

### **1. Chi-squared ( $\chi^2$ ) test:**

The Chi-squared test is used to determine whether there is a significant difference between the expected frequencies and the observed frequencies in one or more categories. It is often used for hypothesis testing in the following scenarios:

- Test for goodness of fit: Compares the observed distribution of data to an expected distribution.
- Test for independence: Examines the association between two categorical variables.
- Test for homogeneity: Analyzes the differences between two or more independent groups with categorical data.

### **2. t-test:**

The t-test is used to determine whether there is a significant difference between the means of two groups. It can be applied in various scenarios:

- Independent samples t-test: Compares the means of two independent groups.
- Paired samples t-test: Compares the means of two related or dependent groups (e.g., before and after treatment).
- One-sample t-test: Tests whether the mean of a single group differs significantly from a specified value.

### **3. z-test:**

The z-test is used to determine whether there is a significant difference between the means of two groups when the population standard deviation is known or when the sample size is large enough ( $n > 30$ ). It can be used in the following scenarios:

- Comparing the means of two large independent samples (two-sample z-test).

- Comparing the mean of a large sample to a population mean when the population standard deviation is known (one-sample z-test).
- Comparing the proportion of successes in a large sample to a known population proportion (z-test for proportions).

In summary, the choice of test depends on factors such as the type of data (categorical, numerical), the number of groups or samples being compared, and the specific hypothesis or research question being addressed.

#### **4. F-test**

The F-test is used to assess whether there is a significant difference in variances between two populations or to determine if a group of variables is significant in a regression model. Some common scenarios where the F-test is employed include:

- **Comparing variances of two independent populations:** Tests whether the variances of two populations are equal, which can be helpful in determining whether the assumption of equal variances is met for other statistical tests, like the t-test or ANOVA.
- **Assessing the overall significance of a regression model:** Determines whether the variability explained by the model is significantly different from the unexplained variability (residuals), indicating that at least one predictor variable in the model has a significant effect on the response variable.