CS491/691 Quiz 11 Name Solution.

1. What do the two terms in the following optimization problem mean in English?

$$\min_{w,b} \underbrace{\frac{1}{2}||w||^2}_{} + \underbrace{C\sum_n \ell^{(\text{hin})}(y_n, w\cdot x_n + b)}_{} \qquad (7.48)$$

large margin

minimize mistakes. small slack

2. Given the following $w = (2,5)$ and $b = -2$, find the slack variables for each of the following samples:

2 (a) $x_1 = (-1,1)$ $y_1 = -1$

0 (b) $x_2 = (1,1)$ $y_2 = 1$

2 (c) $x_3 = (-2,1)$ $y_3 = 1$

$$\min_{w,b,\xi} \underbrace{\frac{1}{2}||w||^2}_{\text{large margin}} + \underbrace{C\sum_n \xi_n}_{\text{small slack}}$$

$$\text{subj. to} \quad y_n(w\cdot x_n + b) \geq 1 - \xi_n \qquad (\forall n)$$
$$\xi_n \geq 0 \qquad (\forall n)$$

a) $-1(-2+5-2) \geq 1-\xi_1$

$-1 \geq 1-\xi_1 \quad \xi_1 = 2$

b) $1(2+5-2) \geq 1-\xi_2$

$5 \geq 1-\xi_2 \quad \xi_2 = 0$

c) $1(-4+5-2) \geq 1-\xi_3$

$-1 \geq 1-\xi_3 \quad \xi_3 = 2$