Homework 3

BSTA 550

Directions

Please turn in this homework on Sakai. Please submit your homework in pdf or html 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.

You must show all of your work to receive credit.

Questions

1. **Cookies.** Consider a jar of 9 chocolate chip and 11 peanut butter cookies. You randomly select 2 cookies to eat. All possible choices are equally likely.

    a. What is the probability that the 2 you select will both will be chocolate chip? *Calculate your answer "by hand."*
    b. What is the probability that at least one of your cookies will be peanut butter? *Calculate your answer "by hand" then verify your answer by simulating the experiment in R at least 1000 times.*
    c. What is the probability that last 2 cookies left in the jar (after 18 have been eaten) will be chocolate chip? (Is this answer the same or different than part a? Why or why not?) *Calculate your answer "by hand" then verify your answer by simulating the experiment in R at least 1000 times.*

2. **Raffle tickets.** There are 30 raffle tickets in a bowl. Three winning tickets will be selected. Each ticket can win at most one prize. How many ways can the prizes be distributed if the following additional information is known?

    a. All 3 winners receive goldfish (the goldfish are indistinguishable).

b. The 1st winner receives a car, the 2nd a bicycle, and the 3rd a goldfish.

3. A new drug is packaged to contain 30 pills in a bottle. Suppose that 98% of all bottles contain no defective pills, 1.5% contain one defective pill, and 0.5% contain two defective pills. Two pills from a bottle are randomly selected and tested. What is the probability that there are 2 defective pills in the bottle given that one of the two tested pills is defective?

Extra Problems

1. Read the Washington Post article *The amazing woman who can smell Parkinson's disease - before symptoms appear* (http://www.washingtonpost.com/news/morning-mix/wp/2015/10/23/scottish-woman-detects-a-musky-smell-that-could-radically-improve-how-parkinsons-disease-is-diagnosed/)

   Assuming Joy Milne does not have the ability to detect Parkinson's disease via smell, answer the following questions:

   a. What is the probability of her correctly detecting Parkinson's by smelling one t-shirt?

   b. What is the probability of her correctly detecting Parkinson's in 12 out of 12 t-shirts?

2. Calculus Review

   a. $$\int_0^y c(x+y)dx$$

   b. $$\frac{d}{dx}\left(\frac{4}{9}x^2y^2 + \frac{5}{9}xy^4\right)$$

   c. $$\frac{d}{dy}\left(\frac{4}{9}x^2y^2 + \frac{5}{9}xy^4\right)$$

   d. $$\int_0^y 2e^{-x}e^{-y}dx$$

   e. $$\int_0^\infty xye^{-(x+y)}dy$$

   f. $$\int_x^{2x} 2e^{-(x+3y)}dy$$

g. Find the area of the region bounded by the graphs of $f(x) = 2 - x^2$ and $g(x) = x$ by integrating with respect to x.

h. Find the area of the region bounded by the graphs of $f(x) = 2 - x^2$ and $g(x) = x$ by integrating with respect to y.

i. Find the area of the region bounded by the graphs of $x = 3 - y^2$ and $y = x - 1$ by integrating with respect to x.

j. Find the area of the region bounded by the graphs of $x = 3 - y^2$ and $y = x - 1$ by integrating with respect to y.