What are the similarities and differences between the Binomial and Geometric distributions?

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The Binomial and Geometric distributions are two commonly used probability distributions in statistics. Both are discrete distributions, meaning they can only take on a finite or countable number of values.

The Binomial distribution represents the probability of a certain number of successes in a fixed number of independent trials, each with the same probability of success. On the other hand, the Geometric distribution represents the probability of the number of trials needed to achieve the first success in a series of independent trials with the same probability of success.

One key similarity between these distributions is that they both have a fixed probability of success for each trial. They also both have a mean and standard deviation that can be calculated using specific formulas.

However, one major difference between the two is that the Binomial distribution has a fixed number of trials, while the Geometric distribution has a variable number of trials until the first success is achieved. Additionally, the Binomial distribution deals with discrete data, while the Geometric distribution can also be used for continuous data.

In summary, the Binomial and Geometric distributions have similarities in terms of their fixed probability of success and calculation of mean and standard deviation. However, their main difference lies in the number of trials and type of data they can be applied to.

Binomial vs. Geometric Distribution: Similarities & Differences

Two commonly used distributions in statistics are the and the .

This tutorial provides a brief explanation of each distribution along with the similarities and differences between the two.

The Binomial Distribution

The binomial distribution describes the probability of obtaining *k* successes in *n* .

If a random variable*X* follows a binomial distribution, then the probability that *X* = *k* successes can be found by the following formula:

P(X=k) = nCk * pk * (1-p)n-k

where:

n: number of trialsk: number of successesp: probability of success on a given trialnCk: the number of ways to obtain *k* successes in *n* trials

For example, suppose we flip a coin 3 times. We can use the formula above to determine the probability of obtaining 0 heads during these 3 flips:

P(X=0) = 3C0 * .50 * (1-.5)3-0 = 1 * 1 * (.5)3 = 0.125

The Geometric Distribution

The geometric distribution describes the probability of experiencing a certain amount of failures before experiencing the first success in a series of binomial experiments.

If a *X* follows a geometric distribution, then the probability of experiencing *k* failures before experiencing the first success can be found by the following formula:

P(X=k) = (1-p)kp

where:

k: number of failures before first successp: probability of success on each trial

For example, suppose we want to know how many times we'll have to flip a fair coin until it lands on heads. We can use the formula above to determine the probability of experiencing 3 "failures" before the coin finally lands on heads:

Similarities & Differences

The binomial and geometric distribution share the following similarities:

The outcome of the experiments in both distributions can be classified as "success" or "failure."The probability of success is the same for each trial.Each

trial is independent.

The distributions share the following key difference:

In a binomial distribution, there is a fixed number of trials (i.e. flip a coin 3 times)In a geometric distribution, we're interested in the number of trials required *until* we obtain a success (i.e. how many flips will we need to make before we see Tails?)

Practice Problems: When to Use Each Distribution

In each of the following practice problems, determine whether the random variable follows a binomial distribution or geometric distribution.

Problem 1: Rolling Dice

Jessica plays a game of luck in which she keeps rolling a dice until it lands on the number 4. Let *X* be the number of rolls until a 4 appears. What type of distribution does the random variable *X* follow?

Answer: *X* follows a geometric distribution because we're interested in estimating the number of rolls required until we finally get a 4. This is not a binomial

distribution because there is not a fixed number of trials.

Problem 2: Shooting Free-Throws

Tyler makes 80% of all free-throws he attempts. Suppose he shoots 10 free-throws. Let *X* be the number of times Tyler makes a basket during the 10 attempts. What type of distribution does the random variable *X* follow?

Answer: *X* follows a binomial distribution because there is a fixed number of trials (10 attempts), the probability of "success" on each trial is the same, and each trial is independent.