00103335: Deep Learning and Reinforcement Learning
Supplementary Problems for Homework 1

1. (Necessity of prior knowledge). Let $\mathcal{X}$ be infinite and let $\mathcal{H}$ be the set of all functions from $\mathcal{X}$ to $\{0, 1\}$. Prove that $\mathcal{H}$ is not PAC learnable.
   Note. If you drive it from the no-free-lunch theorem, state and prove your version of the theorem first.

2. (Asymptotic PAC). If the loss function takes values in $[0, 1]$, show that the (ε, δ) definition of PAC learnability, i.e., for any $\varepsilon > 0$ and $\delta > 0$, there exists some m_0 such that for $m \geq m_0$,

$$\mathop{\mathbb{P}}_{S \sim \mathcal{D}^m} \{R(h_S) \leq \varepsilon\} \geq 1 - \delta,$$

is equivalent to the limiting statement

$$\lim_{m \to \infty} \mathop{\mathbb{E}}_{S \sim \mathcal{D}^m} R(h_S) = 0.$$