Name:

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



Homework 6

Fall 2021

(Due Thursday October 14, 11:59pm)

Homework is due on **Thursday October 14 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: Conditional PMF, PDF, CDF (Chapters 3.4 and 4.2.2);

Exercise 1. (From textbook, problems 4.30, 4.32) THIS PROBLEM IS WORTH 2 POINTS

A random variable X has cdf:

$$F_X(x) = \begin{cases} 0 & \text{for } x < 0\\ 1 - \frac{1}{4}e^{-2x} & \text{for } x \ge 0 \end{cases}$$

NOTE! This is the same CDF as an **earlier problem**.

- (a) Find $F_X(x|A)$, where $A = \{X > 0\}$.
- (b) Find $F_X(x|C)$, where $C = \{X = 0\}$
- (c) Find $f_X(x|B)$ and $F_X(x|B)$, where $B = \{X > 0.25\}$

Exercise 2. (FROM EXAM 2 OF 3; SPRING 2016)) Consider the random variable X with PDF given by

$$f_X(x) = \begin{cases} 0 & x < 0 \\ x & 0 < x \le 1 \\ 2 - x & 1 \le x \le 2 \\ 0 & \text{otherwise} \end{cases}$$

- (a) Sketch $f_X(x)$. Label axes and relevant values.
- (b) Find and sketch the conditional density $f_X(x|A)$ for the event $A = \{X < 1/4\}$.
- (c) What is the conditional mean E(X|B) for the event $B = \{2/3 < X < 4/3\}$? (Hint: you do not need to find P(B) to solve part (c)!)

Exercise 3. THIS PROBLEM IS WORTH 2 POINTS

Let X be a uniform random variable on the interval (0, 10).

- (a) Find $P(X \le 6)$ and P(X > 8).
- (b) Compute the conditional PDF's of $f_X(x|X \le 6)$ and $f_x(x|X > 8)$.
- (c) Find the conditional means of $E(X|X \le 6)$ and E(X|X > 8).
- (d) Find the conditional variances of $Var(X|X \le 6)$ and Var(X|X > 8).