

## Problem Set 8

[Your name] and [student ID]  
MAT1841-2021

**Problem 1 [BHK 5.16] (25 points).** What is the VC-dimension of the class  $\mathcal{H}$  of axis-parallel boxes in  $\mathbb{R}^d$ . i.e.  $\mathcal{H} = \{h_{\mathbf{a},\mathbf{b}} \mid \mathbf{a}, \mathbf{b} \in \mathbb{R}^d\}$ , where  $h_{\mathbf{a},\mathbf{b}} = \{\mathbf{x} \mid a_i \leq x_i \leq b_i \quad \forall i \in [d], \mathbf{x} \in \mathbb{R}^d\}$ . Prove your answer.

**Problem 2 [BHK 5.15] (25 points).** Consider the instance space  $X = \mathbb{R}^2$ . What is the VC-dimension of right corners with axis aligned edges that are oriented with one edge going to the right and the other edge going up? i.e. choose a point, and take everything up and to the right of that point as your subset.

**Problem 3 [BHK 5.17] (25 points).** Directly prove that the VC-dimension of circles in the plane is 3. i.e. you may not use any theorems where we have proven things about the VC-dimension of hyperspheres or hyperplanes.

**Problem 4 [Project Progress Report] (25 points).** Problem 4 is not so much a problem as it is a progress report. Please write a 1-page summary of your progress on your project so far, including any dead-ends you've hit, twists and turns you've had to take, and results so far.