Hypothesis Testing and Statistical Significance in Statistics

Hypothesis testing may be a method within which an analyst verifies a hypothesis a couple of population parameters. The analyst's approach is set by the kind of the info and also the purpose of the study. The utilization of sample data to assess the plausibility of a hypothesis is thought of as hypothesis testing.

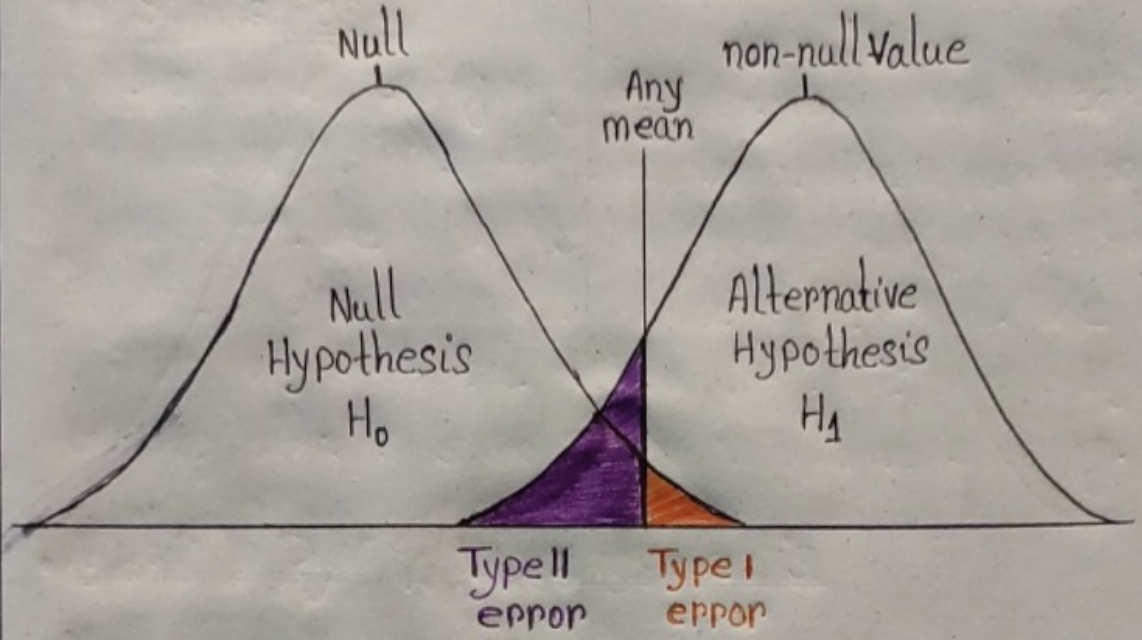
Null and Alternative Hypothesis

Null Hypothesis (HO)

A population parameter (such as the mean, standard deviation, and so on) is equal to a hypothesised value, according to the null hypothesis. The null hypothesis is a claim that is frequently made based on previous research or specialised expertise.

Alternative Hypothesis (H1)

The alternative hypothesis says that a population parameter is less, more, or different than the null hypothesis's hypothesised value. The alternative hypothesis is what you believe or want to prove to be correct.



Type 1 and Type 2 error

Type 1 error :

A type 1 error, often referred to as a false positive, happens when a researcher rejects a real null hypothesis incorrectly. This suggests you are claiming your findings are noteworthy after they actually happened by coincidence.

your alpha level (), which is that the p-value below which you reject the null hypothesis, represents the likelihood of constructing a sort I error. When rejecting the null hypothesis, a p-value of 0.05 suggests that you simply are willing to tolerate a 5% probability of being mistaken.

By setting to a lesser value, you'll lessen your chances of constructing a kind I error.

Type 2 error :

A type II error commonly said as a false negative happens when a researcher fails to reject a null hypothesis that's actually true. During this case, a researcher finds that there's no significant influence when, in fact, there is.
Beta() is that the probability of creating a sort II error, and it's proportional to the statistical test's power (Power = 1-). By ensuring that your test has enough power, you'll reduce your chances of constructing a sort II error.

This can be accomplished by ensuring that your sample size is sufficient to spot a practical difference when one exists.

	Reject H_0	Fail to Reject H_0
H_0 Is True	Type I Error α (FP)	Correct $1-\alpha$ (TN)
H_0 Is False	Correct 1-B ("Statistic Power") (TP)	Type II Error β (FN)

Interpretation

P-Value : The p-value in statistics is that the likelihood of getting outcomes a minimum of as extreme because the observed results of a statistical hypothesis test, given the null hypothesis is valid. The p-value, instead of rejection points, is employed to work out the smallest amount level of significance at which the null hypothesis is rejected. A lower p-value indicates that the choice hypothesis has more evidence supporting it.

Critical value : It is a point on the test distribution that is compared to the test statistic to see if the null hypothesis should be rejected. you can declare statistical significance and reject the null hypothesis if the absolute value of your test statistic is larger than the crucial value.

Significance Level and Rejection Region : The probability that an event (such as a statistical test) occurred by chance is the significance level of the occurrence. We call an occurrence significant if the level is very low, i.e, the possibility of it happening by chance is very minimal. The rejection region depends on the importance level. The importance level is denoted by α and is that the probability of rejecting the null hypothesis if it's true.

Z-Test : The z-test may be a hypothesis test within which the z-statistic is distributed normally. The z-test is best utilized for samples with quite 30 because, in line with the central limit theorem, samples with over 30 samples are assumed to be approximately regularly distributed.

The null and alternative hypothesis, also because the alpha and z-score, should all be reported when doing a z-test. The test statistic should next be calculated, followed by the results and conclusion. A z-statistic, also called a z-score, could be a number that indicates what number of standard deviations a score produced from a z-test is above or below the mean population.

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

$\bar{X}$ = Sample mean
μ = Population mean
σ = Population standard deviation
n = Sample Size

T-Test : A t-test is an inferential statistic that's won't see if there's a major difference within the means of two groups that are related in how. It's most ordinarily employed when data sets, like those obtained by flipping a coin 100 times, are expected to follow a traditional distribution and have unknown variances. A t-test could be a hypothesis-testing technique that will be accustomed to assess an assumption that's applicable to a population.

T-test Formula

$$t = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

$\bar{x}$ = The mean of the Sample.
μ = The assumed mean.
σ = The standard deviation.
n = The number of observations.

ANOVA (Analysis of variance): ANOVA is the way to find out if experimental results are significant. One-way ANOVA compares two means from two independent groups using only one independent variable. Two-way ANOVA is the extension of one-way ANOVA using two independent variables to calculate the main effect and interaction effect.

Chi-Square Test : A chi-square test is a statistical test that is used to compare observed and expected results. The goal of this test is to identify whether a disparity between actual and predicted data is due to chance or to a link between the variables under consideration. As a result, the chi-square test is an ideal choice for aiding in our understanding and interpretation of the connection between our two categorical variables.

Formula

$$X^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

X^2 = chi-squared
O_i = observed value
E_i = Expected value