1. Donated blood is tested for infectious diseases and other contaminants. Since most donated blood is safe, it saves time and money to test batches of donated blood rather than test individual samples. A certain test is performed to see if a certain toxin is present, and the entire batch is discarded if the toxin is detected. This is similar to using a null and an alternative hypothesis to determine whether to discard or keep the batch. The hypotheses being tested could be stated as:

H0 : The blood is not contaminated

H0 : The blood is contaminated

What is type 1 and type 2 error in this problem?

H0: The blood is not contaminated with the toxin and the alternative hypothesis as H1: The blood is contaminated with the toxin.

Type I error: Rejecting the null hypothesis when it is actually true. In this context, a Type I error would mean discarding a batch of blood when it is actually not contaminated with the toxin.
Type II error: Failing to reject the null hypothesis when it is actually false. In this context, a Type II error would mean keeping a batch of blood when it is actually contaminated with the toxin.

Therefore, in this problem:
Type I error: Discarding a batch of blood when it is actually not contaminated with the toxin.
Type II error: Keeping a batch of blood when it is actually contaminated with the toxin.

2. An interview in some South East Asian countries showed that the popularity of music group grew by 9% after their first English release. Their company wants to know if this is also reflected globally.

H0 : The global popularity is same as local popularity
H0 : The global popularity and the local popularity is not the same.
What is type 1 and type 2 error in this problem?

he global popularity of the music group after their first English release is the same as their local popularity, and the alternative hypothesis as H1: The global popularity of the music group after their first English release is not the same as their local popularity.

Type I error: Rejecting the null hypothesis when it is actually true. In this context, a Type I error would mean concluding that there is a difference in global and local popularity of the music group when there is actually no difference.

Type II error: Failing to reject the null hypothesis when it is actually false. In this context, a Type II error would mean concluding that there is no difference in global and local popularity of the music group when there is actually a difference.

Therefore, in this problem:

Type I error: Concluding that there is a difference in global and local popularity of the music group after their first English release when there is actually no difference.

Type II error: Concluding that there is no difference in global and local popularity of the music group after their first English release when there is actually a difference.

3. What is meant by Statistical Hypothesis?Give any examples of hypothesis?

A statistical hypothesis is a statement or assumption about a population parameter or a statistical relationship between two or more variables that can be tested using statistical methods. The hypothesis can either be null hypothesis, which states that there is no significant difference or relationship between variables, or alternative hypothesis, which states that there is a significant difference or relationship.

Here are some examples of statistical hypotheses:

1.Null hypothesis: There is no significant difference in the mean weight of apples produced by two different fertilizers. Alternative hypothesis: There is a significant difference in the mean weight of apples produced by two different fertilizers.

2.Null hypothesis: There is no significant correlation between hours spent studying and exam scores. Alternative hypothesis: There is a significant correlation between hours spent studying and exam scores.

3.Null hypothesis: The proportion of defective products produced by a factory is equal to or less than 5%. Alternative hypothesis: The proportion of defective products produced by a factory is greater than 5%.

4.Null hypothesis: The average commute time for employees is less than or equal to 30 minutes. Alternative hypothesis: The average commute time for employees is greater than 30 minutes.

4. Which are 2 types of statistical hypothesis? Give its definitions?

The two types of statistical hypotheses are:

1.Null Hypothesis: The null hypothesis, denoted as H0, is a statement that there is no significant difference or relationship between two or more variables in a population. It is the default position that is assumed to be true until proven otherwise. For example, if we are comparing

the mean scores of two groups, the null hypothesis would state that there is no significant difference between the means of the two groups.

2.Alternative Hypothesis: The alternative hypothesis, denoted as Ha or H1, is a statement that contradicts the null hypothesis. It states that there is a significant difference or relationship between two or more variables in a population. For example, the alternative hypothesis for the above example would state that there is a significant difference between the means of the two groups.

In statistical hypothesis testing, both null and alternative hypotheses are tested using data and statistical tests. The goal is to either reject the null hypothesis and accept the alternative hypothesis, or fail to reject the null hypothesis. The decision is made based on the level of significance, sample size, and the statistical test used.

