for fold 4 with 50 base class: 0.189189
Train Error for fold 5 with 50 base class: 0.101852
Test Error for fold 5 with 50 base class: 0.135135
Train Error for fold 6 with 50 base class: 0.135802
Test Error for fold 6 with 50 base class: 0.081081
Train Error for fold 7 with 50 base class: 0.129630
Test Error for fold 7 with 50 base class: 0.081081
Train Error for fold 8 with 50 base class: 0.135802
Te0st Error for fold 8 with 50 base class: 0.027027
Train Error for fold 9 with 50 base class: 0.126543
Test Error for fold 9 with 50 base class: 0.162162
Train Error for fold 10 with 50 base class: 0.095679
Test Error for fold 10 with 50 base class: 0.216216

Mean Train error 10 fold 50 base class is 0.112346
Std Train error 10 fold 50 base class is 0.020893

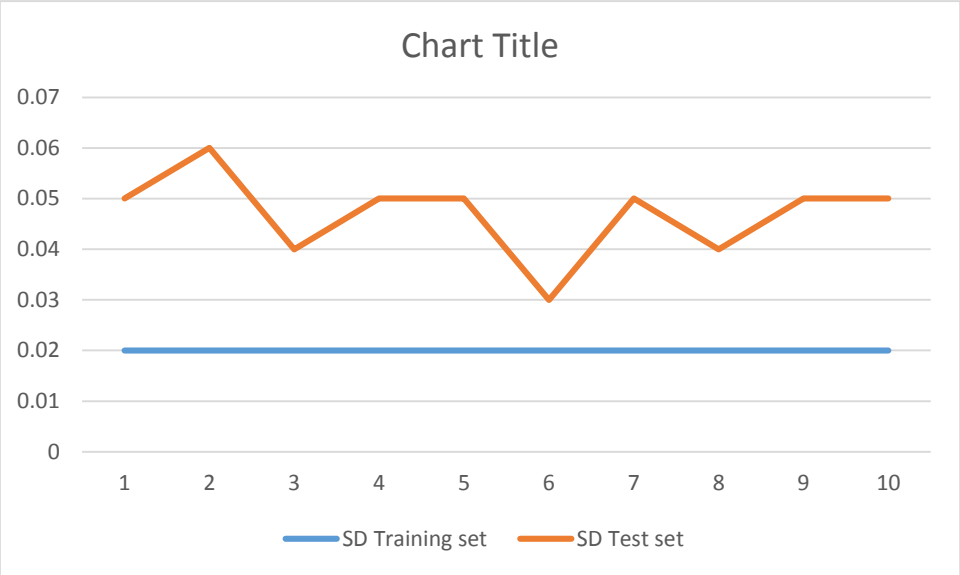
Mean Test error 10 fold 50 base class is 0.129730
Std Test error 10 fold 50 base class is 0.056692

GRAPH

FOR MEAN ERROR ANALYSIS:



FOR STANDARD DEVIATION OF ERRORS:



ANALYSIS:

It can be seen from the graph that the train set errors are almost same for the varying number of decision tree used.

As explained in the class adding weak trees does not make much of an improvement in performance.

The last output of the random forest is the output for bagging with 100 trees. As seen in the value even after adding 100 trees the error rate is about 0.1 and hence we can say that it stabilises at that point.