Independent T-test

An independent t-test, also referred to as a two-sample t-test, is a statistical procedure used to compare the **means of two independent groups**.

Steps involved in a Two-Sample T-Test :

1. **Formulate the hypothesis:**

   - **Null hypothesis (H0):** There's no significant difference between the means of the two populations ($\mu_1 = \mu_2$).

   - **Alternative hypothesis (HA):** There's a significant difference ($\mu_1 \neq \mu_2$). You can also specify a one-tailed hypothesis (HA: $\mu_1 > \mu_2$ or $\mu_1 < \mu_2$) if you expect the difference to be in a specific direction.

2. **Collect data:** You need independent samples from each group with an appropriate sample size.

3. **Calculate the test statistic (t-score):** This involves the sample means ($\bar{x}_1$ and $\bar{x}_2$), sample sizes (n_1 and n_2), and the pooled variance (sp^2). The formula looks something like this:

   Equal variances :

   $$t = (\bar{x}_1 - \bar{x}_2)/(sp * sqrt(1/n_1 + 1/n_2))$$

   Not equal variances :

   $$t = (\bar{x}_1 - \bar{x}_2)/sqrt((s_1^2/n_1) + (s_2^2/n_2))$$

4. **Determine the p-value:** The p-value represents the probability of observing a test statistic as extreme or more extreme than the calculated value, assuming the null hypothesis is true. Lower p-values indicate stronger evidence against the null hypothesis.

5. **Interpret the results:**

   - Choose a significance level (alpha, typically 0.05).

   - If the p-value is less than alpha, you reject the null hypothesis and conclude there's a significant difference between the means of the two groups at the chosen significance level.

   - If the p-value is greater than alpha, you fail to reject the null hypothesis. There's not enough evidence to say the means are different at the chosen significance level.