Q2

**F1 Score of Random Classifier on Test: 0.1698106588077911**

**F1 Score of Majority Classifier on Test: 0.10392301998519615**

**<class 'sklearn.naive\_bayes.BernoulliNB'>**

Attempt with : {'alpha': 0.05}

F1 Score for the Validation set would be : 0.38208807684857354

Attempt with : {'alpha': 0.1}

F1 Score for the Validation set would be : 0.3915563281535137

Attempt with : {'alpha': 0.25}

F1 Score for the Validation set would be : 0.37372400517516835

Attempt with : {'alpha': 0.5}

F1 Score for the Validation set would be : 0.36500839075894537

Attempt with : {'alpha': 1}

F1 Score for the Validation set would be : 0.33339023941525203

Attempt with : {'alpha': 2}

F1 Score for the Validation set would be : 0.2822462204827068

Attempt with : {'alpha': 4}

F1 Score for the Validation set would be : 0.23941854979790222

**Optimal parameters for Validation is : {'alpha': 0.1}**

**F1 Score on Validation set given optimal parameters is: 0.3915563281535137**

**Here is our f1 score for the test set with optimal parameters: 0.39520743243198553**

**Here is our f1 score for the training set given optimal parameters: 0.763130557751155**

**<class 'sklearn.tree.tree.DecisionTreeClassifier'>**

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3210092709647562

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3226778751032483

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.31907359020790615

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2861829321745747

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.28783790155206296

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2914999458768217

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3238049221094788

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.31318650369373885

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3175159126314397

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3210092709647562

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3226778751032483

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.31907359020790615

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.29878024646407664

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3055131912774341

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.312643842058901

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.26483689732017196

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2609583209005046

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2646701258394289

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3109696138072718

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3075429646705846

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3027441418910299

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.29878024646407664

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3055131912774341

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.312643842058901

**Optimal parameters for Validation is : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}**

**F1 Score on Validation set given optimal parameters is: 0.3238049221094788**

**Here is our f1 score for the test set with optimal parameters: 0.324108997062064**

**Here is our f1 score for the training set given optimal parameters: 0.9890631602177915**

**<class 'sklearn.svm.classes.LinearSVC'>**

Attempt with : {'C': 0.025, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.4375908231400061

Attempt with : {'C': 0.025, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.4330354671542799

Attempt with : {'C': 0.05, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.43160236852555195

Attempt with : {'C': 0.05, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.4272985508499497

Attempt with : {'C': 0.1, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.43910662792335187

Attempt with : {'C': 0.1, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.41967275125056097

Attempt with : {'C': 0.25, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.4204688433470105

Attempt with : {'C': 0.25, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.41062971103015167

Attempt with : {'C': 0.5, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.40841408097336995

Attempt with : {'C': 0.5, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.4056698182052374

Attempt with : {'C': 1, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.3887265186277521

Attempt with : {'C': 1, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.40149658149463197

Attempt with : {'C': 2.0, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.3871972250596113

Attempt with : {'C': 2.0, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.3912150418633966

