Exercise Sheet 3

Due at the beginning of the exercise session at 16:20. A total of at least 50% of all available points is required for the "Studienleistung" (I expect there to be 12 or 13 sheets).

Exercise 1 (BDSS 6.8.1, 1 point)**.** Suppose that $\mathcal{H}, \mathcal{H}'$ are hypothesis classes such that $\mathcal{H} \subseteq \mathcal{H}'$. Show that $\text{VCdim}(\mathcal{H}) \leq \text{VCdim}(\mathcal{H}')$.

Note: When you are asked to provide a VC dimension, you also need to prove that your VC dimension is the correct one!

Exercise 2 (BDSS 6.8.2, 2 points)**.** Let $\mathcal{X}$ be a finite domain set and let $k \leq |\mathcal{X}|$. Find the VC dimension of

$$\mathcal{H} := \{h : \mathcal{X} \to \{0,1\} \mid |\{x : h(x) = 1\}| = k\},$$

i.e. the hypothesis class consisting of functions that take the value 1 on exactly k elements.

Exercise 3 (MRT 3.16, 2 points each)**.**

1. Consider axis aligned squares in $\mathbb{R}^2$. What is the VC dimension of this hypothesis class?
2. Consider the hypothesis class of right triangles with the non-hypotenuse sides parallel to the x and y-axes respectively, and with the right angle in the lower left corner (hence with the hypotenuse on the upper right). What is the VC dimension of this class?