

**Homework 3**  
MATH 166 - Spring 2023  
Tufts University, Department of Mathematics  
Instructor: James M. Murphy  
Due: February 14, 2023

1. BOOK QUESTIONS

Wasserman: Chapter 6: #2; Chapter 7: #1, 4, 9

2. SUPPLEMENTAL QUESTION (BIAS-VARIANCE TRADEOFF FOR MEAN ESTIMATION)

Let  $x_1, x_2, \dots, x_n$  be i.i.d. samples from a random variable  $X$  with expected value  $\mu = \mathbb{E}(X)$  and variance  $\sigma^2 = \text{Var}(X)$ . For each of the following three estimators for  $\mu$ , compute the bias, variance, and MSE. Discuss the benefits and problems associated with each. Which one would you prefer to use?

(a)  $\hat{\theta}_n = \frac{1}{n} \sum_{i=1}^n x_i.$

(b)  $\hat{\theta}_n = x_1.$

(c)  $\hat{\theta}_n = 0.$