Solution to Question 1

A and b on paper.

c) The overall accuracy on the test dataset is 93.71%.

The command line arguments (in Matlab) are-

model1 = svmlearn(Z,W,'-c 0.1');
[err1, pred] = svmclassify(X,Y,model1);

**To break the ties between accuracy values for different values of c, we choose the smallest values of c- as it is least likely to overfit.

Tables containing accuracy values for different cases:

Digits	c=0.0001	c=0.0005	c=0.001	c=0.005	c=0.01	c=0.05	c=0.1	Best Value of C
Digit 0	1	1	1	1	1	1	1	C=0.0001
Digit 1	0.977099	0.97709924	0.977099	0.979644	0.979644	0.977099	0.974555	C=0.005
Digit 2	0.992167	0.9921671	0.992167	0.992167	0.992167	0.989556	0.989556	C=0.0001
Digit 3	0.994778	0.9921671	0.989556	0.989556	0.989556	0.989556	0.989556	C=0.0001
Digit 4	0.991957	0.9919571	0.991957	0.994638	0.997319	0.994638	0.989276	c=0.01
Digit 5	0.997389	1	1	1	1	0.994778	1	c=0.0005
Digit 6	0.997389	1	1	1	1	0.994778	0.992167	c=0.0005
Digit 7	0.989276	0.9919601	0.991957	0.991957	0.989276	0.991957	0.991957	c=0.0005
Digit 8	0.947507	0.95275591	0.958005	0.955381	0.955381	0.955381	0.96063	c=0.1
Digit 9	0.968254	0.97883598	0.984127	0.981481	0.978836	0.981481	0.981481	c=0.001

d) Final accuracy on the Test Dataset is 98.05%.

The command line arguments are-

W=TrainLabel;
Z=TrainX;
Y=TestLabel;
X=TestX;

model1 = svmlearn(Z,W,'-t 1 -d 5 -c 0.005');
[err1, pred] = svmclassify(X,Y,model1);

**To break the ties between accuracy values for different values of c, we choose the smallest values of c- choosing the largest possible margin.

Tables accuracies for different values of C.

	D=2						
	c=0.0001	c=0.0005	c=0.001	c=0.005	c=0.01	c=0.05	c=0.1
Digit 0	1	1	1	1	1	1	1
Digit 1	0.997455	0.99745547	0.997455	0.997455	0.997455	0.997455	0.997455
Digit 2	1	1	1	1	1	1	1
Digit 3	0.989556	0.98955614	0.989556	0.989556	0.989556	0.989556	0.989556
Digit 4	0.994638	0.99463807	0.994638	0.994638	0.994638	0.994638	0.994638
Digit 5	1	1	1	1	1	1	1
Digit 6	0.997389	0.99738903	0.997389	0.997389	0.997389	0.997389	0.997389
Digit 7	0.994638	0.99463807	0.994638	0.994638	0.994638	0.994638	0.994638
Digit 8	0.981627	0.9816273	0.981627	0.981627	0.981627	0.981627	0.981627
Digit 9	0.994709	0.99470899	0.994709	0.994709	0.994709	0.994709	0.994709
Avg	0.995001						

	D=3						
	c=0.0001	c=0.0005	c=0.001	c=0.005	c=0.01	c=0.05	c=0.1
Digit 0	1	1	1	1	1	1	1
Digit 1	0.997455	0.99745547	0.997455	0.997455	0.997455	0.997455	0.997455
Digit 2	1	1	1	1	1	1	1
Digit 3	0.992167	0.9921671	0.992167	0.992167	0.992167	0.992167	0.992167
Digit 4	0.997319	0.99731903	0.997319	0.997319	0.997319	0.997319	0.997319
Digit 5	0.997389	0.99738903	0.997389	0.997389	0.997389	0.997389	0.997389
Digit 6	1	1	1	1	1	1	1
Digit 7	0.994638	0.99463807	0.994638	0.994638	0.994638	0.994638	0.994638
Digit 8	0.984252	0.98425197	0.984252	0.984252	0.984252	0.984252	0.984252
Digit 9	0.994709	0.99470899	0.994709	0.994709	0.994709	0.994709	0.994709
Avg	0.995793						

	D=4						
	c=0.0001	c=0.0005	c=0.001	c=0.005	c=0.01	c=0.05	c=0.1
Digit 0	1	1	1	1	1	1	1
Digit 1	0.997455	0.99745547	0.997455	0.997455	0.997455	0.997455	0.997455
Digit 2	1	1	1	1	1	1	1
Digit 3	0.992167	0.9921671	0.992167	0.992167	0.992167	0.992167	0.992167
Digit 4	1	1	1	1	1	1	1
Digit 5	1	1	1	1	1	1	1
Digit 6	1	1	1	1	1	1	1
Digit 7	0.994638	0.99463807	0.994638	0.994638	0.994638	0.994638	0.994638
Digit 8	0.986877	0.98687664	0.986877	0.986877	0.986877	0.986877	0.986877

Digit 9	0.994709	0.99470899	0.994709	0.994709	0.994709	0.994709	0.994709
Avg	0.996585						
	D=5						
	c=0.0001	c=0.0005	c=0.001	c=0.005	c=0.01	c=0.05	c=0.1
Digit 0	1	1	1	1	1	1	1
Digit 1	0.997455	0.99745547	0.997455	0.997455	0.997455	0.997455	0.997455
Digit 2	1	1	1	1	1	1	1
Digit 3	0.992167	0.9921671	0.992167	0.992167	0.992167	0.992167	0.992167
Digit 4	1	1	1	1	1	1	1
Digit 5	1	1	1	1	1	1	1
Digit 6	1	1	1	1	1	1	1
Digit 7	0.994638	0.99463807	0.994638	0.994638	0.994638	0.994638	0.994638
Digit 8	0.986877	0.98687664	0.986877	0.986877	0.986877	0.986877	0.986877
Digit 9	0.994709	0.99470899	0.994709	0.994709	0.994709	0.994709	0.994709
Avg	0.996585						