

Name: _____

PU ID: _____

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



Homework 2

Fall 2021

(Due Thursday September 9 at 11:59pm)

Homework is due on **Thursday September 9 at 11:59pm** on Gradescope. No late homework will be accepted. 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: Probability mappings; Conditional probability (Chapter 2.4); Independent events; sequential experiments (Chapters 2.5, 2.6.1, 2.6.5).

Exercise 1. SIMILAR TO BUT NOT TEXTBOOK PROBLEM 2.38

Two numbers (x, y) are selected at random from the interval $[0, 1]$.

- (a) Find the probability that the pair of numbers are outside the unit circle.

(a)

- (b) Find the probability that $3y > x$.

(b)

Exercise 2.

Mobile phones perform *handoffs* as they move from one cell to another. During a call, a phone either performs zero handoffs (H_0), one handoff (H_1), or more than one handoff (H_2). In addition, each call is either long (L), if it last more than three minutes, or short S . The following table describes the probabilities of the possible types of calls.

	H_0	H_1	H_2
L	0.1	0.1	0.2
S	0.4	–	0.1

- (a) What is the probability $P(H_0)$ that a phone makes no handoffs?

(a)

- (b) What is the probability a call is short?

(b)

- (c) What is the probability a call is long or there are at least two handoffs?

(c)

Exercise 3.

A simplified model for the movement of the price of a stock supposes that on each day the stock's price either moves up one unit with probability p or it moves down one unit with probability $1 - p$. The changes on different days are assumed to be independent.

- (a) What is the probability that after two days the stock will be at its original price?
- (b) What is the probability that after three days the stock's price will have increased by one unit?
- (c) Given that after three days the stock's price has increased by one unit, what is the probability that it went up on the first day?

(a):

(b):

(c):

Exercise 4. (FROM EXAM 1, FALL 2016)

Among the Purdue students taking ECE 302 this semester, some like dogs, some like cats, some like both, and some like neither. Let D be the set of Purdue ECE 302 students who like dogs, and C be the set who like cats.

A study shows that 22% like both cats and dogs, and 12% like neither. The probability a student likes dogs exceeds the probability a student likes cats by 0.14. What is the probability a randomly chosen student likes cats?

Answer :

Exercise 5.

Suppose among all six-letter English words, a word is picked at random (i.e., each six-letter word has the same probability of being picked). Which event is more probable: That the selected word has an “n” as its fifth letter, or that the selected word ends in “ing”?

Answer :

Exercise 6. FROM EXAM 1, FALL 2015

You have 4 otherwise identical cans of soda (also known as pop or cola), except you know that 1 was shaken up about 10 minutes ago, while the other 3 have been stable for hours. (You have lost track of which can is which.) The probability of the shaken can splattering when opened is $4/5$, and the probability of a stable can splattering when opened is $1/3$.

(a) If you choose one can at random and open it, what is the probability of it splattering?

(b) If you open a can and it splatters, what is the probability that it was the shaken can?

(You may leave your answers in fractional form.)

(a):

(b):

Exercise 7. (FROM EXAM 1 SPRING 2016; NOTE: THIS COUNTS AS 2 PROBLEMS)

Suppose 3 boxes contain Red, Green, and Blue marbles, denoted R, G, B, respectively.

Box 1 has 3 Red, 4 Green, and 3 Blue.

Box 2 has 8 Red, 1 Green, and 1 Blue.

Box 3 has 0 Red, 4 Green, and 1 Blue.

Suppose a box is chosen at random, and then a marble is selected from the box.

- (a) If box 1 is selected, what is the probability a Green marble is drawn?
- (b) What is the probability a Blue marble is drawn from Box 3?
- (c) What is the probability a Red marble is drawn?
- (d) Suppose a Red marble is drawn. What is the probability it came from Box 2?

(a):

(b):

(c):

(d):

Exercise 8.

An experiment consists of picking one of two urns at random and then selecting a ball from the urn and noting its color (black or white). Let A be the event “urn 1 is selected” and B the event “a black ball is observed.” Under what conditions are A and B independent?

(Hint: recall that independence is a mathematical definition, so determine what mathematical conditions are necessary, and how that translates into the world.)