Quiz: Chapter 1

Printed Name:

Quiz rules:

1. You MAY use:
   (a) any notes (handwritten, printed, or electronic),
   (b) any computer programs (including websites like WolframAlpha or ChatGPT), and
   (c) any additional scratch paper.
2. You MAY NOT communicate with another student.
3. If you finish the quiz early, stay seated. I will collect all the quizzes at the same time.

Problem 1. For each statement below, circle `True` if the statement is known to be true, `False` if the statement is known to be false, and `Open` if the statement reduces to an open problem. You will receive +1 point for each correct answer, **-0.5 points for each incorrect answer**,and 0 points for each blank answer.

1. `True` `False` `Open` Let $g_{\text{axis2}} \in \mathcal{H}_{\text{axis2}}$ be the output of the TEA algorithm and f be the true labeling function. Then the following inequality is guaranteed to hold: $E_{\text{out}}(f) \leq E_{\text{out}}(g_{\text{axis2}})$.

2. `True` `False` `Open` Let $\mathcal{H}_1$ and $\mathcal{H}_2$ be two finite hypothesis classes satisfying $\mathcal{H}_1 \subseteq \mathcal{H}_2$. Let g_1 be the result of the TEA algorithm on $\mathcal{H}_1$ and g_2 be the result of TEA on $\mathcal{H}_2$. Then for all training and test sets, the following inequality is guaranteed to hold: $E_{\text{test}}(g_1) \leq E_{\text{test}}(g_2)$.

3. `True` `False` `Open` For all $d > 100$, we have that $|\mathcal{H}_{\text{axis2}}| < |\mathcal{H}_{\text{multiaxis2}}|$.

4. `True` `False` `Open` Let g_{axis2} be the result of running TEA on $\mathcal{H}_{\text{axis2}}$, $g_{\text{multiaxis2}}$ be the result of running TEA on $\mathcal{H}_{\text{multiaxis2}}$, and g_{union} be the result of running TEA on $\mathcal{H}_{\text{union}} = \mathcal{H}_{\text{axis2}} \cup \mathcal{H}_{\text{multiaxis2}}$. Then we have that for all datasets,

$$E_{\text{in}}(g_{\text{union}}) \leq E_{\text{in}}(g_{\text{axis2}})$$

and

$$E_{\text{in}}(g_{\text{union}}) \leq E_{\text{in}}(g_{\text{multiaxis2}}).$$