

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

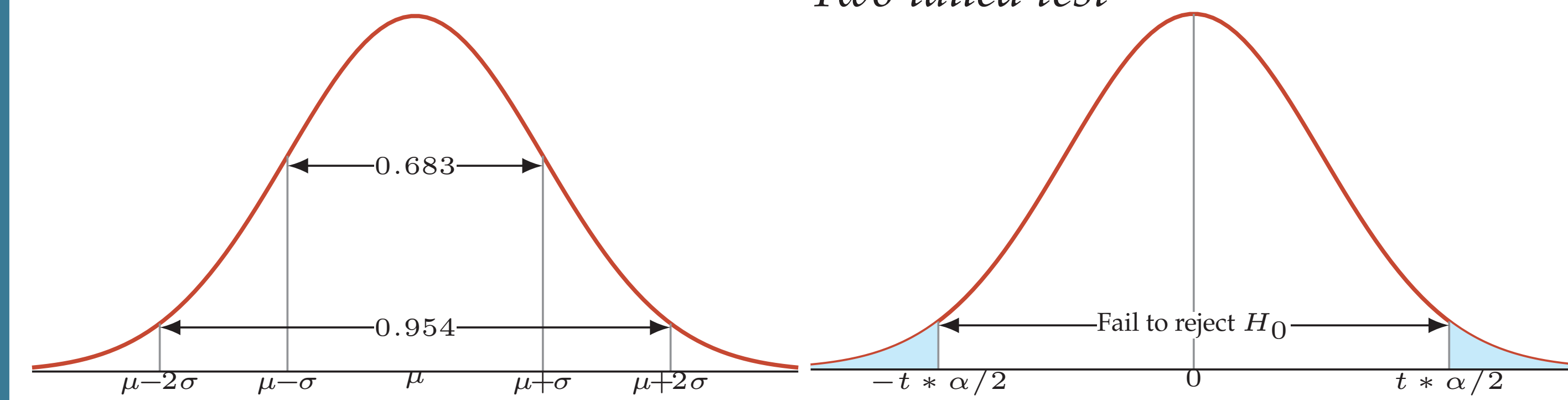
One tailed test: Test statistics falls into one specified tail of its sampling distribution

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

Normal curve:

Acceptance/Rejection regions:

Two tailed test



NEED HELP?

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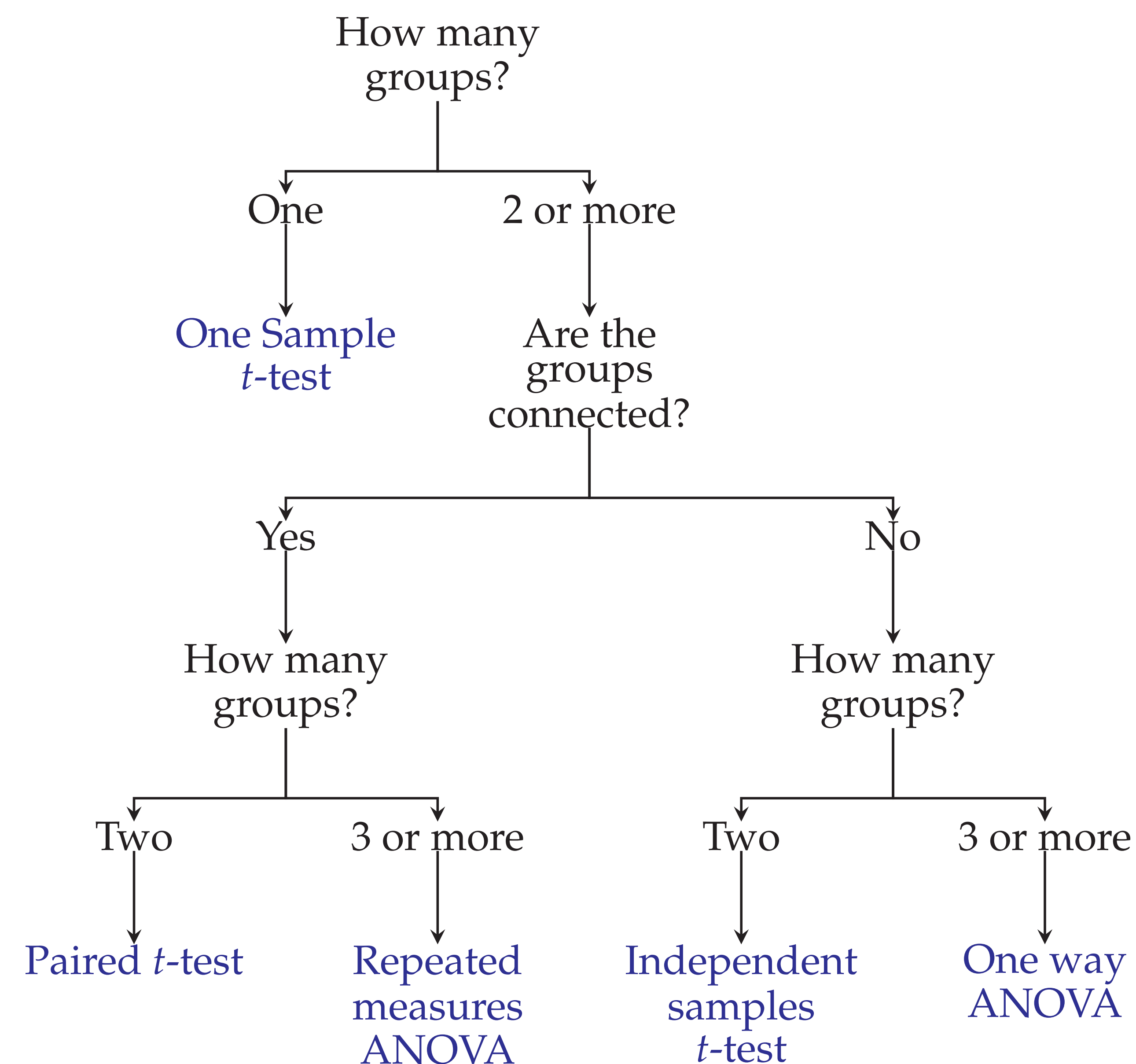
2 HYPOTHESIS TESTING

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 may 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 response is binary, eg. yes or no; Vote for candidate A or not vote for candidate A

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

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

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

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

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