Hypothesis Testing Cheat Sheet

Graduate Resource Center, University of New Mexico

1 Background

Definitions and Terms

Null Hypothesis (H_0)**:** A statement of no change and is 0 assumed true until evidence indicates otherwise

Alternate Hypothesis (H_a)**:** A statement that the researcher is trying to find evidence to support

Type I Error: Reject the null hypothesis when the null hypothesis is true

Type II Error: Do not reject the null hypothesis when the alternative hypothesis is true

Test Statistics (*t*): A single number that summarizes the sample data used to conduct the test hypothesis

Standard Error: How far sample statistics (e.g., mean) deviates from the actual population mean

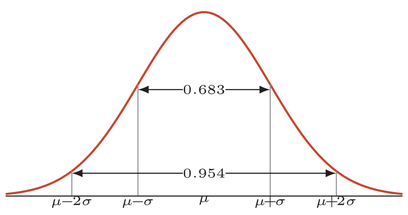
***p*-value:** Probability of observing a test statistics

Significance level (α): Probability of making Type I error

One tailed test: Test statistics falls into one specified tail of its sampling distribution

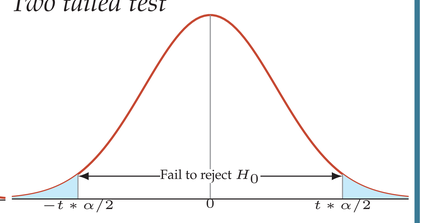
Two tailed test: Test statistics can falling into either tail of its sampling distribution

Normal curve:



Acceptance/Rejection regions:

Two tailed test



Need Help?

Contact Us

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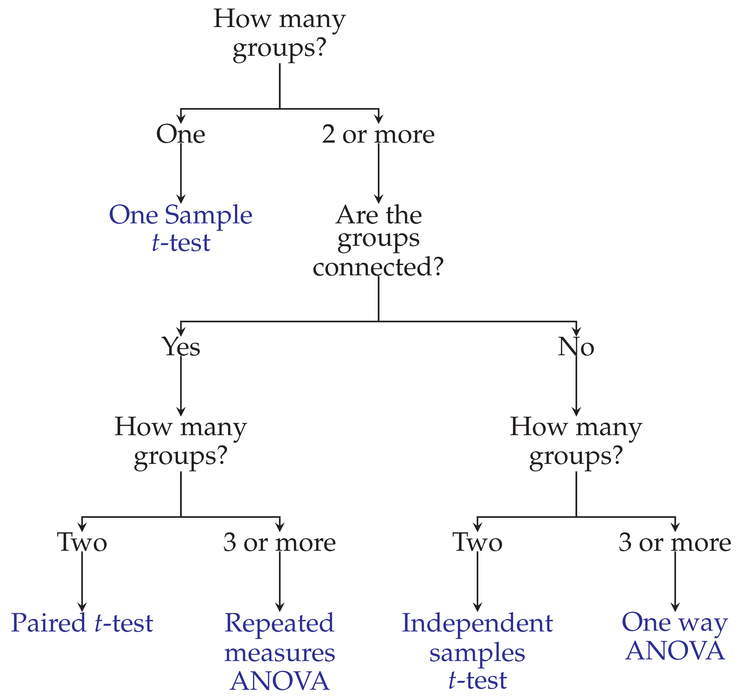
2 Hypothesis Testing

Steps to Significance Testing

1. Define H_0 and H_a
2. Identify test, α, find critical value, test statistics
3. Construct acceptance/rejection regions
4. Calculate test statistics
   Critical value approach: *Determine critical region*
   p-value approach: *Calculate p-value*
5. Retain or reject the hypothesis

3 Choosing a Statistical Test

Decision Tree



Decision Tree - by data structure

Categorical Data: Use Chi Square

Sample size (n):

n < 30 and Population Variance is unknown - *t-test*
n < 30 and Population Variance is known - *z-test*
n > 30 - *z-test* or *t-test*

4 Examples

Chi Square test for independence:
Checks whether two categorical variables are related or not (independence)
E.g., Is the distribution of sex and voting behavior due to chance or is there a difference between sexes on voting behavior?

T-Test:
Looks at the difference between two groups (e.g., undergrad/grad)
E.g., Do undergrad and grad students differ in the amount of hours they spend studying in a given month?

ANOVA (Analysis of Variance):
Tests the significance of group differences between two or more groups
Only determines that there is a difference between groups, but does not tell which is different
E.g., Do GRE scores differ for low-, middle, and high-income students?

ANCOVA (Analysis of Covariance):
Same as ANOVA, but adds control of one or more covariates that my influence dependent variable
E.g., Do SAT scores differ for low-, middle-, and high-income students after controlling for single/dual parenting?

5 Proportions

Use when the respose is binary, eg. yes or no; Vote for candidate A or not vote for candidate A

$$\hat{p} = \frac{Number\ of\ successes(Yes\ or\ Vote\ for\ candidate\ A)}{Sample\ size} = \frac{x}{n}$$

Test statistics (one sample): $z = \dfrac{\hat{p} - p_0}{\sqrt{p_0(1-p_0)/n}}$

Standard error of proportion: $SE = \sqrt{\dfrac{\hat{p}_0(1-\hat{p})}{n}}$

Margin of Error: $MoE = z\text{-}value\sqrt{\dfrac{\hat{p}_0(1-\hat{p})}{n}}$

Sample size: $n = \dfrac{z\text{-}value^2 \hat{p}_0(1-\hat{p})}{MoE^2}$