Table outlining the steps for each advanced statistical test, followed by common steps:

| **Test** | **Steps** |
| --- | --- |
| **t-test** | 1. **Define Hypotheses:** Null hypothesis (H₀) and alternative hypothesis (H₁). 2. **Select Significance Level:** Usually 0.05. 3. **Collect Data:** Sample data should be collected. 4. **Calculate Test Statistic:** t = (X̄ - μ) / (s / √n) for one-sample or t = (X̄₁ - X̄₂) / √[(s₁²/n₁) + (s₂²/n₂)] for two-sample. 5. **Find p-value:** Compare t-statistic to t-distribution. 6. **Make Decision:** Compare p-value to significance level. |
| **F-test** | 1. **Define Hypotheses:** Null hypothesis (H₀) and alternative hypothesis (H₁). 2. **Select Significance Level:** Usually 0.05. 3. **Collect Data:** Sample data should be collected. 4. **Calculate Test Statistic:** F = Variance between groups / Variance within groups. 5. **Find p-value:** Compare F-statistic to F-distribution. 6. **Make Decision:** Compare p-value to significance level. |
| **ANOVA** | 1. **Define Hypotheses:** Null hypothesis (H₀) and alternative hypothesis (H₁). 2. **Select Significance Level:** Usually 0.05. 3. **Collect Data:** Sample data from multiple groups. 4. **Calculate Test Statistic:** F = Variance between groups / Variance within groups. 5. **Find p-value:** Compare F-statistic to F-distribution. 6. **Post-Hoc Tests:** If ANOVA is significant, perform post-hoc tests for pairwise comparisons. 7. **Make Decision:** Compare p-value to significance level. |
| **Chi-Square Test** | 1. **Define Hypotheses:** Null hypothesis (H₀) and alternative hypothesis (H₁). 2. **Select Significance Level:** Usually 0.05. 3. **Collect Data:** Observed frequencies in categorical data. 4. **Calculate Expected Frequencies:** Based on the null hypothesis. 5. **Calculate Test Statistic:** χ² = Σ[(Oᵢ - Eᵢ)² / Eᵢ], where Oᵢ = observed frequency, Eᵢ = expected frequency. 6. **Find p-value:** Compare χ²-statistic to chi-square distribution. 7. **Make Decision:** Compare p-value to significance level. |
| **Skewness** | 1. **Collect Data:** Sample data. 2. **Calculate Mean and Standard Deviation:** For the sample. 3. **Calculate Skewness:** γ₁ = [n / (n-1)(n-2)] \* Σ[(Xᵢ - X̄)³ / s³], where X̄ = sample mean, s = sample standard deviation. 4. **Interpret Results:** Positive skew indicates right skew, negative skew indicates left skew. |
| **Kurtosis** | 1. **Collect Data:** Sample data. 2. **Calculate Mean and Standard Deviation:** For the sample. 3. **Calculate Kurtosis:** γ₂ = [n(n+1) / ( (n-1)(n-2)(n-3) ) ] \* Σ[(Xᵢ - X̄)⁴ / s⁴] - [3(n-1)² / ( (n-2)(n-3) )], where X̄ = sample mean, s = sample standard deviation. 4. **Interpret Results:** Positive kurtosis indicates heavier tails, negative kurtosis indicates lighter tails. |
| **Additional Tests** | **Regression Analysis:** 1. Define Hypotheses. 2. Select Significance Level. 3. Collect Data. 4. Fit Model. 5. Check Assumptions. 6. Interpret Coefficients. 7. Validate Model. 8. Make Decisions. **Mann-Whitney U Test:** 1. Define Hypotheses. 2. Select Significance Level. 3. Collect Data. 4. Rank Data. 5. Calculate U Statistic. 6. Find p-value. 7. Make Decision. |

**Common Steps:**

1. **Define Hypotheses:** Formulate null and alternative hypotheses relevant to the test.
2. **Select Significance Level:** Typically, 0.05, but may vary depending on context.
3. **Collect Data:** Gather sample data appropriate for the test.
4. **Calculate Test Statistic:** Compute the test statistic based on the specific test formula.
5. **Find p-value:** Compare the test statistic to the appropriate distribution to find the p-value.
6. **Make Decision:** Compare p-value to the significance level to accept or reject the null hypothesis.
7. **Interpret Results:** Draw conclusions based on the test results and context of the study.

The significance level, often denoted as α (alpha), is a threshold used in statistical hypothesis testing to determine whether the results of a test are statistically significant. Here’s a simple way to understand it:

**What is Significance Level?**

* **Definition:** The significance level is the probability of rejecting the null hypothesis when it is actually true. In other words, it's the chance of making a Type I error (false positive).

