**Q4**

This question is used to solve the Soft-margin SVM with a value of error-penalty as 1(as it already gives soft-margin SVM). In this question, we have the dataset which is loaded into the data frame and the dataset is changed in the way where only labels 1 and 5 exists for both testing and training the one-way SVM.

**Part a**: This uses a **linear kernel <x,xT>** which gives an accuracy of 97.8 with the number of support vectors as 28

**Part b:** This function takes as input as a **linear kernel** and

| | **50** | **100** | **200** | **800** |
|---|---|---|---|---|
| **Accuracy** | 98.113 | 98.113 | 98.113 | 98.113 |
| **Number of Support Vectors** | 2 | 4 | 8 | 14 |

**Part c:** This sub-problem solves the T/F values as:

When C = 0.0001, training error is higher at Q = 5- **False**

When C = 0.001, the number of support vectors is lower at Q = 5-**True**

When C = 0.01, training error is higher at Q = 5-**False**

When C = 1, test error is lower at Q = 5.- **False**

**Part d:** Returns the testing and training error for various values of C and print the value of C that gives the least testing and training error as 100 and 1000000

| | C=0.01 | C=1 | C=100 | C=1000 | C=1000000 |
|---|---|---|---|---|---|
| **Testing error** | 2.35849056 | 2.1226415094 | 1.8867924 | 1.886792452 | 2.3584905660 |
| **Training error** | 0.38436899 | 0.4484304932 | 0.32030749 | 0.3203074951 | 0.0640614990 |