How to Calculate Theoretical Probability with Examples

Authored by

stats writer

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Theoretical probability refers to the likelihood or chance of an event occurring based on mathematical calculations and assumptions. It is a theoretical concept that can be used to predict the outcomes of events in a controlled setting. This type of probability is often represented as a fraction, where the number of favorable outcomes is divided by the total number of possible outcomes.

Some examples of theoretical probability include flipping a fair coin and getting heads, rolling a six-sided die and getting a certain number, or drawing a specific colored marble from a bag of different colored marbles. In all of these examples, the theoretical probability can be calculated by dividing the number of desired outcomes by the total number of possible outcomes.

It is important to note that theoretical probability is not always reflective of actual outcomes, as it is based on assumptions and ideal conditions. However, it is a useful tool in understanding the likelihood of events and can be applied in various fields such as statistics, economics, and gambling.

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Theoretical Probability: Definition + Examples

Probability is a topic in statistics that describes the likelihood of certain events happening. When we talk about probability, we're often referring to one of two types:

1. Theoretical probability

Theoretical probability is the likelihood that an event will happen based on pure mathematics. The formula to calculate the theoretical probability of event *A* happening is:

P(*A*) = number of desired outcomes / total number of

possible outcomes

For example, the theoretical probability that a dice lands on "2" after one roll can be calculated as:

P(*land on 2*) = (only one way the dice can land on 2) / (six possible sides the dice can land on) = 1/6

2. Experimental probability

Experimental probability is the actual probability of an event occurring that you directly observe in an experiment. The formula to calculate the experimental probability of event *A* happening is:

P(*A*) = number of times event occurs / total number of trials

For example, suppose we roll a dice 11 times and it lands on a "2" three times. The experimental probability for the dice landing on "2" can be calculated as:

P(*land on 2*) = (lands on 2 three times) / (rolled the dice 11 times) = 3/11

How to Remember the Difference

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You can remember the difference between theoretical probability and experimental probability using the following trick:

The theoretical probability of an event occurring can be calculated in theory using math.The experimental probability of an event occurring can be calculated by directly observing the results of an experiment.

The Benefit of Using Theoretical Probability

Statisticians often like to calculate the theoretical probability of events because it's much easier and faster to calculate compared to actually conducting an experiment.

For example, suppose it's known that 1 out of every 30 students at a particular school will need additional help with their math homework after school. Instead of waiting to see how many students show up for homework help after school, a school administrator could instead calculate the total number of students at the school (suppose it's 300) and multiply by the theoretical probability (1/30) to know that he will likely need 10 people present to help each of the students

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one-on-one.

Examples of Theoretical Probability

Experimental probabilities are usually easier to calculate than theoretical probabilities because it just involves counting the number of times that a certain event actually occurred relative to the total number of trials.

Conversely, theoretical probabilities can be trickier to calculate. So, here are several examples of how to calculate theoretical probabilities to help you master the topic.

Example 1

A bag contains the following:

3 red balls4 green balls2 purple balls

Question: If you close your eyes and randomly pull out one ball, what is the probability that it will be green?

Answer: We can use the following formula to calculate the theoretical probability of pulling out a green ball:

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P(*green*) = (4 green balls) / (9 total balls) = 4/9

Example 2

You own a 9-sided dice that contains the numbers 1 through 9 on the sides.

Question: What is the probability that the dice lands on "7" if you were to roll it one time?

Answer: We can use the following formula to calculate the theoretical probability that the dice lands on 7:

P(*lands on 7*) = (only one way the dice can land on 7) / (9 possible sides) = 1/9

Example 3

A bag contains the name of 3 boys and 7 seven girls.

Question: If you close your eyes and randomly pull one name out of the bag, what is the probability that you pull out a girl's name?

Answer: We can use the following formula to calculate the theoretical probability that you pull out a girl's name:

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P(*girls name*) = (7 possible girl names) / (10 total names) = 7/10

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