Homework 4

BSTA 550

Directions

Please turn in this homework on Sakai. Please submit your homework in pdf format. You can type your work on your computer or submit a photo of your written work or any other method that can be turned into a pdf. The Adobe Scan phone app is an easy way to scan photos and compile into a PDF. Please let me know if you greatly prefer to submit a physical copy. We can work out another way for you to turn in homework.

Try to complete all of the problems listed below at some point this quarter! You may want to save some of them for studying later! Only turn in the ones listed in the "Turn In" column. Please submit problems in the order they are listed.

You must show all of your work to receive credit.

Chapter	Turn In	Extra Problems
9	NTB # 1, 2	# 1, 2, 4, 8[#], 9, 10
10*	TB # 6	# 1, 8, 10, 11, 14, 17
11**	NTB # 3, 4	# 1, 2, 9***, 17***, 18***, 20

[#] Break up your solution to Chapter 9 #8 into the following 5 parts:

1. Make a table of the joint probabilities for X and Y.
2. Using the table in the previous part, write down the piecewise-defined equation for $p_{X,Y}(x, y)$. There should be only 3 pieces (cases) for $p_{X,Y}(x, y)$.
3. Express $p_Y(y)$ as a formula (i.e. a function in terms of y).
4. Find the conditional pmf $p_{X|Y}(x|y)$ and express your answer as a piecewise-defined equation. There should be only 3 pieces (cases) for $p_{X|Y}(x|y)$.
5. Make a table of the joint cdf $F_{X,Y}(x, y)$ values.

* Use Chapter 10 techniques when computing expected values for Chapter 10 problems, i.e. computing the expected value directly using the definition of $\mathbb{E}[X]$.

** Use Chapter 11 techniques when computing expected values for Chapter 11 problems, i.e. expressing the r.v. as a sum of other r.v.'s and calculating the expected value of the sum of r.v.'s. Also, as I mentioned in class and posted on Sakai, we will be skipping the more complex examples of finding expected values using indicator r.v.'s. You can skip Examples 11.5, 11.10, and 11.11. We will not be covering these techniques.

*** Although Chapter 11 exercises, these are to be done using Chapter 10 techniques since we aren't covering the more complex examples of finding expected values using indicator r.v.'s.

Non-textbook problems (NTB)

1. The following table shows the results of a survey in which the subjects were a sample of 300 adults residing in a certain metropolitan area. Each subject was asked to indicate which of three policies they favored with respect to smoking in public places. (Table is from *Biostatistics: A Foundation for Analysis in the Health Sciences*, 10th Edition, Daniel, Wayne W.; Cross, Chad L., pg. 630)

	Policy Favored				
Highest Education Level	**No Restrictions on Smoking**	**Smoking Allowed in Designated Areas Only**	**No Smoking at All**	**No Opinion**	**Total**
College graduate	5	44	23	3	75
High-school graduate	15	100	30	5	150
Grade-school graduate	15	40	10	10	75
Total	35	184	63	18	300

Let X = highest education level and Y = policy favored. We can let $X = 1$ for college graduate, $X = 2$ for high-school graduate, etc., and similarly for Y, or just keep the category names for the different levels of X and Y

a. Make a table for the joint pmf $p_{X,Y}(x, y)$ and briefly describe in words what the values are the probability of.

b. Find the marginal pmf $p_X(x)$ and briefly describe in words what the values are the probability of.

c. Find the marginal pmf $p_Y(y)$ and briefly describe in words what the values are the probability of.

d. Make a table for the joint cdf $F_{X,Y}(x, y)$ and briefly describe in words what the values are the probability of.

e. Find the marginal cdf $F_X(x)$ and briefly describe in words what the values are the probability of.

f. Find the marginal cdf $F_Y(y)$ and briefly describe in words what the values are the probability of.

g. Make a table for the conditional pmf $p_{X|Y}(x|y)$ and briefly describe in words what the values are the probability of.

h. Make a table for the conditional pmf $p_{Y|X}(y|x)$ and briefly describe in words what the values are the probability of.

2. Each day, Maude has a 1% chance of losing her cell phone (her behavior on different days is independent). Each day, Maude has a 3% chance of forgetting to eat breakfast (again, her behavior on different days is independent). Her breakfast and cell phone habits are independent. Let X be the number of days until she first loses her cell phone. Let Y be the number of days until she first forgets to eat breakfast. (Here, X and Y are independent.)

   a. Find the joint probability mass function of X and Y.

   b. Find the joint cdf of X and Y and briefly explain what $F_{X,Y}(x, y)$ represents in the context of the problem.

   c. Find the conditional pmf $p_{Y|X}(y|x)$.

3. Approximately 10% of U.S. Veterans are women. Suppose an investigator plans a study with 4500 participants that are Veterans. How many women can they expect to be included? *Your answer must be calculated by defining a random variable and showing how to calculate the expected value.*

4. There is a bowl containing 30 cashews, 20 pecans, 25 almonds, and 25 walnuts. I am going to randomly pick and eat 3 nuts (without replacement). Find the expected value of the number of cashews by defining the number of cashews as a sum of random variables. (This one takes a little while if we don't rely on the

Some select answers

Selected answers (or hints) not provided at the end the book:

- Chapter 9
  - NTB # 1 Partial answers:

    * (g) $p_{X|Y}(X = \text{high school}|Y = \text{no smoking at all}) = 0.476$
    * (h) $p_{Y|X}(Y = \text{no smoking at all}|X = \text{high school}) = 0.200$

- Chapter 10
  - # 6: 750.5
  - # 8: 0.9
  - # 10: 201
  - # 14: (a) 1.875 (b) 3.125

- Chapter 11
  - # 2: 1.6
  - # 18: a) 48.5 (b) 96
  - # 20: ≈ 23.077