Frequently Asked Questions

1. **Give one example to illustrate a statistical test of hypothesis.**
   Answer:
   The below explained pharmaceutical company's problem illustrates a statistical test of hypothesis:
   We may wish to decide on the basis of sample data whether a new serum is really effective in curing a disease, whether one educational procedure is better than the other or whether there is increase in consumption of tea after excise duty of tea is reduced.
   In practical situations statistical inference can involve either estimating a population parameter or making decisions about the value of the parameter. For example if a pharmaceutical company is fermenting a vat of antibiotic , samples from the vat can be used to estimate the mean potency μ for all of the antibiotic in the vat. In contrast, suppose the company is not concerned about the exact mean potency of the antibiotic but is concerned only that it meet the minimum government policy standards. Then the company can use the samples from the vat to decide between these two possibilities
   - The mean potency μ does not exceed the minimum allowable potency
   - The mean potency μ exceeds the minimum allowable potency

2. **Explain the type of reasoning to bring out the basic concepts of hypothesis testing using one example.**
   Answer:
   The reasoning used in statistical test hypothesis is similar to the process in a court trial. In trying a person for theft, the court must decide between innocence and guilt. As the trial begins the accused person is assumed to be innocent. The prosecution collects and presents all possible evidences in an attempt to contradict the innocent hypothesis and hence obtain a conviction. If there is enough evidence against the innocence the court will reject the innocence hypothesis and declare that the defendant guilty. If the prosecution does not presence enough evidence to prove the defendant guilty, the court will find him not guilty. Notice that this does not prove that the defendant is innocent but merely that there was not enough evidence to conclude that the defendant was guilty. We use this same type of reasoning to explain the basic concepts of hypothesis testing.

3. **Distinguish between maintained and testable hypothesis.**
   Answer:
   A distinction is often made between maintained and testable hypothesis. Much of the assumptions that we normally use in theory as a simplifying devise are not testable empirically. They are called maintained hypothesis.
   For example: when we formulate the demand theory we assume that the taste and preferences of the consumer remain constant. We will not test this hypothesis in general. It is used in theory merely as a simplifying device.
   The testable theoretical hypothesis on the other hand states that there is "no difference" between the sample statistics and population parameter.

4. **What do you mean by a Hypothesis?**
   Answer:
   In general a hypothesis is a theoretical proposition capable of empirical verification. It may be viewed as a statement of an event, which may or may not be true.

Hence a Hypothesis is a supposition made as a base of reasoning. A hypothesis is simply a statement related to our study.

5. **What is meant by a test of hypothesis?**
   Answer:
   A test of statistical hypothesis is a rule or procedure for deciding whether to reject to reject the hypothesis or not. It is a systematic procedure evolved for accepting or rejecting a null hypothesis on the basis of a random sample drawn from the population

6. **What is meant by statistical hypothesis?**
   Answer:
   In attempting to reach decisions it is useful to make assumptions or guesses about the population involved. Such assumptions which may or may not be true are called statistical hypothesis. They are generally statements about the probability distributions of the populations. By statistical hypothesis we mean a statement about a population from which samples have been drawn. The assumption may be about the form of the population or about the parameters of the population. A statistical hypothesis may be defined as a tentative conclusion logically drawn concerning any parameter or form of the distribution of the population. It is a systematic and formal statement usually in the form of a proposition.

7. **Give some examples for statistical hypothesis.**
   Answer:
   Examples for statistical hypothesis are

   a. A statement that for a Normal population $\mu = \mu_0$ and $\sigma = \sigma_0$
   b. For a Normal population with an unknown mean and variance $\sigma^2 = 12$
   c. For a binomial variable $p = ½$
   d. If X is a Poisson population with parameter λ then the following statements about λ are hypotheses

i. H: $\lambda = 5$
ii. H: $7 < \lambda < 8$

8. **What are Parametric and Nonparametric hypothesis?**
   Answer:
   A hypothesis which specifies only the parameters of the probability density function of the population is called a parametric hypothesis. For example: the hypothesis that the population follows Normal distribution with mean =25, that is we want to test whether the mean is equal to 25.
   A hypothesis which specifies only the form of the density function in the population is called the non parametric hypothesis. For example: Hypothesis that the population is Normal is a nonparametric hypothesis (that is we want to test whether the population is Normal)

9. **What do you mean by Null hypothesis?**
   Answer:
   In many instances we formulate the statistical hypothesis for the sole purpose of rejecting or nullifying it. In any test there are two hypothesis and they are so constructed that if one accepted the other is rejected. A statistical hypothesis which is to be tested is called a null hypothesis. It is a neutral hypothesis or an unbiased hypothesis and is denoted by H_0.For example if we want to test whether the given coin is loaded, we formulate the hypothesis that the coin is fair (that I sp = 0.5, where p is the probability of heads). Similarly if we want to decide whether one procedure is better than the other, we formulate the hypothesis that the there is no

difference between the procedures (That is my observed differences are due merely to fluctuations in sampling from the same population). It asserts that there is no significant difference between population parameter and sample statistic and the difference if any is due to the sampling fluctuations. Such hypothesis are often called null hypothesis and are denoted by H0

10. Give one example for the construction of null hypothesis.

Answer:

The null hypothesis constitutes a challenge and the function of the experiment is to give the facts a chance to refute or fail to refute this challenge.

