



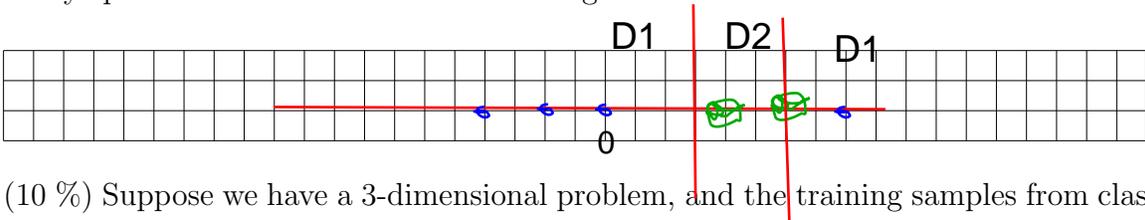
Name: _____

CS442/952: Artificial Intelligence II
Winter 2015: Quiz 1, Partial Solutions

Instructions:

Show all the work you do. Use the back of the page, if necessary. Calculators are allowed, laptops, cell phones, or any other communication devices are not allowed. This is an open notes exam. However, the sample quiz 1 solution is not allowed.

- (10%) Suppose we have collected the following one dimensional samples from two classes: $D_1 = \{-2, -1, 0, 4\}$ and $D_2 = \{2, 3\}$. We use kNN classifier with $k = 2$, and whenever there is any ambiguity (e.g. one closest neighbor is from class 1 and another from class 2), we always prefer class 1. Draw the decision regions and decision boundaries for this case.



- (10 %) Suppose we have a 3-dimensional problem, and the training samples from class 1 and class 2 are, respectively:

$$C_1 = \left\{ \begin{bmatrix} -1 \\ 5 \\ 4 \end{bmatrix}, \begin{bmatrix} 8 \\ 9 \\ 1 \end{bmatrix}, \begin{bmatrix} 6 \\ 9 \\ 6 \end{bmatrix}, \begin{bmatrix} -3 \\ 7 \\ 5 \end{bmatrix} \right\}, C_2 = \left\{ \begin{bmatrix} 5 \\ 4 \\ 9 \end{bmatrix}, \begin{bmatrix} 1 \\ 6 \\ 3 \end{bmatrix}, \begin{bmatrix} -3 \\ 3 \\ 5 \end{bmatrix}, \begin{bmatrix} 4 \\ 1 \\ 2 \end{bmatrix}, \begin{bmatrix} 3 \\ 7 \\ 4 \end{bmatrix} \right\}$$

How is example $\begin{bmatrix} -3 \\ 5 \\ 9 \end{bmatrix}$ classified with kNN if $k = 9$?

SOLUTION: Class 2, since the training data has only 9 samples, and the majority of them are of class2.

- (5 %) Suppose you have implemented the batch protocol to train a neural network and you plot the objective function J after each iteration. Suppose the value of J oscillates, that is keeps going up and down, up and down. Which of the following might be true? Mark all that apply.

- Oscillating J is a sign that you have the best possible implementation of gradient descent.
- Your training set is too small
- ✓ You set the learning rate is too high.
- You set the learning rate is too low.
- Batch protocol is not appropriate in this case, you have to switch to a single sample training protocol.