**Optimal parameters for Validation is : {'C': 0.1, 'loss': 'hinge', 'random\_state': 329}**

**F1 Score on Validation set given optimal parameters is: 0.43910662792335187**

**Here is our f1 score for the test set with optimal parameters: 0.44532371727703246**

**Here is our f1 score for the training set given optimal parameters: 0.9150330191360148**

Q3

**<class 'sklearn.naive\_bayes.GaussianNB'>**

Attempt with : {'var\_smoothing': 1e-06}

F1 Score for the Validation set would be : 0.2484847678818137

Attempt with : {'var\_smoothing': 1e-07}

F1 Score for the Validation set would be : 0.24854996538217194

Attempt with : {'var\_smoothing': 1e-08}

F1 Score for the Validation set would be : 0.24676684774170804

Attempt with : {'var\_smoothing': 1e-09}

F1 Score for the Validation set would be : 0.24446290139087007

Attempt with : {'var\_smoothing': 1e-10}

F1 Score for the Validation set would be : 0.2421773477741977

Attempt with : {'var\_smoothing': 1e-11}

F1 Score for the Validation set would be : 0.2427082688239141

**Optimal parameters for Validation is : {'var\_smoothing': 1e-07}**

**F1 Score on Validation set given optimal parameters is: 0.24854996538217194**

**Here is our f1 score for the test set with optimal parameters: 0.24618440104792644**

**Here is our f1 score for the training set given optimal parameters: 0.8045798422374391**

**<class 'sklearn.tree.tree.DecisionTreeClassifier'>**

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.31432870359620957

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3174640506814245

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.31128066105217134

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.278120847594835

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2755498452441022

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2775537586747503

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.312757906979773

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3293617670349512

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.33076127742337313

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.31432870359620957

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3174640506814245

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.31128066105217134

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3076727436759497

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.29513957206937846

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3189806129957726

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.25822223367492275

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2538376221351265

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.24983798796675324

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2976681401040572

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.2861017589150312

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.31522507241364944

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3076727436759497

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.29513957206937846

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.3189806129957726

**Optimal parameters for Validation is : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}**

**F1 Score on Validation set given optimal parameters is: 0.33076127742337313**

**Here is our f1 score for the test set with optimal parameters: 0.3063024220069257**

**Here is our f1 score for the training set given optimal parameters: 0.849706587017492**

**<class 'sklearn.svm.classes.LinearSVC'>**

Attempt with : {'C': 1.0, 'loss': 'hinge', 'random\_state': 329}

/Users/cayman329/anaconda3/lib/python3.6/site-packages/sklearn/svm/base.py:922: ConvergenceWarning: Liblinear failed to converge, increase the number of iterations.

"the number of iterations.", ConvergenceWarning)

F1 Score for the Validation set would be : 0.3808329725966012

Attempt with : {'C': 1.0, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.2959857514522948

Attempt with : {'C': 0.5, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.379023001876849

Attempt with : {'C': 0.5, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.22860047268242392

Attempt with : {'C': 2.0, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.3893413234353727

Attempt with : {'C': 2.0, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.3587891972619519

Attempt with : {'C': 5.0, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.3967061457705372

Attempt with : {'C': 5.0, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.4381163765092354

**Optimal parameters for Validation is : {'C': 5.0, 'loss': 'squared\_hinge', 'random\_state': 329}**

**F1 Score on Validation set given optimal parameters is: 0.4381163765092354**

**Here is our f1 score for the test set with optimal parameters: 0.42686689869067873**

**Here is our f1 score for the training set given optimal parameters: 0.6729961078797334**

Q4

**F1 Score of Random Classifier on Test: 0.49505468890935816**

**<class 'sklearn.naive\_bayes.BernoulliNB'>**

Attempt with : {'alpha': 0.05}

F1 Score for the Validation set would be : 0.8484363053573265

Attempt with : {'alpha': 0.1}

F1 Score for the Validation set would be : 0.8486351416718549

Attempt with : {'alpha': 0.25}

F1 Score for the Validation set would be : 0.8483331149036725

Attempt with : {'alpha': 0.5}

F1 Score for the Validation set would be : 0.8475275389876284

Attempt with : {'alpha': 1}

F1 Score for the Validation set would be : 0.846513058857059

Attempt with : {'alpha': 2}

F1 Score for the Validation set would be : 0.8461836764052815

Attempt with : {'alpha': 4}

F1 Score for the Validation set would be : 0.8450393305795181

**Optimal parameters for Validation is : {'alpha': 0.1}**

**F1 Score on Validation set given optimal parameters is: 0.8486351416718549**

**Here is our f1 score for the test set with optimal parameters: 0.8353844574163147**

**Here is our f1 score for the training set given optimal parameters: 0.8757402222106325**

**<class 'sklearn.tree.tree.DecisionTreeClassifier'>**

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6942980893630585

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6916948173898803

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6925972333751005

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7110771570362202

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7107543842351427

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7097490119175729

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6905821280237147

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6920606792281306

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.692598512176799

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6942980893630585

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6916948173898803

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6925972333751005

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7025769675603679

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7060989390171699

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7021878016123542

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7081859156374325

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7068901822027767

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7068721407582905

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7056711528296888

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7052554080906901

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7083460556864598

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7025769675603679

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7060989390171699

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7021878016123542

**Optimal parameters for Validation is : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}**

**F1 Score on Validation set given optimal parameters is: 0.7110771570362202**

**Here is our f1 score for the test set with optimal parameters: 0.7101659983178783**

**Here is our f1 score for the training set given optimal parameters: 0.758296532392636**

**<class 'sklearn.svm.classes.LinearSVC'>**

Attempt with : {'C': 0.025, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8751889716975392

Attempt with : {'C': 0.025, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8718969242451511

Attempt with : {'C': 0.05, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8678977793616711

Attempt with : {'C': 0.05, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.865498868845487

Attempt with : {'C': 0.1, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8622999655749914

Attempt with : {'C': 0.1, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8619998012797139

Attempt with : {'C': 0.25, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8546998241867874

Attempt with : {'C': 0.25, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8530998222507848

Attempt with : {'C': 0.5, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8474994494730127

Attempt with : {'C': 0.5, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8498998784189016

Attempt with : {'C': 1, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8419992352762988

Attempt with : {'C': 1, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8460996537242209

Attempt with : {'C': 2.0, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.840699424924924

Attempt with : {'C': 2.0, 'loss': 'squared\_hinge', 'random\_state': 329}

/Users/cayman329/anaconda3/lib/python3.6/site-packages/sklearn/svm/base.py:922: ConvergenceWarning: Liblinear failed to converge, increase the number of iterations.

