

Statistical Reasoning | Table of Contents

Chapter 1: Data Collection and Sampling

1.1 Evidence, Claims and Study Types

- Evaluate the strength of evidence against a claim about a population proportion
- Identify and describe the steps in the statistical analysis process
- Determine whether a study is observational or an experiment and appropriate use cases
- Identify confounding variables
- