

**Homework 9**  
MATH 166 - Spring 2023  
Tufts University, Department of Mathematics  
Instructor: James M. Murphy  
Due: April 6, 2023

1. BOOK QUESTIONS

Wasserman: Chapter 15: #1, #4<sup>1</sup>

SUPPLEMENTAL QUESTION 1 (CORRELATION V. CAUSATION)

Recall that two variables are uncorrelated if  $\mathbb{E}(XY) = \mathbb{E}(X)\mathbb{E}(Y)$ .

- (a) Show that if  $(X, Y)$  are independent, then they are uncorrelated.
- (b) Show by example that the converse is false in general, i.e. that  $(X, Y)$  may be dependent but uncorrelated.
- (c) Show that if  $(X, Y)$  are jointly Gaussian, then  $(X, Y)$  independent is equivalent to  $(X, Y)$  being uncorrelated. So in this special case, the converse discussed in (b) *is* true.

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<sup>1</sup><https://www.nytimes.com/2003/01/08/us/death-penalty-found-more-likely-if-victim-is-white.html#originalstory> is the location of the original article this question is based on