Types of statistical tests

Statistics are the arrangement of statistical tests which analysts use to make inference from the data given. These tests enable us to make decisions on the basis of observed pattern from data. There is a wide range of statistical tests. The choice of which statistical test to utilize relies upon the structure of data, the distribution of the data, and variable type. There are many different types of tests in statistics like t-test, Z-test, chi-square test, Anova test , binomial test, one sample median test etc.

Choosing a Statistical test (Parametric tests):

Parametric tests are used if the data is normally distributed .A parametric statistical test makes an assumption about the population parameters and the distributions that the data came from. These types of tests include t-tests, z-tests and ANOVA tests, which assume data is from normal distribution.

Z-test:

Z-test- A z-test is a statistical test used to determine whether two population means are different when the variances are known and the sample size is large. In z-test mean of the population is compared. The parameters used are population mean and population standard deviation. Z-test is used to validate a hypothesis that the sample drawn belongs to the same population.

Example: A company claims that the average weight of their product packaging is 500 grams. To test this claim, a sample of 50 packages is randomly selected, and the average weight is found to be 510 grams. A one-sample z-test can be used to determine if the average weight is significantly different from the claimed value of 500 grams.

T-test:

T-test-In t-test the mean of the two given samples are compared. A t-test is used when the population parameters (mean and standard deviation) are not known.

Example: A researcher wants to compare the mean heights of male and female students. A random sample of 100 male students and 100 female students is taken, and their heights are recorded. An independent samples t-test can be used to assess whether there is a significant difference in the mean heights between the two groups.

Paired T-test:

Paired T-Test-Tests for the difference between two variables from the same population (pre- and post test score). For example: In a training program performance score of the trainee before and after completion of the program.

Independent T-test:

Independent T-test- The independent t-test which is also called the two sample t-test or student's t-test, is a statistical test that determines whether there is a statistically significant difference between the means in two unrelated groups. For example: comparing boys and girls in a population.

Example: Two different teaching methods are being compared to assess their impact on student performance. A group of students is randomly assigned to each teaching method, and their test scores are collected. An independent samples t-test can be used to determine if there is a significant difference in the mean test scores between the two groups.

One sample T-test:

One sample t-test- The mean of a single group is compared with a given mean. For example-to check the increase and decrease in sales if the average sales is given.

Example: A researcher wants to test whether the average time spent commuting by employees of a company is significantly different from 30 minutes. A random sample of employees is selected, and their commuting times are recorded. A one-sample t-test can be used to determine if the average commuting time is significantly different from the claimed value of 30 minutes.

ANOVA test:

ANOVA Test- Analysis of variance (ANOVA) is a statistical technique that is used to check if the means of two or more groups are significantly different from each other. ANOVA checks the impact of one or more factors by comparing the means of different samples. If we use a t-test instead of ANOVA test it won't be reliable as numbers of samples are more than two and it will give error in the result.

Example: A study aims to compare the mean scores of three different diets on weight loss. Participants are randomly assigned to one of the three diets, and their weight loss is measured after a specified period. An analysis of variance (ANOVA) can be used to determine if there are significant differences in the mean weight loss across the three diet groups.

Non Parametric tests:

Non parametric statistical test- Non parametric tests are used when data is not normally distributed. Non parametric tests include chi-square test.

Chi-square test:

Chi-square test ($\chi 2$ test)- chi-square test is used to compare two categorical variables. Calculating the Chi-Square statistic value and comparing it against a critical value from the Chi-Square distribution allows to assess whether the observed frequency are significantly different from the expected frequency.

Example: A survey is conducted to investigate the association between smoking habits (smoker/non-smoker) and the development of a certain disease (yes/no). The data collected is tabulated into a 2x2 contingency table, and a chi-square test of independence can be used to determine if there is a significant association between smoking habits and disease development.