**Assessing the Impact of Skewed Distributions on T-Test Accuracy**

**Research Question**

How do different skewed distributions and sample sizes impact the reliability of a one-sample t-test?

**Objective**

1. Examine if and how different types of skewed distributions lead to misleading t-test results.
2. Investigate how increasing sample size mitigates the impact of skewed data on t-test results.

**Methods**

1. Simulate Data with Different Types of Skewness:
   * Symmetric Distribution: Normal distribution (no skew) to serve as a baseline. Additional symmetric baseline distributions may be included.
   * Moderate Skew:
     + Exponential distribution.
     + Chi-square distribution with a low degree of freedom (e.g., df = 2).
   * High Skew:
     + Log-normal distribution with large-scale parameters.
     + Weibull distribution with shape parameters that produce high skew.
   * Mixture Distribution:
     + A mixture of a Gaussian distribution and a heavy-tailed distribution (e.g., t-distribution with low degrees of freedom) with the same location parameter. This distribution will be designed to appear normal to the naive eye while incorporating heavy-tailed features.
2. Set Sample Sizes:
   * Small, medium, and large sample sizes will be analyzed.
3. Conduct One-Sample T-Tests:
   * Perform a one-sample t-test for each combination of distribution and sample size with the null hypothesis that the mean is zero.
   * Repeat each test 1,000 times to capture variability and the likelihood of extreme results.
4. Analyze the Distribution of Test Results:
   * Compare the range, variability, and behavior of the t-test results across different distributions and sample sizes.
   * Observe how skewness and sample size interact to either stabilize or amplify the t-test outputs.
   * Specifically evaluate the performance of the t-test on the mixture distribution, highlighting any challenges posed by its heavy-tailed nature