

Problem Set 2

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Problem 1 Please write your analysis on Problem 1 here

Problem 2 Please write your analysis on Problem 2 here

Problem 3 Please write your analysis on Problem 3 here

Problem 4 Please write your analysis on Problem 4 here a)

Lemma 1: Let $X_i = I_S[f_i]$, then $\mathbb{E}[X_i] = I[f]$ and by chebyshev's bound therefore:

$$Pr[|I_S[f_i] - I[f_i]| \geq \epsilon] \leq \frac{Var[X_i]}{\epsilon^2}$$

Proof: Let $X_i = I_S[f_i] = \frac{1}{n} \sum_{j=1}^n V(f_i, z_j)$, where z_j is the random samples/data and f_i is a non random (and fixed) function in \mathcal{H} . Then, if we take the expectation of X_i wrt to the distribution of z we get:

$$\mathbb{E}[X_i] = \mathbb{E}\left[\frac{1}{n} \sum_{j=1}^n V(f_i, z_j)\right] = \frac{1}{n} \sum_{j=1}^n \mathbb{E}[V(f_i, z_j)] = \mathbb{E}[V(f_i, z_j)] = I[f_i]$$

Thus, we can use chebyshev's and thus the following statement is true (concluding proof of lemma):

$$Pr[|I_S[f_i] - I[f_i]| \geq \epsilon] \leq \frac{Var[X_i]}{\epsilon^2}$$

□

Problem 5 (MATLAB) Please write your analysis on Problem 5 here