Probability Theory case study

What is Probability Theory?

Probability theory makes the use of random variables and probability distributions to assess uncertain situations mathematically. In probability theory, the concept of probability is used to assign a numerical description to the likelihood of occurrence of an event. Probability can be defined as the number of favorable outcomes divided by the total number of possible outcomes of an event

The Probability of an Event

The probability of an event is:

The number of ways the event can happen / The number of possible outcomes.

Probability = # of Ways / Outcomes

Applications of Probability Theory

Probability theory is used in every field to assess the risk associated with a particular decision. Some of the important applications of probability theory are listed below:

In the finance industry, probability theory is used to create mathematical models of the stock market to predict future trends. This helps investors to invest in the least risky asset which gives the best returns.

The consumer industry uses probability theory to reduce the probability of failure in a product's design.

Casinos use probability theory to design a game of chance so as to make profits.

Important Notes on Probability Theory

Probability theory is a branch of mathematics that deals with the probabilities of random events.

The concept of probability in probability theory gives the measure of the likelihood of occurrence of an event.

The probability value will always lie between 0 and 1.

In probability theory, all the possible outcomes of a random experiment give the sample space.

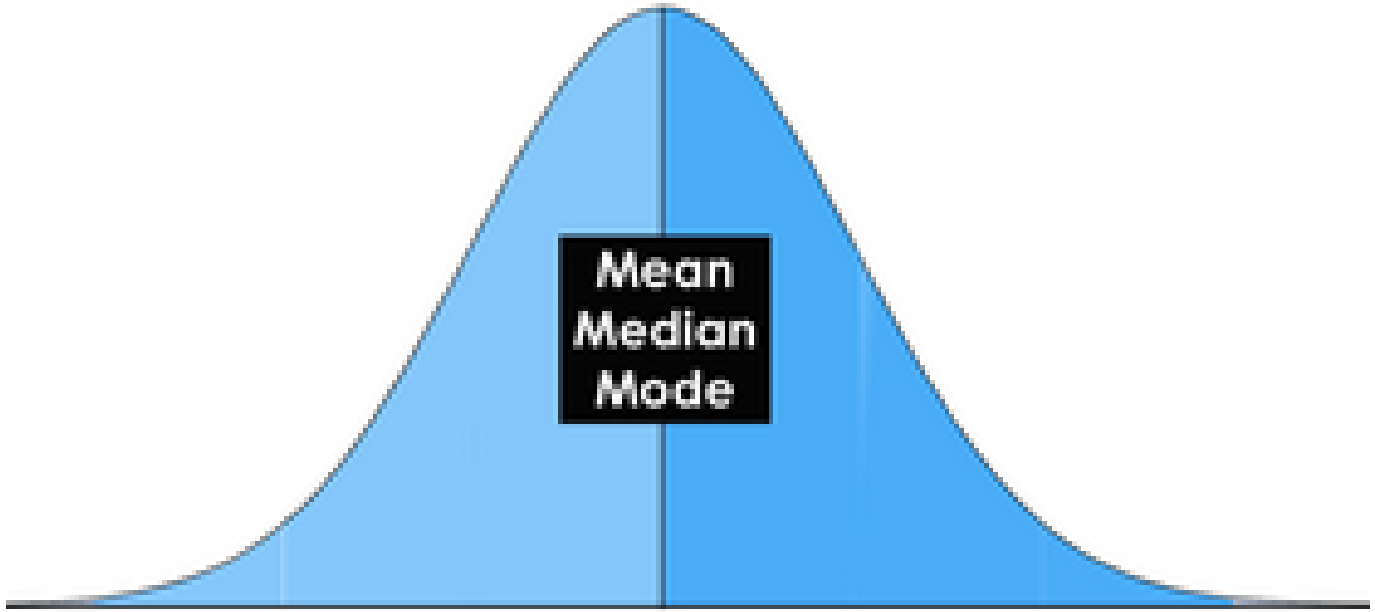
Probability theory uses important concepts such as random variables, and cumulative distribution functions to model a random event and determine various associated probabilities.

Introduction to the Normal Distribution

Have you heard of the bell curve? It tends to be among the most discussed water-cooler topics among people around the globe.

For a long time, a bell curve dictated the professional assessment of an employee and was a beloved or dreaded topic, depending on

who to spoke to!



What is Z-Score?

Z-score also known as the standard score gives us an idea of how far a data point is from the mean. It indicates how many standard deviations an element is from the mean. Hence, Z-Score is measured in terms of standard deviation from the mean. For example, a standard deviation of 2 indicates the value is 2 standard deviations away from the mean. In order to use a z-score, we need to know the population mean (μ) and also the population standard deviation (σ).

A z-score can be calculated using the following formula.

$$z = (X - \mu) / \sigma$$

where,
z = Z-Score,
X = The value of the element,
μ = The population mean, and
σ = The population standard deviation

Example 1:

Question:

You take the GATE examination and score 500.
The mean score for the GATE is 390 and the standard deviation is 45.
How well did you score on the test compared to the average test taker?

Solution:

The following data is readily available in the above question statement
Raw score/observed value = X = 500
Mean score = μ = 390
Standard deviation = σ = 45
By applying the formula of z-score,

$z = (X – \mu) / \sigma$
$z = (500 – 390) / 45$
$z = 110 / 45 = 2.44$

*This means that your z-score is **2.44**.*

Since the Z-Score is positive 2.44, we will make use of the positive Z-Table.

Now let's take a look at Z Table (CC-BY) to know how well you scored compared to the other test-takers.

Follow the instruction below to find the probability from the table.

*Here, **z-score = 2.44***

Firstly, map the first two digits 2.4 on the Y-axis.

Then along the X-axis, map 0.04

Join both axes. The intersection of the two will provide you the Z-Score value you're looking fo

*As a result, you will get the final value which is **0.99266**.*

Now, we need to compare how our original score of 500 on the GATE examination compares to the average score of the batch. To do that we need to convert the Z-Score into a percentage value.

0.99266 * 100 = 99.266%

*Finally, you can say that you have performed well than almost **99%** of other test-takers.*