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ECO 602 – Analysis of Environmental Data
Week 5 Reading Questions
Due 10/16/2022

Warm-Up Questions: Q1-Q7

Q1 (2 pts.): Choose the best words or phrases to fill in the blanks: A probability distribution is a map from the (a)_____ to the (b)_____.

Events, likelihoods

Q2 (2 pts.): How many possible outcomes are there (i.e. what is the sample space) if you flip two coins sequentially: a penny and a quarter? Assume that the two coins each have a head and a tail, you care about order, the probability of heads or tails is about 0.5 for each coin.

pH, qH

qH, pH

pT, qT

qT, pT

pT, qH

qH, pT

pH, qT

qT, pH

There are 8 possible events.

Q3 (2 pts.): How many possible outcomes are there (i.e. what is the sample space) if you flip two quarters at the same time? Assume that the two coins are indistinguishable i.e. you just want to know the number of heads or tails for each possible outcome. Each have a head and a tail the probability of heads or tails is about 0.5 for each quarter.

HT, HH, TT

There are three possible events.

Q4 (2 pts.): How many outcomes are there if you flip a penny three times? If you care about the order of flips, how many possible events are there in the sample space?

HTT, HHT, HTH, HHH, TTT, THT, TTH, THH

There are 8 possible events.

Q5 (1 pt.): Are these combinations, or permutations?

These are permutations because we care about the order of the penny flips.

Q6 (2 pts.): Now suppose you don't care about the order, and you simply want to know about the number of heads when you flip the penny three times. How many possible events are in the sample space?

There are four possible events in the sample space. That you'd get no heads during the three flips, that you'd get one heads during the three flips, that you'd get two heads during three flips, or that all three flips would be heads.

Q7 (1 pt.): Are these combinations, or permutations?

These are combinations because we don't care about order.

Simultaneous Acorns 1: Q8 – Q10

Q8 (2 pts.): What is the size of the sample space?

BB, RR, WW, BR, BW, RW

The sample size is 6.

Q9 (2 pts.): Given the scenario description, how many ways are to there to collect two acorns of the same species?

There are three ways to collect two acorns of the same species: grabbing two bur oak acorns, grabbing two red oak acorns, or grabbing two white oak acorns.

Q10 (2 pts.): Given the scenario description, how many ways can you collect two acorns of different species?

There are three ways to collect two acorns of different species because the order does not matter. You can collect a bur oak acorn and a red oak acorn, a red oak acorn and a white oak acorn, or a white oak acorn and a bur oak acorn.

Sequential Acorns: Q11 – Q16

Q11 (1 pt.): What is the probability that the acorn in your left pocket is Q. alba?

There is a 1/3 probability that the acorn in your left pocket is Q. alba.

Q12 (1 pt.): What is the probability that the acorn in your right pocket is Q. macrocarpa?

There is a 1/3 probability that the acorn in your right pocket is Q. macrocarpa.

Q13 (2 pts.): If you already know that the acorn in your left pocket is Q. alba, what is the probability that the acorn in your right pocket is also Q. alba?

There is still a 1/3 probability that the acorn in your right pocket is also Q. alba if the acorn in your left pocket is Q. alba.

Q14 (2 pts.): What is the probability that both acorns are Q rubra?

There is a 1/9 probability that both acorns are Q. rubra. There are three possible species to choose from and thousands of each on the ground. There is a 1/3 probability to select one Q rubra, and a 1/3 probability to select the second acorn as Q rubra. You multiply these two probabilities to get 1/9.

Q15 (2 pts.): What is the probability that you collected exactly one each of Q. alba and Q. rubra?

There is a 1/9 probability that you collected exactly one Q. alba and one Q. rubra. There are three possible species to choose from and thousands of each on the ground. There is a 1/3 probability to select one Q alba, and a 1/3 probability to select a Q. rubra. You multiply these two probabilities to get 1/9.

Q16 (2 pts.): What is the probability that the acorn in your left pocket is Q. alba and you have an acorn of Q. rubra in your right pocket?

There is a 1/9 probability that you collected a Q. alba in your left pocket and one Q. rubra in your right pocket. There are three possible species to choose from and thousands of each on the ground. There is a 1/3 probability to select one Q alba, and a 1/3 probability to select a Q. rubra. You multiply these two probabilities to get 1/9.

Binomial and Poisson: Q17 – Q20

Q17 (1 pt.): Which of the following is the size of the sample space of this Poisson distribution?

∞ is the size of the sample space of this Poisson distribution.

Q18 (2 pts.): Which of the following is the size of the sample space of this Binomial distribution?

10 is the size of the sample space of this Binomial distribution.

Q19 (2 pts.): Describe a character that is common to both the Binomial and Poisson distributions that makes them good models for counts.

Binomial and Poisson both deal with counts as the Binomial distribution is the sum of multiple Bernoulli trials which are single binary events. The Poisson distribution is the county of events that happen at a constant rate. Both distributions are therefore good for counts. Both distributions also can only represent positive values which make them good for counts.

Q20 (2 pts.): Hypothesize a scenario in which a Binomial distribution may be a better count model than a Poisson distribution.

A Binomial distribution might be better if you have a smaller bounded amount of trials, like an experiment with 10 plots where the likelihood of observing a species presence is 0.6 for each plot. A Poisson distribution would be better for an experiment with a much bigger or unbounded number of trials.