Hypothesis Testing

Hypothesis Testing Framework

1. State the Hypotheses:
- **Null Hypothesis (H_0)**: The default assumption (e.g., there is no effect or difference).
- **Alternative Hypothesis (H_1)**: What you're trying to prove (e.g., there is an effect or difference).

2. Choose the Significance Level:
- Typically $\alpha=0.05$. This is the threshold for deciding whether to reject the null hypothesis.

3. Calculate the Test Statistic:
- Based on the test you're using (e.g., Z, t, F, χ2).

Hypothesis Testing Framework (cont.)

4. Find the p-value:
  • The p-value tells you the probability of observing the data, or something more extreme, assuming the null hypothesis is true.

5. Make a Decision:
  • **Reject H_0** if the p-value is less than α, otherwise **fail to reject H_0**.

Test Statistics

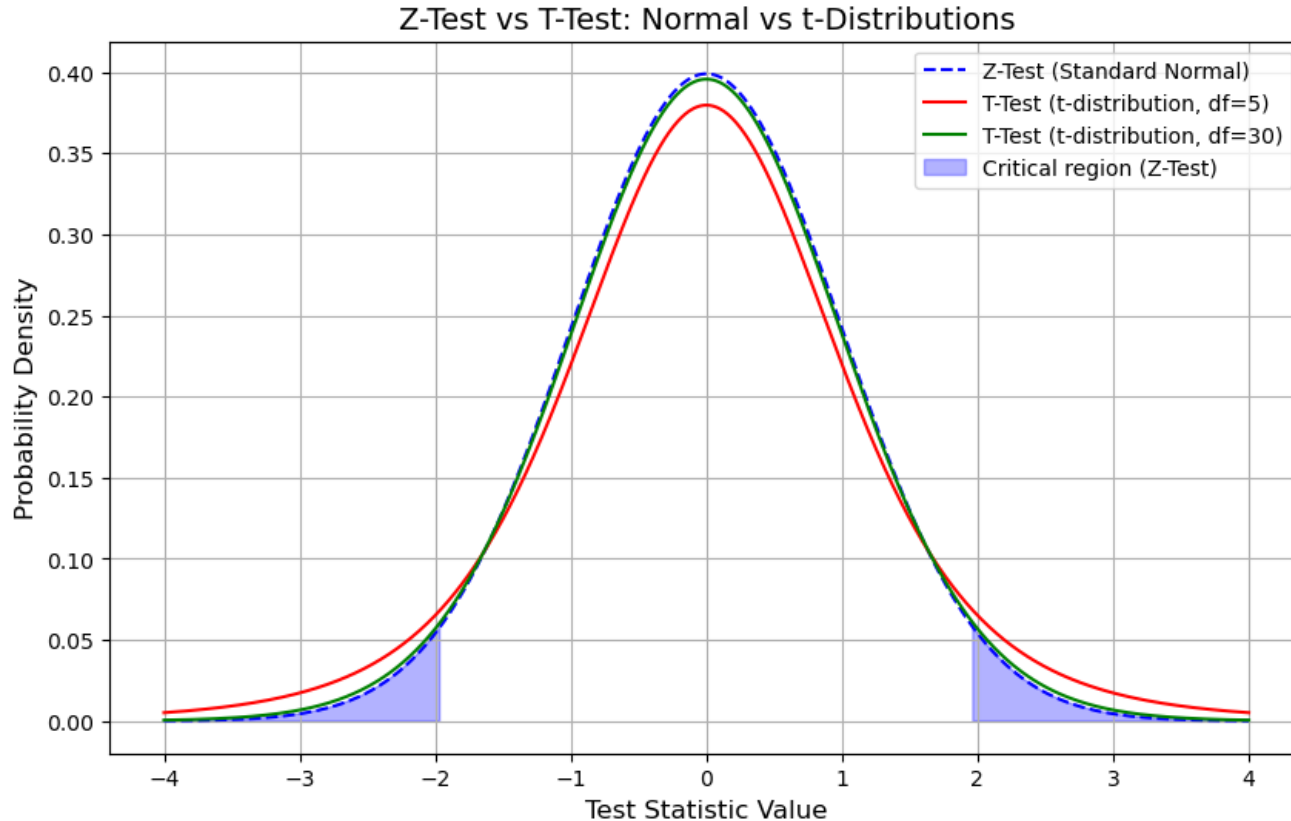| T-test |
|---|

- A **T-test** is used when the population variance is **unknown** and the sample size is small (n<30). The test statistic follows a **t-distribution**, which adjusts for small sample sizes by accounting for additional uncertainty.

