**Week 5 Reading Questions**

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I did not work with any other students.

**Q1.** Choose the best words or phrases to fill in the blanks: A probability distribution is a map from the (a)___event__ to the (b)__likelihood___.

**Q2.** There are four possible outcomes if you flip two coins sequentially and you care about order.

**Q3.** There are three possible outcomes if you flip two coins simultaneously and don't care about order.

**Q4.** There are six possible outcomes if you care about the order of the flips of one penny three times.

**Q5.** In the cases where order matters, it's a permutation, and if order doesn't matter it's a combination. So the case above where order matters it's a permutation.

**Q6.** If you don't care about the order, there are four possible events.

**Q7.** The case where order doesn't matter is a combination.

*Suppose it is a beautiful fall day and you are sitting underneath three oak trees: Bur oak (Quercus. macrocarpa), Northern Red Oak (Q. rubra), and White oak (Q. alba). They've just started to drop their acorns.*

*Without looking, you reach down and pick up **two** acorns **in one hand** at the **same time** and shuffle them around before you look.*

*Describe the sample space of your collection (i.e. enumerate the set of all possible outcomes).*

Some things to consider when describing your sample space?

- Assume that *two acorns of the same species* are **indistinguishable**.
- In your 2-acorn draw, what is an *event*?
- How many elements are in each possible event?
- Does the order or arrangement of acorns matter?

**Q8.** What is the size of the sample space?

The sample space of the two-acorn draw is 6, because you could pick up two bur oak acorns, two red oak acorns, two white oak acorns, a bur oak and a red oak, a bur oak and a white oak, or a white oak and a red oak.

**Q9.** In this scenario, there are three ways to collect two acorns of the same species.

**Q10.** In this scenario, there are three ways to collect two acorns of different species.

**Q11.** There is a 33% chance that the probability of the acorn in your left pocket is *Q. alba*, because since there are three species, the possibility of picking up an acorn of any particular species is 1/3 assuming that the populations of acorns are scattered consistently and there are an infinite number of them (in a statistical sense—there are so many that picking one doesn't significantly reduce the possibility of picking the same one again.

**Q12.** There is a 33% chance that the acorn in your right pocket is *Q. macrocarpa*, because in this scenario the pocket side is independent.

**Q13.** If the events are independent and the numbers of acorns are large (you're picking up both acorns at the same time), then the probability of a species in one pocket shouldn't significantly influence the probability of the species in the other pocket. So the probability that the acorn in your right pocket is also *Q. alba* should still be 33%.

**Q14.** The probability that both acorns are *Q. rubra* is .33 *.33 or about 11%.

**Q15.** The probability of collecting one each of *Q. rubra* and *Q. alba* is .33 * .33 or about 11%.

**Q16.** The probability of having a *Q. alba* acorn in your left pocket and a *Q. rubra* acorn in your right pocket is .33 *.5 (deciding the side of the first pocket) *.33 or about 5%.

*For the questions below consider two discrete probability distributions, parameterized as:*

- *a Poisson distribution with* $\lambda=6$
- *a Binomial distribution with* $n=10$ *and* $p=0.6$.

**Q17.** The Poisson distribution has an infinite sample space.

**Q18.** The size of the sample space of this binomial distribution is 11 because of the existence of 0 (n+1).

**Q19.**Both the binomial and the Poisson distribution capture the number of independent occurrences of something happening.

**Q20.** A binomial distribution would be a better choice if the domain is limited, i.e. if there's a particular number of trials as opposed to being theoretically infinite. For example, the binomial distribution might be a better choice for modeling if I hang 25 sticky traps and want to count presence/absence of a particular insect order on each of them.