

Name: _____

PU ID: _____

ECE 302: Probabilistic Methods in Electrical and Computer Engineering
Fall 2021
Instructor: Prof. A. R. Reibman



Homework 10

Fall 2021

(Due Thursday November 18, 11:59pm)

Homework is due on **Thursday November 18 at 11:59pm** on Gradescope. No late homework will be accepted, and no homework will be accepted without a statement. Include a brief description of all sources of information you used (including other people), not counting the text, handouts, or material posted on the web page, **or** state “I did not receive help on this homework”. You do not need to reference any material presented in class or on the course web-site, in the textbook, nor Prof. Reibman nor TA Haoyu Chen.

Statement:

Topics: Joint moments (Chapter 5.6); Conditional Probability (Chapter 5.7)

Exercise 1. (FROM TEXTBOOK, PROBLEMS 5.26, 5.65, AND 5.80)

Let X and Y have the joint pdf

$$f_{X,Y}(x,y) = (x+y), \text{ for } 0 \leq x \leq 1, 0 \leq y \leq 1$$

From the last homework, we know that the marginal PDF's are

$$f_X(x) = (x + 1/2), \text{ for } 0 \leq x \leq 1$$

$$f_Y(y) = (1/2 + y), \text{ for } 0 \leq y \leq 1$$

- (a) Find the correlation and covariance of X and Y .
- (b) Determine if X and Y are independent, orthogonal, or uncorrelated. How do you know?

Exercise 2. (FROM TEXTBOOK, PROBLEMS 5.26, 5.65, AND 5.80)
Using the same joint and marginal PDFs from the previous exercise:

- (c) Find the conditional pdf of Y given $X = x$, namely, $f_Y(y|x)$.
- (d) Find $E(Y|X = x)$. (You can use the result from (c).)

Exercise 3. (EXAM 3, FALL 2016) (CUT HERE INTO 2 PROBLEMS)
Given X with PDF

$$f_X(x) = \begin{cases} 1/2 & \text{for } 0 \leq x \leq 2 \\ 0 & \text{otherwise} \end{cases}$$

Then Y is uniformly distributed between x and $2x$.

- (a) Sketch the region of support. That is, indicate where $f_{XY}(x, y)$ is nonzero.
- (b) Find the joint PDF $f_{XY}(x, y)$.

Exercise 4. (EXAM 3, FALL 2016) (THE SECOND PART)

Using the same conditional, marginal, and joint PDFs from the previous exercise:

- (c) What is $P(Y < 1)$?
- (d) What is $E(Y)$? (Hint: you may use the law of iterated expectations.)