# PROBABILITY DISTRIBUTION

Imagine you have a bag of differently colored marbles, and you want to understand how likely it is to pick each color. A probability distribution is like a chart or a set of rules that tells you the chances of picking each color.

If all the marbles are equally likely to be picked, you have a **uniform distribution**. Each color has the same chance.

If some colors are more common, you might have a distribution where certain colors have higher probabilities of being picked. For instance, you're more likely to pick red marbles than blue marbles.

On the other hand, some distributions might make it very unlikely to pick certain colors. Maybe there's a rare, special marble that's hard to get.

Now, think about this in terms of everyday situations:

* In weather forecasting, a probability distribution could describe the chances of different weather conditions (sunny, rainy, cloudy) on a given day.
* In finance, it could tell you the probability of making different amounts of money when investing in stocks.
* In a classroom, it might show the likelihood of getting different scores on a test.

In essence, a probability distribution is a **tool to understand and quantify uncertainty or randomness**. It helps us make informed decisions by knowing the odds of different outcomes in various situations.

## DEFINITION

A probability distribution is a mathematical function that specifies the likelihood of different outcomes or events in a random experiment or process.

Probability distributions can be categorized into two primary groups based on the type of data they are intended to model:

1. **Discrete Distributions**: These distributions are used to model discrete data, where the random variable can only take on specific, distinct values with gaps in between. These values are typically finite and countable. Discrete distributions are often associated with situations involving counts, integers, or events that are distinct and separate from each other. Common examples include the Poisson distribution, binomial distribution, and geometric distribution.
2. **Continuous Distributions**: Continuous distributions are designed for continuous data, where the random variable can take on an infinite number of possible values within a given range. These distributions are used when data can vary smoothly and can include any real number within an interval. Continuous distributions are characterized by probability density functions and are often used to model measurements or observations that are not restricted to specific values. The normal (Gaussian) distribution, exponential distribution, and uniform distribution are examples of continuous distributions.

# BINOMIAL DISTRIBUTION

The formula for finding **binomial probability** is given by:

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Where **n** is **the number of trials**, **p** is the **probability of success**, and **r** is the **number of successes after n trials**.

However, there are some **conditions** that need to be met in order for us to be able to apply the formula.

1. The **total number** of trials is **fixed** at **n**.
2. Each trial is **binary**, i.e., it has **only two possible outcomes:** success or failure.
3. **Probability of success** is the **same** in all trials, denoted by **p**.