# Machine learning Homework- Soft-Margin SVM and Kernels

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## Problem 1:

No it will not be the correct label. The training sample depends on the distance from the hyperplane decision boundary $\xi$. If $\xi < 1$ for the training sample it gets classified correctly else it gets mis-classified.

## Problem 2:

The cost function for soft-margin SVM is

$$min f_0(\mathbf{w}, b, \xi) = \frac{1}{2}\mathbf{w}^T\mathbf{w} + C\sum_{i=1}^{N}\xi_i \qquad (1)$$

C is a penalizing factor on $\xi$.
case 1: when C = 0 there is no restriction on $\xi$ values.
case 2: when C ¡ 0 it encourages higher values of $\xi$ and hence encouraging mis-classification.

## Problem 3:
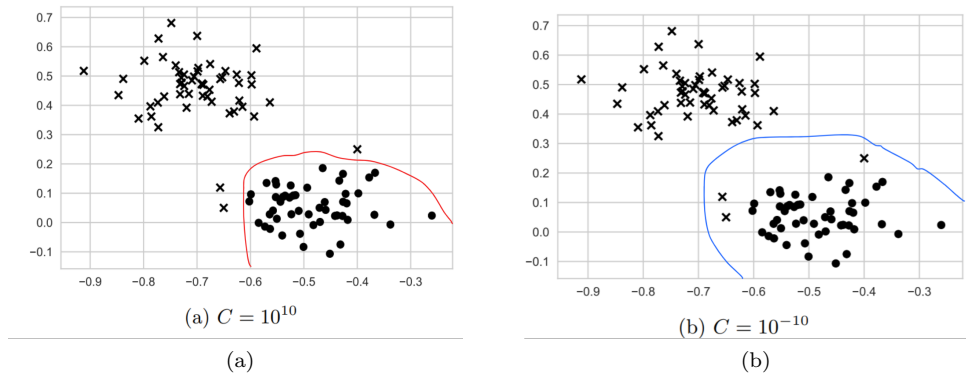


(a) $C = 10^{10}$

(a)

(b) $C = 10^{-10}$

(b)

Figure 1

The first case tends to have hard margin of SVM since the C value is very big and C tends to $\infty$. The second figure on the right has soft margin since the C value is very less and this can take some mis-classification.

## Problem 4:

We know that $\sum_{i=0}^{N} a_i(x_i{}^T x_j)^i$ is a polynomial kernel. by the kernel preserving operation we know that sum of valid kernel is also a valid kernel and hence $k(x1, x2)$

**Problem 5:**

**Problem 6:**

**Problem 7:**