Exercise 1

(a) Using Theorem 3.6:

$$\Pr_{T\ \mathcal{D}^m}(\forall h \in \mathcal{H} : |err_T(h) - err_D(h)| \leq \epsilon) > 1 - \delta$$
$$\Pr_{T\ \mathcal{D}^m}(\forall h \in \mathcal{H} : |err_T(h) - err_D(h)| \leq \epsilon) > 0.9$$
$$\Rightarrow \delta = 0.1$$

$$m \geq \frac{1}{2\epsilon^2}\log\left(\frac{2|\mathcal{H}|}{\delta}\right)$$
$$143 \geq \frac{1}{2\epsilon^2}\log\left(\frac{2\cdot 2^3}{0.1}\right)$$
$$143 \geq \frac{1}{2\epsilon^2}(\log(2^4) - \log(0.1))$$
$$143 \geq \frac{1}{2\epsilon^2}(4 - \log(0.1))$$
$$\epsilon^2 \geq \frac{(4 - \log(0.1))}{143\dot{2}}$$
$$|\epsilon| \geq \sqrt{\frac{(4 - \log(0.1))}{286}}$$
$$\Rightarrow \epsilon \geq \sqrt{\frac{(4 - \log(0.1))}{286}}$$
$$\epsilon \geq \sqrt{\frac{(4 - \log(0.1))}{286}}$$

$$\Pr_{T\ \mathcal{D}^m}(\forall h \in \mathcal{H} : |err_T(h) - err_D(h)| \leq \epsilon) > 0.9$$
$$\Pr_{T\ \mathcal{D}^m}\left(\forall h \in \mathcal{H} : |0.03 - err_D(h)| \leq \sqrt{\frac{(4 - \log(0.1))}{286}}\right) > 0.9$$
$$\Rightarrow err_D(h) \leq 0.03 + \sqrt{\frac{(4 - \log(0.1))}{286}} \simeq 0.05560114718 \simeq 0.06$$

(b) Using Theorem 3.4:

$$\Pr_{T\ \mathcal{D}^m}(\forall h \in \mathcal{H} : \text{if } h \text{ is consistent with } T, \text{ then } err_D(h) \leq \epsilon)\, 1 - \delta$$
$$\Pr_{T\ \mathcal{D}^m}(\forall h \in \mathcal{H} : \text{if } h \text{ is consistent with } T, \text{ then } err_D(h) \leq 0.01)\, 0.9$$
$$\Rightarrow \epsilon = 0.01, \delta = 0.1$$

$$m \geq \frac{1}{\epsilon}\ln\left(\frac{|\mathcal{H}|}{\delta}\right)$$
$$m \geq \frac{1}{0.01}\ln\left(\frac{2^3}{0.1}\right)$$
$$m \geq 100(\ln(3) - \ln(0.1)) \sim 100 \cdot 3.40119738166 = 340.1197$$
$$\Rightarrow m \geq 341$$

Exercise 2

(a)

(b)

Exercise 3

(a)

(b)

Exercise 4

(a)

(b)

Exercise 5

(a)

(b)

Exercise 6

(a) (i)

(ii)

(b)

(c)

Appendix