# Examples

## 1 Questions

1. Suppose there is a classification problem $f : X \longrightarrow Y$, where each instance $X$ has four attributes i.e. $X = \langle X_1, X_2, X_3, X_4 \rangle$.
   a. What is the number of possible values of the instances.

   b. What is the number of hypotheses possible, if they are of the form:
   IF $\langle X_1, X_2, X_3, X_4 \rangle = \langle 1, 0, ?, ? \rangle$ THEN CLASS = 1 ELSE CLASS = 0
   This means each attribute can be 0, 1 or ?

   c. Is there a guarantee that the true concept will be in the training examples?

   d. How many training examples $m$ suffice to assure that with probability at least 0.99 i.e $1 - \delta = 0.99$, any consistent learner will output a hypothesis with true error at most 0.05 i.e. $\epsilon \leq 0.05$?

2. Consider classification problem $f : X \longrightarrow Y$, where each instance $X$ has $n$ attributes i.e. $X = \langle X_1, X_2, \ldots, X_n \rangle$ where each $X_i$ is a boolean.
   Also assume that the classifier is a decision tree of max depth 2 only.
   a. What is the size of the hypothesis state?
   Hint: It's a product of two terms - first term is how to select two variables from N and second term is how to label the classes.
   b. How many training examples $m$ suffice to assure that with probability at least 0.99 i.e $1 - \delta = 0.99$, any consistent learner will output a hypothesis with true error at most 0.05 i.e. $\epsilon \leq 0.05$?

3. Consider classification problem $f : X \longrightarrow Y$, where each instance $X$ has 4 attributes i.e. $X = \langle X_1, X_2, X_3, X_4 \rangle$ where each $X_i$ is a boolean.
   Also assume that the classifier is a consists of only AND-POSITIVE literals i.e. the rules are of the form:
   IF $X_1 = b_1 \wedge X_2 = b_2 \wedge X_3 = b_3 \wedge X_4 = b_4$ THEN CLASS = 1 ELSE CLASS = 0 where each of the $b_i$ are booleans
   a. What is the size of the hypothesis state?
   b. How many training examples $m$ suffice to assure that with probability at least 0.99 i.e $1 - \delta = 0.99$, any consistent learner will output a hypothesis with true error at most 0.05 i.e. $\epsilon \leq 0.05$?