

**Homework 10**  
MATH 166 - Fall 2024  
Tufts University, Department of Mathematics  
Instructor: James M. Murphy  
Due: December 3, 2024

BOOK QUESTIONS

Wasserman: Chapter 11: #2 (a)-(c), #3; Chapter 20: #4

SUPPLEMENTAL QUESTION 1 (HISTOGRAM AND KDE BANDWIDTH)

For each of the following random variables and sample sizes  $n$ , construct (i) a histogram estimator for the density at a range of bin sizes and (ii) a kernel density estimator using the Gaussian kernel at a range of bandwidths. Describe the behavior qualitatively, and connect back to our theoretical discussions of the bias-variance trade-off and optimal bin/bandwidths.

- (a)  $X \sim \text{Unif}([0, 1])$ ,  $n = 100$ .
- (b)  $X \sim \text{Unif}([0, 1])$ ,  $n = 10000$ .
- (c)  $X \sim \mathcal{N}(0, 1)$ ,  $n = 100$ .
- (d)  $X \sim \mathcal{N}(0, 1)$ ,  $n = 10000$ .