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1. What do you understand by hypothesis testing?

Hypothesis testing is a statistical method that is used in making statistical decisions using experimental data. Hypothesis Testing is basically an assumption that we make about the population parameter. In statistical analysis, we have to make decisions about the hypothesis. It evaluates two mutually exclusive statements about a population to determine which statement is best supported by the sample data. Example**:**

You say an average student in the class is 30 or a boy is taller than girls. All those are an example in which we assume or need some statistic way to prove those. We need some mathematical conclusion whatever we are assuming is true. There are two hypotheses involved in hypothesis testing

Null hypothesis H0: It is the hypothesis to be tested

Alternative hypothesis HA: It is a statement of what we believe is true if our sample data cause us to reject the null hypothesis

In statistical analysis, we have to make decisions about the hypothesis. These decisions include deciding if we should accept the null hypothesis or if we should reject the null hypothesis. Every test in hypothesis testing produces the significance value for that particular test. In Hypothesis testing, if the significance value of the test is greater than the predetermined significance level, then we accept the null hypothesis. If the significance value is less than the predetermined value, then we should reject the null hypothesis. For example, if we want to see the degree of relationship between two stock prices and the significance value of the correlation coefficient is greater than the predetermined significance level, then we can accept the null hypothesis and conclude that there was no relationship between the two stock prices. However, due to the chance factor, it shows a relationship between the variables. The process of distinguishing between the null hypothesis and the alternative hypothesis is aided by considering two conceptual types of errors. The first type of error occurs when the null hypothesis is wrongly rejected. The second type of error occurs when the null hypothesis is wrongly not rejected. (The two types are known as type 1 and type 2 errors.)

Parameters of hypothesis testing:

∀ **Null hypothesis (H0):** In statistics, the null hypothesis is a general given statement or default position that there is no relationship between two measured cases or no relationship among groups.

In other words, it is a basic assumption or made based on the problem knowledge.

Example: A company production is = 50 unit/per day.

∀ **Alternative hypothesis (H1):** The alternative hypothesis is the hypothesis used in hypothesis testing that is contrary to the null hypothesis.

Example : A company production is not equal to 50 unit/per day.

∀ **Level of significance**

It refers to the degree of significance in which we accept or reject the null-hypothesis. 100% accuracy is not possible for accepting a hypothesis, so we, therefore, select a level of significance that is usually 5%. This is normally denoted with and generally, it is 0.05 or 5%, which means your output should be 95% confident to give similar kind of result in each sample.

∀ **P-value**

The P value, or calculated probability, is the probability of finding the observed/extreme results when the null hypothesis(H0) of a study given problem is true. If your P-value is less than the chosen significance level then you reject the null hypothesis i.e. accept that your sample claims to support the alternative hypothesis.

Therefore, Statistical hypothesis test is a method of statistical inference.

2. Differentiate between the classical and the p-value approach for hypothesis testing.

a. The first approach of hypothesis testing is a classical test statistic approach, which computes a test statistic from the empirical data and then makes a comparison with the critical value. If the test statistics in the classical approach is larger than the critical value, then the null hypothesis is rejected

while The attractiveness of the p-value is in its interpretation. It indicates how likely observing the particular value of our test statistic would be if, in fact, the null hypothesis were true. Small p-values provide 27 evidence against the null hypothesis; larger p-values do not provide evidence against the null hypothesis. The closer that the p-value is to zero, the stronger is the evidence against the null hypothesis. What is a small versus a large p-value is frequently put into perspective by comparing the p-value to a chosen level of significance. Once this is done, decisions regarding a hypothesis test are made just like they were when using the classical approach. That is, reject the null hypothesis when the p-value is smaller than the level of significance. Do not reject the null hypothesis when the p-value is larger than the level of significance.

Classical approach to hypothesis testing	P-value approach to hypothesis testing
b. Critical value is highly used as it is a point on the test distribution that is compared to the test statistics to determine whether to reject the null hypothesis. If the absolute value of your test statistics is greater than the critical value, you can declare statistical significance and reject the null hypothesis.	Use of level of significance which is a value for which a P-value less than or equal to is considered statistically significant. Typical values for are 0.1, 0.05 and 0.01 and these values correspond to the probability of observing such an extreme value by chance.
c. Before gathering evidence, a tail probability (α) is decided upon which is associated with H0 (alternate hypothesis) true. This tail probability is your admission that an eventual X in this tail is so remote from that μ0 X does not support this hypothesis as true.	Using the sample data and assuming the null hypothesis is true, The value of the test statisticis calculated. Again, to conduct the hypothesis test for the population mean μ, we use the t-statistic $t_* = \bar{x} - \mu s/n$ which follows a t-distribution with n - 1 degrees of freedom.
d. There are 5 steps involved	There are 4 steps involved.
e. In the classical approach, a	In P-value approach, The known

decision rule is established to assist in choosing between hypothesis.	distribution of the test statistic is used to calculate the P-value.
f. Generate sample using data to calculate the mean and the value. Convert the mean to t. Place t on the decision rule line. Apply the decision rule by comparing t(null Hypothesis) and tα . Make a decision. State your conclusion in words.	Compare the p-value to the level of significance. If the *P*-value is less than (or equal to) α, reject the null hypothesis in favor of the alternative hypothesis. If the *P*-value is greater than α, do not reject the null hypothesis.

3. Importance of Hypothesis testing in research.

a. To make decisions in order to reach conclusions.

b. Possible Conclusions

Once the statistics are collected and you test your hypothesis against the likelihood of chance, you draw your final conclusion. If you reject the null hypothesis, you are claiming that your result is statistically significant and that it did not happen by luck or chance. As such, the outcome proves the alternative hypothesis. If you fail to reject the null hypothesis, you must conclude that you did not find an effect or difference in your study. This method is how many pharmaceutical drugs and medical procedures are tested.

c. Hypothesis testing evaluates two mutually exclusive population statements to determine which statement is most supported by sample data.

d. Provides guidance to the research work or study.

e. Serves as a great platform in the investigation activities. Formulation of hypothesis is a crucial step of this type of studies.