What is P-value?

The p-value is a measure used to determine the statistical significance of evidence against a null hypothesis. It quantifies the strength of the evidence against the null hypothesis and helps in making decisions in hypothesis testing.

To understand the p-value, it's important to know about hypothesis testing.

In hypothesis testing, we start with a null hypothesis (H0), which represents the assumption that there is no significant effect or relationship between variables in the population. The alternative hypothesis (H1 or Ha) represents the opposite of the null hypothesis, suggesting that there is a significant effect or relationship in the population.

The p-value is the probability of obtaining a result as extreme as, or more extreme than, the observed data, assuming that the null hypothesis is true. It measures the likelihood of observing the data if the null hypothesis is correct.

Here's how the p-value is typically used in hypothesis testing:

1. Set up the null hypothesis (H0) and alternative hypothesis (H1).
2. Collect data and perform a statistical test, which generates a test statistic (e.g., t-value, z-value, F-value).
3. Calculate the p-value based on the test statistic and the chosen statistical distribution (e.g., t-distribution, normal distribution, F-distribution).
4. Compare the p-value to a predetermined significance level (alpha), often set at 0.05 (5%) or 0.01 (1%).
5. If the p-value is less than or equal to the significance level ($p \leq alpha$), the result is considered statistically significant. This suggests that the observed data is unlikely to occur if the null hypothesis is true, and we reject the null hypothesis in favor of the alternative hypothesis.
6. If the p-value is greater than the significance level ($p > alpha$), the result is not statistically significant. This suggests that the observed data is likely to occur if the null hypothesis is true, and we do not reject the null hypothesis.

It's important to note that the p-value is not a measure of the size or practical importance of an effect. It simply indicates the strength of evidence against the null hypothesis. Researchers should consider other factors, such as effect size and context, when interpreting the practical significance of their findings.