- One-Sample

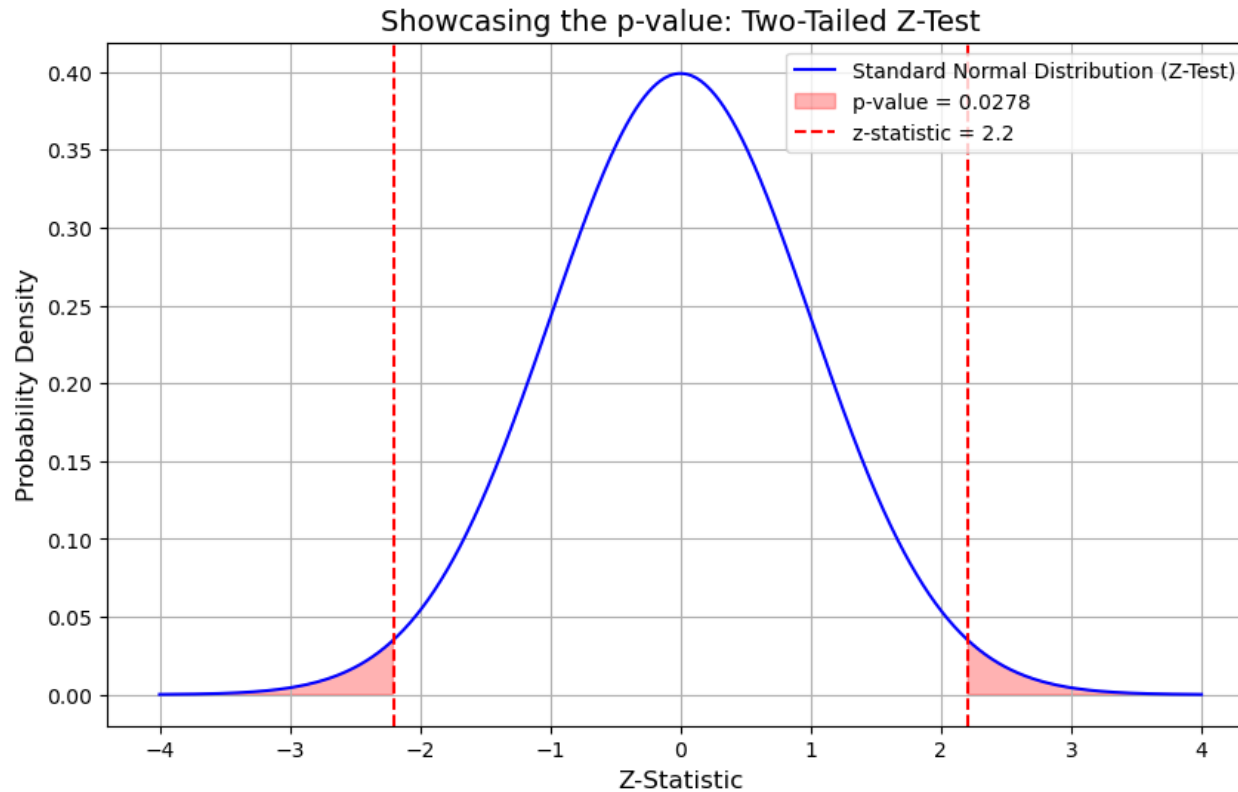- Independent Two-Sample

- Paired T-Test

Z-test

- A **Z-test** is used when the population variance is known and the sample size is large (typically n≥30). The test statistic follows a **standard normal distribution** (the **Z-distribution**)

- One-Sample

- Two-Sample

Test Statistics (cont.)

Z-Test vs T-Test: Normal vs t-Distributions

p-Values

Showcasing the p-value: Two-Tailed Z-Test

Legend:
- Standard Normal Distribution (Z-Test)
- p-value = 0.0278
- z-statistic = 2.2

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