one-way ANOVA

One-way analysis of variance (ANOVA), also written as one-way ANOVA, is a statistical method used to compare the means of three or more independent groups. It helps determine if there's a statistically significant difference between the average values of these groups.

Assumptions:

- One-way ANOVA relies on certain assumptions for accurate results. These include:

  - **Normality:** The residuals (differences between observed and expected values) should be normally distributed.

  - **Homogeneity of variance:** The variances of the groups being compared should be equal.

  - **Independence:** The observations within each group should be independent of each other.

Steps involved:

1. **Formulating the hypothesis:**

   - **Null hypothesis (H0):** The means of all groups are equal.

   - **Alternative hypothesis (Ha):** At least one group mean is different from the others.

2. **Data collection:** You collect data on the dependent variable for each level of the independent variable.

3. **ANOVA calculation:**

   - The software calculates the variance within each group (explained by random error) and the variance between groups (potentially explained by the factor).

   - It then computes the F-statistic, which is the ratio of the between-group variance to the within-group variance.
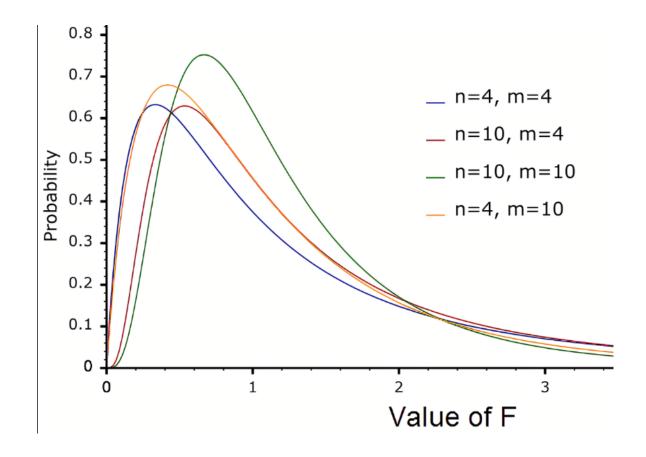
4. **Interpretation:**

- A high F-statistic suggests a greater difference between group means compared to the variation within groups.

- You compare the F-statistic with a critical value obtained from the F-distribution table based on the degrees of freedom (related to the number of groups and total sample size).

- If the F-statistic is greater than the critical value at a chosen significance level (e.g., 0.05), you reject the null hypothesis and conclude there's a statistically significant difference between at least one pair of means.

F-distribution

the F-distribution arises from the ratio of two independent chi-square distributions, each divided by its respective degrees of freedom.