For example if we want to find out whether the new vaccine has benefited the people or not, the null hypothesis shall be setting up saying that .The new vaccine has not benefitted the people". The rejection of the null hypothesis indicates that the differences have statistical significance and the acceptance of the null hypothesis indicates that the differences are due to chance.

11. Briefly explain an alternative hypothesis?

Answer:

The alternative hypothesis specifies those values that the researcher believes to hold true and hopes that the sample data would lead to acceptance of this hypothesis to be true. The alternate hypothesis may embrace the whole range of values rather than a single point. As per the definition it is very difficult to find out which is null hypothesis and which is alternative hypothesis. However for statistical convenience, these definitions are used.

A statistical hypothesis which is complementary to the null hypothesis is called an alternative hypothesis. Any hypothesis that differs from a given hypothesis is called an alternate hypothesis. Hence in testing null hypothesis an alternative hypothesis is also made so that if the null hypothesis is to be rejected based on the samples and tests there is an alternative hypothesis to be accepted. For example if one hypothesis is p =0.5, alternate hypothesis might be p=0.7, p not equal to 0.5, or p>0.5. A hypothesis alternate to the null hypothesis is denoted by H_1

Hence when $H_0 : \mu = \mu_0$ is rejected we are forced to accept another hypothesis that $\mu \neq \mu_0$ is the alternative hypothesis.

12. What are simple and composite hypothesis?

Answer:

A hypothesis may be simple or composite. If a hypothesis is concerning the population completely (such as functional form and parameter) it is called a simple hypothesis. For example a statement that the population is Normal with mean as twenty five, and standard deviation equal to ten, is a simple hypothesis, since the population is completely specified.

A statistical hypothesis that completely specifies a distribution is called a simple hypothesis and otherwise a composite hypothesis. Hence if the hypothesis is not simple it is composite. For example: The statement that the population follows Normal distribution with mean =25 is a composite hypothesis, since only one parameter of the population is specified and the other parameter namely standard deviation is not specified.

13. Give some examples for simple and composite hypothesis.

Answer:

i. A statement that for a Normal population $\mu=\mu_0$ and $\sigma=\sigma_0$ and

ii. If X is a Poisson population with parameter λ then the hypothesis

a. H: λ =3 are simple hypotheses

While the hypothesis

I. For a Normal population with an unknown mean and variance $\sigma^2 = 12$
II. For a binomial variable $p = ½$
III. If X is a Poisson population with parameter λ then the following statements about λ H: $7 < \lambda < 8$ are composite hypothesis
IV. While testing whether a new method of cultivation is more efficient than the old method, the statement H: $\mu_1 = \mu_2 = 50$ is a simple hypothesis whereas a statement H: $\mu_1 \neq \mu_2$ is a composite hypothesis where μ_1 is the average yield of crop when the old method is used and μ_2 is the average yield of crop when the new method is used.

14. Illustrate with examples that both null and alternative hypothesis may be simple or both composite or one simple and the other composite.

Answer:

Both null and alternative hypothesis may be simple or both composite or one simple and the other composite

For example:

i)The hypothesis $H_0: \lambda=3$ against $H_1: \lambda=4$, Both are simple

ii) The hypothesis H0: λ=3 against H1: λ>3, Null hypothesis is simple but the alternative hypothesis is composite

iii) The hypothesis H0: $\lambda \leq 3$ against $H_1: \lambda>3$, Both are composite

iv) Ina Normal population to a known σ^2 we have a null hypothesis H_0 as $H_0: \mu=\mu_0$ the alternative hypothesis here could be $H_1: \mu \neq \mu_0$; $H_1: \mu>\mu_0$ or $H_1: \mu < \mu_0$

Null hypothesis is simple but the alternative hypotheses are composite

15. What are the characteristics of a good hypothesis?

Answer:

A good hypothesis must be based on a good research question. It should be simple, specific and stated in advance

Hypothesis should be simple

A simple hypothesis contains one predictor and one outcome variable, e.g. positive family history of schizophrenia increases the risk of developing the condition in first-degree relatives. Here the single predictor variable is positive family history of schizophrenia and the outcome variable is schizophrenia. A complex hypothesis contains more than one predictor variable or more than one outcome variable, e.g., a positive family history and stressful life events are associated with an increased incidence of Alzheimer's disease. Here there are 2 predictor variables, i.e., positive family history and stressful life events, while one outcome variable, i.e., Alzheimer's disease. Complex hypothesis like this cannot be easily tested with a single statistical test and should always be separated into 2 or more simple hypotheses.

Hypothesis should be specific

A specific hypothesis leaves no ambiguity about the subjects and variables, or about how the test of statistical significance will be applied. It uses concise operational definitions that summarize the nature and source of the subjects and the approach to measuring variables (History of medication with tranquilizers, as measured by review of medical store records and physicians' prescriptions in the past year, is more common in patients who attempted suicides than in controls hospitalized for other conditions). This is a long-winded sentence, but it explicitly states the nature of predictor and outcome variables, how they will be measured and the research hypothesis. Often these details may be included in the study proposal and may not be stated in the research hypothesis. However, they should be clear in the mind of the investigator while conceptualizing the study.

Hypothesis should be stated in advance

The hypothesis must be stated in writing during the proposal state. This will help to keep the research effort focused on the primary objective and create a stronger basis for interpreting the

study's results as compared to a hypothesis that emerges as a result of inspecting the data. The habit of post hoc hypothesis testing (common among researchers) is nothing but using third-degree methods on the data (data dredging), to yield at least something significant. This leads to overrating the occasional chance associations in the study.