**How to Understand It:**

1. **Threshold for Decision Making:**
   * Think of the significance level as a cutoff point for deciding whether to accept or reject the null hypothesis. For instance, if the significance level is set at 0.05, it means you are willing to accept a 5% chance of wrongly rejecting the null hypothesis.
2. **Typical Values:**
   * Common significance levels are 0.05, 0.01, and 0.10. A 0.05 significance level means you are willing to risk a 5% chance of a false positive.
3. **Practical Example:**
   * Imagine you are testing whether a new drug is more effective than an existing one. If you set the significance level to 0.05, you are saying that you will accept a 5% chance of concluding the new drug is better when, in reality, it isn't.
4. **Decision Rule:**
   * If the p-value (calculated from your test) is less than or equal to the significance level, you reject the null hypothesis. If it’s greater, you do not reject it.

**In Summary:**

* The significance level helps you decide how strong the evidence must be to reject the null hypothesis.
* Lower significance levels (e.g., 0.01) mean stricter criteria for rejecting the null hypothesis, reducing the risk of false positives but potentially increasing the risk of false negatives.
* Higher significance levels (e.g., 0.10) mean more lenient criteria, which might increase the risk of false positives but reduce the risk of missing true effects.

Understanding significance level is crucial because it balances the trade-off between finding true effects and avoiding false positives.

The "table value of 2.3" you’re referring to might be related to the critical value for a specific statistical test, often used in hypothesis testing. Here’s a breakdown of what this could mean:

**Critical Value and Significance Level:**

1. **Critical Value:**
   * A critical value is a point on the scale of the test statistic beyond which you reject the null hypothesis. It corresponds to a specific significance level (α) and depends on the distribution of the test statistic (e.g., t-distribution, chi-square distribution).
2. **Context of 2.3:**
   * For example, in the context of the **t-test** or **z-test**, the critical value of 2.3 might correspond to a particular significance level or a specific test scenario. The critical value changes based on the degrees of freedom (in t-tests) or sample size.

**Example in Hypothesis Testing:**

1. **One-Sided Test:**
   * If you're performing a one-sided test with a significance level of 0.05 (5%), the critical value might be around 1.645 for a z-test. For a higher level like 0.01 (1%), the critical value would be around 2.33.
2. **Two-Sided Test:**
   * For a two-sided test with a 0.05 significance level, the critical values are typically ±1.96 for a z-test. For a significance level of 0.01, the critical values are typically ±2.58.

**Practical Interpretation:**

* **In Practice:** If you are using a critical value of 2.3, it could be for a specific test with its associated significance level and degrees of freedom. Always check the statistical table relevant to your test (z-table, t-table, chi-square table) to find the exact critical value for your chosen significance level and test type.

**Summary:**

* The value of 2.3 might refer to a critical value in the context of a specific statistical test with a given significance level.
* To understand its exact application, you should refer to the statistical distribution table corresponding to your test and significance level.

the critical value is indeed dependent on the significance level. Here’s a clearer explanation of their relationship:

**Relationship Between Critical Value and Significance Level:**

1. **Significance Level (α):**
   * The significance level (α) is the probability of rejecting the null hypothesis when it is true, also known as the Type I error rate. It represents the threshold for determining whether the test statistic is extreme enough to reject the null hypothesis.
2. **Critical Value:**
   * The critical value is the threshold that the test statistic must exceed to reject the null hypothesis. It depends on the chosen significance level and the type of test being performed.

**How They Relate:**

1. **Higher Significance Level (α):**
   * A higher significance level means a higher probability of rejecting the null hypothesis. For instance, with α = 0.10 (10%), the critical value will be lower, making it easier to reject the null hypothesis. This increases the chance of finding a statistically significant result but also increases the risk of a Type I error.
2. **Lower Significance Level (α):**
   * A lower significance level means a lower probability of rejecting the null hypothesis. For example, with α = 0.01 (1%), the critical value will be higher, making it harder to reject the null hypothesis. This reduces the chance of a Type I error but also increases the risk of a Type II error (failing to detect a true effect).

**Examples:**

* **Z-Test:**
  + For a **one-sided test**:
    - α = 0.05 corresponds to a critical value of approximately 1.645.
    - α = 0.01 corresponds to a critical value of approximately 2.33.
  + For a **two-sided test**:
    - α = 0.05 corresponds to critical values of approximately ±1.96.
    - α = 0.01 corresponds to critical values of approximately ±2.58.
* **T-Test:**
  + The critical value depends on both the significance level and the degrees of freedom (which are related to the sample size). For a given α, the critical value increases as degrees of freedom decrease.

**Summary:**

* **Critical values** increase as the significance level decreases, making it harder to reject the null hypothesis.
* **Critical values** decrease as the significance level increases, making it easier to reject the null hypothesis.

Understanding this relationship helps in choosing the appropriate significance level for your test and interpreting the results accurately.