Answer 2

Linear Kernel
14 iterations
Optimal solution found.
Support vector.shape()=(151, 784)
1849
1874
Accuracy=0.9866595517609391
b=1.45676
Linear kernel training time=183s

With Gaussian Kernel: accuracy=99.89%
Support vector ~1561
b=0.1856
Gaussian training time=500s

LIBSVM

Linear
Accuracy=98.66
b=-1.45676
nSV=151
time=3.72

Gaussian
Accuracy=99.89%
b=0.1856
nSV=1459
time=26.87

For both the kernels, Values exactly match my implementation. Time taken is much lesser. For the gaussian kernel I have slightly more support vectors as the =0 checking for float has been done using the > 0.000001 operator.

Multi-class SVM:

```
[[ 969   0        4        0        0        2        6        1        4        4]
 [   0 1081       0        0        0        0        2        4        0        4]
 [   1   43      958       8        4        3        1       19        3        3]
 [   0    2       46      991       0       30        0        3       36       10]
 [   0    1        2        0      962        1        4        4        1       13]
 [   3    2        0        1        0      835        4        0        5        4]
 [   4    2        1        0        6       14      938        0        1        0]
 [   1    0        6        6        0        1        1      987        3        7]
 [   2    3       15        2        2        5        2        1      916        4]
 [   0    1        0        2        8        1        0        9        5      960]]
```

Accuracy = 0.9597 test set
Accuracy= 0.9756 train set

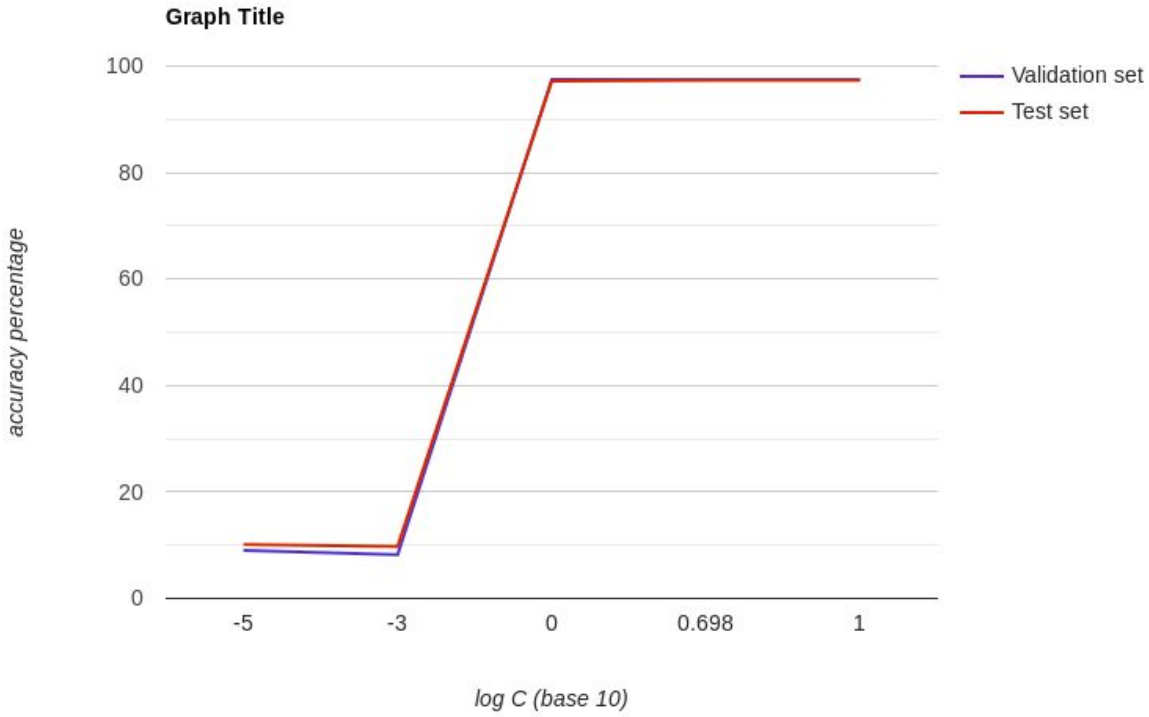
The training takes around 3 hours.

LIBSVM: Multi class gaussian

Train accuracy=99.92%
Test accuracy=97.23%
Time ~20 minutes

Validation set:		9.01	8.2	97.5	97.5	97.5
Test set:	10.1	9.8	97.22	97.34	97.34	
Value of log C:		-5	-3	0	0.698	1

The test set accuracy and validation set accuracy are close to each other => validation set is a good representative to choose the value of C for a good test accuracy


Graph Title
100
80
60
40
20
0
accuracy percentage
-5
-3
0
0.698
1
log C (base 10)
Validation set
Test set