"the number of iterations.", ConvergenceWarning)

F1 Score for the Validation set would be : 0.8419990899147579

**Optimal parameters for Validation is : {'C': 0.025, 'loss': 'hinge', 'random\_state': 329}**

**F1 Score on Validation set given optimal parameters is: 0.8751889716975392**

**Here is our f1 score for the test set with optimal parameters: 0.8697556788060092**

**Here is our f1 score for the training set given optimal parameters: 0.9528659860515052**

Q5

**<class 'sklearn.naive\_bayes.GaussianNB'>**

Attempt with : {'var\_smoothing': 1e-06}

F1 Score for the Validation set would be : 0.7626912950829565

Attempt with : {'var\_smoothing': 1e-07}

F1 Score for the Validation set would be : 0.7613036643875809

Attempt with : {'var\_smoothing': 1e-08}

F1 Score for the Validation set would be : 0.7604153271477583

Attempt with : {'var\_smoothing': 1e-09}

F1 Score for the Validation set would be : 0.75872737051261

Attempt with : {'var\_smoothing': 1e-10}

F1 Score for the Validation set would be : 0.7576988919615479

Attempt with : {'var\_smoothing': 1e-11}

F1 Score for the Validation set would be : 0.7571574576688758

**Optimal parameters for Validation is : {'var\_smoothing': 1e-06}**

**F1 Score on Validation set given optimal parameters is: 0.7626912950829565**

**Here is our f1 score for the test set with optimal parameters: 0.7022328616181344**

**Here is our f1 score for the training set given optimal parameters: 0.8712466988045353**

**<class 'sklearn.tree.tree.DecisionTreeClassifier'>**

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.703197328775959

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6973995642553725

Attempt with : {'criterion': 'gini', 'max\_depth': None, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7004974811838168

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.704110078570626

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7046525219547417

Attempt with : {'criterion': 'gini', 'max\_depth': 10, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7029493651373502

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7062955327550533

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.703299332423498

Attempt with : {'criterion': 'gini', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7008895879665571

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.703197328775959

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6973995642553725

Attempt with : {'criterion': 'gini', 'max\_depth': 1000, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7004974811838168

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.699799807871877

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7063953023248373

Attempt with : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6985965157757223

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7007759266416893

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7015197562720787

Attempt with : {'criterion': 'entropy', 'max\_depth': 10, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7010548644848302

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6988967209852915

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7059988239952959

Attempt with : {'criterion': 'entropy', 'max\_depth': 100, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6988986721431442

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 2, 'random\_state': 329}

F1 Score for the Validation set would be : 0.699799807871877

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 5, 'random\_state': 329}

F1 Score for the Validation set would be : 0.7063953023248373

Attempt with : {'criterion': 'entropy', 'max\_depth': 1000, 'min\_samples\_split': 10, 'random\_state': 329}

F1 Score for the Validation set would be : 0.6985965157757223

**Optimal parameters for Validation is : {'criterion': 'entropy', 'max\_depth': None, 'min\_samples\_split': 5, 'random\_state': 329}**

**F1 Score on Validation set given optimal parameters is: 0.7063953023248373**

**Here is our f1 score for the test set with optimal parameters: 0.7049996559115987**

**Here is our f1 score for the training set given optimal parameters: 0.99266666458074**

**<class 'sklearn.svm.classes.LinearSVC'>**

Attempt with : {'C': 0.025, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.6825032756673839

Attempt with : {'C': 0.025, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.7354978997168582

Attempt with : {'C': 0.05, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.6825032756673839

Attempt with : {'C': 0.05, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.7577911005710625

Attempt with : {'C': 0.1, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.6865183790222921

Attempt with : {'C': 0.1, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.7812269579899138

Attempt with : {'C': 0.25, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.6048284070574107

Attempt with : {'C': 0.25, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8097223392262927

Attempt with : {'C': 0.5, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.7031006589255251

Attempt with : {'C': 0.5, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8240580922949214

Attempt with : {'C': 1, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.7745607283412659

Attempt with : {'C': 1, 'loss': 'squared\_hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8405228130415121

Attempt with : {'C': 2.0, 'loss': 'hinge', 'random\_state': 329}

F1 Score for the Validation set would be : 0.8146078923297242

Attempt with : {'C': 2.0, 'loss': 'squared\_hinge', 'random\_state': 329}

/Users/cayman329/anaconda3/lib/python3.6/site-packages/sklearn/svm/base.py:922: ConvergenceWarning: Liblinear failed to converge, increase the number of iterations.

"the number of iterations.", ConvergenceWarning)

**F1 Score for the Validation set would be : 0.8542457079837669**

**Optimal parameters for Validation is : {'C': 2.0, 'loss': 'squared\_hinge', 'random\_state': 329}**

**F1 Score on Validation set given optimal parameters is: 0.8542457079837669**

**Here is our f1 score for the test set with optimal parameters: 0.8569303330738662**

**Here is our f1 score for the training set given optimal parameters: 0.8803635007650956**