# EECS 496-10 – Computational Learning Theory
## Winter 2019
## Problem Set 2

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**Due**: 2/28/19 by the beginning of class

**Instructions:** Atop your problem set, please write your name and list your collaborators. You may consult outside references, but cite all the resources used (e.g. which resources on the internet you consulted). You should not, however, search for answers to these questions. All problems in this assignment require proof.

### Problems

**1.** Show that conjunctions are efficiently learnable with statistical queries.

**2.** Prove that statistical query dimension is asymptotically lower-bounded by VC-dimension. Namely show that $\exists k$ such that for every concept class $C$, VC-DIM$(C) \leq k$ SQ-DIM$(C)$.

**3.** Assume that the weak learning assumption of AdaBoost holds. Let $h_t$ be the base learner selected at round $t$. Show that the base learner $h_{t+1}$ selected by AdaBoost at round $t+1$ must be different from $h_t$.

**4.** Suppose that in boosting, the weak learning condition is guaranteed to hold so that $\epsilon_t \leq \frac{1}{2} - \gamma$ for some $\gamma > 0$ that is known before boosting begins. Describe a modified version of AdaBoost whose final classifier is an *unweighted* majority vote and whose training error is at most $(1 - 4\gamma^2)^{T/2}$.