5. Define simple/null and alternative hypothesis with the help of examples?

In statistics, a hypothesis is an assumption or claim about a population that needs to be tested using data. There are two types of hypotheses: the null hypothesis and the alternative hypothesis.

Null Hypothesis: The null hypothesis, denoted by H0, is a statement that there is no significant difference between two populations, or that there is no effect of a certain treatment or intervention. In other words, it is the default assumption that nothing has changed, and any observed difference is due to chance or random variation.

Alternative Hypothesis: The alternative hypothesis, denoted by Ha or H1, is a statement that contradicts the null hypothesis. It states that there is a significant difference between two populations or that there is an effect of a certain treatment or intervention.

6. Explain types of alternative hypothesis with the help of simple examples?

There are three types of alternative hypotheses that can be used in statistical testing: directional, non-directional, and one-tailed.

1.Directional Alternative Hypothesis: A directional alternative hypothesis is used when the researcher has a specific expectation of the direction of the effect or difference between two populations. In other words, the researcher predicts that one population will have a higher or lower value than the other population.

2.Non-directional Alternative Hypothesis: A non-directional alternative hypothesis is used when the researcher has no specific expectation of the direction of the effect or difference between two populations. In other words, the researcher simply wants to test whether there is a significant difference between two populations.

3.One-tailed Alternative Hypothesis: A one-tailed alternative hypothesis is used when the researcher has a specific expectation of the direction of the effect or difference between two populations, but only in one direction. In other words, the researcher predicts that one population will have a higher or lower value than the other population, but only in one specific direction.

7. Define One sided hypothesis two-sided hypothesis?

One-sided hypothesis and two-sided hypothesis are types of statistical hypotheses used in hypothesis testing.
A one-sided hypothesis (also known as a directional hypothesis) predicts the direction of the effect or difference between two groups. It is a hypothesis that states the expected direction of the relationship between variables being tested. For example, if we want to test whether a new drug lowers blood pressure, a one-sided hypothesis would state that the drug lowers blood pressure more than the placebo. One-sided hypotheses are typically used when there is a clear and specific directional effect that is predicted based on prior knowledge or theory.

8. Explain the concept of left sided hypothesis and right sided hypothesis using simple examples?

Left-sided and right-sided hypotheses are terms used in statistical hypothesis testing to describe the direction of an effect or difference between groups.

A left-sided hypothesis (also known as a one-tailed or directional hypothesis) predicts that there will be a decrease or a negative effect in the outcome being measured. It is usually represented as H1: $\mu < \mu 0$, where μ is the population mean and $\mu 0$ is a specific value of the population mean.

A right-sided hypothesis (also known as a one-tailed or directional hypothesis) predicts that there will be an increase or a positive effect in the outcome being measured. It is usually represented as H1: $\mu > \mu 0$.

9. Define type I and type II errors?

Type I error, also known as a false positive, occurs when the null hypothesis is rejected even though it is true. In other words, it is the mistake of accepting a hypothesis that should have been rejected. The probability of making a Type I error is denoted by the symbol alpha (α) and is typically set at 0.05 or 0.01, which means that there is a 5% or 1% chance of making a Type I error.
Type II error, also known as a false negative, occurs when the null hypothesis is not rejected even though it is false. In other words, it is the mistake of failing to accept a hypothesis that should have been accepted. The probability of making a Type II error is denoted by the symbol beta.

10. Give any 2 examples of type I and type II error?

Type I and Type II errors are concepts from hypothesis testing in statistics.
Type I error (false positive) is the rejection of a true null hypothesis (i.e., a conclusion that there is an effect when there is actually no effect).

Example 1: In a clinical trial, a new drug is being tested to see if it is effective in treating a disease. A Type I error would occur if the drug is deemed effective (i.e., the null hypothesis is rejected) when it actually has no effect on the disease.

Example 2: A manufacturer of metal components has a quality control process that rejects components that are defective. A Type I error would occur if the process rejects a component that is actually not defective (i.e., the null hypothesis is rejected).

Type II error (false negative) is the failure to reject a false null hypothesis (i.e., a conclusion that there is no effect when there is actually an effect).

