STAT/MA 41600
Practice Problems: October 3, 2014

1. Hungry customers. At a certain restaurant, during the working day, there are 12 customers. Seven of them have pizza, and the other five have burgers. Suppose that a person is conducting a survey of three customers at the restaurant, and he conducts the survey without replacement, i.e., he does not talk to the same customer more than once. All possible selections of three people for the survey are equally likely.

Let X be the number of people in the survey who are eating pizza.

a. What is the mass of X?

b. Evaluate the mass at the four values where the mass is positive. (Make sure that your four numbers sum to 1.)

c. What is the average number of people in the survey who are eating pizza?

2. Harmonicas. Dr. Ward owns quite a few harmonicas. In particular, he has 7 "Deluxe" harmonicas and 12 "Crossover" harmonicas. Without looking at them, they have relatively similar shapes, so he does not notice a difference between them when he reaches into his harmonica container. Suppose that Dr. Ward grabs 8 harmonicas, without replacement, and all selections are equally likely.

    a. How many Deluxe harmonicas does he expect to select?

    b. What is the variance of the number of Deluxe harmonicas that he selects?

    c. What is the probability that exactly 5 out of the 8 harmonicas are Deluxe?

3. Granola bars. I have 6 chocolate chunk granola bars, 10 raspberry granola bars, and 8 chocolate chip granola bars. I grab 3 without looking.

a. What is the probability that 2 are chocolate (either chunk or chip)?

b. What is the probability that strictly fewer than 2 are chocolate (either chunk or chip)?

c. What is the expected number of chocolate (either chunk or chip) granola bars out of the 3 that I grab?

4. Superfans. At Ross-Ade Stadium, there are 60,000 fans attending a football game. It is well known that only a few people at a Purdue football game will like Indiana University. Suppose that a person at the game likes Indiana University with probability $\frac{1}{10,000}$, independently of the other fans.

a. Give an exact formula for the probability that 8 of the people at the game like Indiana University. You do *not* have to evaluate the formula on your calculator.

b. Use a Poisson estimation for the probability above.

c. Use your calculator to evaluate the Poisson expression that you gave in part b.

5. Shoppers. During the holiday rush, there are 100,000 shoppers in a certain region. Each of these shoppers is extremely likely to make a purchase. Suppose that a person makes a purchase with probability 49,999/50,000 and declines to make a purchase with probability 1/50,000. Let X be the number of people who decline to make a purchase.

a. Give an exact formula for the probability that $P(X \leq 3)$. You do *not* have to evaluate the formula on your calculator.

b. Use a Poisson estimation for the probability above.

c. Use your calculator to evaluate the Poisson expression that you gave in part b.