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What Is Probability?

Probability is the area of mathematics that uses numbers to quantify the uncertainty of an event occurring. The likelihood of an event happening or not is represented on a scale from 0 to 1.

It can also be expressed as a percentage, where 100% implies a certain event and 0% indicates an impossible one.

The notation $P(E)$ represents the probability of an event E .

For instance, when a coin is tossed, the likelihood of receiving a head is equal to $1/2$. In a similar vein, $1/2$ is the likelihood of receiving a tail when tossing a coin.

Therefore, the overall likelihood will be:

$$P(E) = 1/2 + 1/2 = 1$$

Event and outcome

An experiment conducted at random yields an outcome. For instance, six is the result of rolling the dice.

A collection of results is an event. For instance, the likelihood of rolling a die and having a number lower than five is an event.

Note: There can only be one result for an event.

Experimental Probability

Any occurrence connected to an experiment that is conducted repeatedly can be subjected to experimental probability.

An experiment is considered a trial if it is run just once. Another name for it is empirical probability.

Experimental or empirical probability: $P(E) = \frac{\text{Number of trials where the event occurred}}{\text{Total Number of Trials}}$

Example: In a day, a shopkeeper is able to sell 15 balls, out of which 6 were red balls. Find the probability of selling red balls on the next day of his sales.

Given, the total number of balls sold = 15

Number of red balls sold = 6

Probability of red balls = $6/15 = 2/5$

Theoretical Probability

Theoretical Probability, $P(E) = \frac{\text{Number of Outcomes Favourable to E}}{\text{Number of all possible outcomes of the experiment}}$

Here we assume that the outcomes of the experiment are **equally likely**.

Example: Find the probability of picking up a red ball from a basket that contains 5 red and 7 blue balls.

Solution: Number of possible outcomes = Total number of balls = $5+7 = 12$

Number of favourable outcomes = Number of red balls = 5

Hence,

Probability, $P(\text{red}) = 5/12$

Elementary Event

An elementary event is one that has just one possible outcome from the experiment.

Consider the experiment where you throw a coin n times. This experiment contains two possible results for a single trial: Heads (H) or Tails (T). Therefore, there is only one possible result for a single toss: Heads or Tails.

Sum of Probabilities

The **sum** of the probabilities of all the **elementary events** of an experiment is **one**.

Example: take the coin-tossing experiment. $P(\text{Heads}) + P(\text{Tails})$

$$= (1/2) + (1/2) = 1$$

Impossible Event

An event that has **no chance of occurring** is called an **Impossible event**, i.e. $P(E) = 0$.

E.g., The probability of getting a 7 on a roll of a die is 0. As 7 can never be an outcome of this trial.



Sure event

A sure event is one that has a 100 percent chance of happening. The likelihood of a certain event happening is one.

E.g., What is the probability that a number obtained after throwing a die is less than 7?

So, $P(E) = P(\text{Getting a number less than 7}) = 6/6 = 1$

Range of Probability of an event

Probability can be expressed as a number between 0 and 1, where 0 denotes an impossibility and 1 denotes a certainty of an event.

i.e. $0 \leq P(E) \leq 1$.

Geometric Probability

The probability that a bullet will strike a specific region of a figure is calculated using geometric probability. The targeted area is divided by the total area to compute it. When it comes to geometrical probability, the possibilities are endless.



Complementary Events

Two outcomes of an event that are the only two potential outcomes are said to be complementary events. It's comparable to tossing a coin and receiving heads or tails.



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