

Bayesian Statistics, Assignment for Tuesday, Sept. 10

From *Statistical Treatment of Experimental Data*

Study pp. 58-64. The derivation of the Poisson distribution on p. 59 is pretty tricky! That's why we did it together in Friday's class. Also, the last sentence on p. 60 is very important. Going forward, we are going to *normalize* our probability distributions. That means all the bars in the histogram have to add up to 1, rather than all the bars in the histogram adding up to the number of trials. For example, in the puppy litters, all the bars in the histogram added up to 200. The number of litters with six puppies was 34. If we normalize the distribution, instead of putting 34 for the sixth position of the histogram, we would put $34/200 = 0.17$.

For Problem Set 4

Poisson Distributions

Let's suppose we break one mug per week on average in the BH, and that every time we break a mug, Sarah buys another, so the number of mugs is not decreasing. We can examine the same problem three ways! (1) We break $1/7$ of a mug per day on average. (2) We break 1 mug per week on average. (3) We break 4 mugs per month on average (I am making one month equal to four weeks even though actually only February is that short).

1. Plot the Poisson distribution with $a = 1/7$. Plot it for $n = 0, 1, 2, 3, 4, 5$. On most days, we break 0 mugs! You will see that in the plot. I have put quality paper in your folders. Use the front side only. The graph grid is meant to show faintly through the paper. Don't use the back side.
2. Plot the Poisson distribution with $a = 1$. Plot it for $n = 0, 1, 2, 3, 4, 5$. You will see that in about $1/3$ of the weeks, we break 0 mugs.
3. Plot the Poisson distribution with $a = 4$. Plot it for $n = 0, 1, 2, 3, 4, 5$. You will see that in about 20% of the months we break 3 mugs and in another 20% we break 4 mugs. In only 2% of the months do we break 0 mugs.
4. Do Problem 13 on p. 88.

I know this is a lot of time-consuming punching of numbers into calculators. It is instructive though! I usually use a fancy tool like Mathematica to do these kinds of problems, but out of solidarity, I will do my solutions with an ordinary calculator too.