Example 1: In a criminal trial, a defendant is accused of a crime. A Type II error would occur if the defendant is found not guilty (i.e., the null hypothesis is not rejected) when they are actually guilty.

Example 2: A medical test is designed to detect a disease. A Type II error would occur if the test results indicate that the patient does not have the disease (i.e., the null hypothesis is not rejected) when they actually do have the disease.

11. What is the probability of type I error and probability of type II error?

The probability of Type I error and the probability of Type II error depend on the specific situation, including the significance level of the test, the sample size, and the effect size.
The probability of Type I error is denoted by the symbol alpha (α) and is the level of significance chosen for the test. It represents the probability of rejecting the null hypothesis when it is actually true. In statistical tests, a commonly used significance level is 0.05, which corresponds to a 5% chance of making a Type I error.

The probability of Type II error is denoted by the symbol beta (β) and represents the probability of failing to reject the null hypothesis when it is actually false. The power of a statistical test is 1-β, which represents the probability of correctly rejecting the null hypothesis when it is actually false.

12. What do you mean by Critical Region and critical value?

In statistics, a critical region is the set of all possible values of a test statistic that would lead to the rejection of a null hypothesis at a given level of significance (alpha). In other words, it is the range of values that would lead us to conclude that the observed data is unlikely to have occurred by chance alone and that the alternative hypothesis is true.

The critical value is the boundary value that separates the critical region from the non-critical region. It is the minimum value of a test statistic that would lead us to reject the null hypothesis at a given level of significance (alpha). The critical value is based on the distribution of the test statistic, which in turn depends on the sample size, the level of significance, and the null hypothesis being tested.

13. Define power of the test?

The power of a statistical test is defined as the probability of correctly rejecting a null hypothesis when it is false. In other words, it is the probability of detecting a true effect or relationship between variables, given that it exists in the population.

The power of a test depends on various factors, such as the sample size, the level of significance, the effect size, and the variability in the data. A test with higher power is better at detecting real differences or effects and is less likely to make a type II error (failing to reject a false null hypothesis).

14. Define p-value?

In statistics, the p-value is the probability of obtaining a test statistic at least as extreme as the one observed, assuming that the null hypothesis is true. In other words, it is the probability of observing the data or more extreme data under the assumption that the null hypothesis is true.

The p-value is a measure of the strength of evidence against the null hypothesis. A small p-value (e.g., less than 0.05) indicates that the observed data is unlikely to have occurred by chance alone and that the null hypothesis should be rejected in favor of the alternative hypothesis. Conversely, a large p-value (e.g., greater than 0.05) indicates that the observed data is consistent with the null hypothesis and that we do not have enough evidence to reject it.

15. What is Level of significance?

In statistics, the level of significance (alpha) is the probability of rejecting the null hypothesis when it is actually true. It is the maximum allowable probability of making a Type I error, which is the error of rejecting the null hypothesis when it is actually true.

The level of significance is typically set prior to conducting a hypothesis test and is used to determine the critical region or critical value for the test statistic. For example, if the level of

significance is set to 0.05, this means that we are willing to tolerate a 5% chance of rejecting the null hypothesis when it is actually true.

16. Define critical region and acceptance region?

In statistics, the critical region is the set of all possible values of a test statistic that would lead to the rejection of a null hypothesis at a given level of significance (alpha). In other words, it is the range of values that would lead us to conclude that the observed data is unlikely to have occurred by chance alone and that the alternative hypothesis is true.

On the other hand, the acceptance region is the set of all possible values of a test statistic that would lead to the failure to reject the null hypothesis at a given level of significance. It is the range of values that would lead us to conclude that the observed data is consistent with the null hypothesis and that we do not have enough evidence to reject it.

17. When we reject the null hypothesis based on p-value?

In statistical hypothesis testing, we use a p-value to determine the statistical significance of our results. The p-value represents the probability of obtaining a test statistic as extreme as or more extreme than the observed one, assuming that the null hypothesis is true.

If the p-value is smaller than the chosen significance level (usually 0.05), we reject the null hypothesis and conclude that there is sufficient evidence to support the alternative hypothesis. In other words, we reject the idea that the observed effect or relationship occurred by chance alone and consider it statistically significant.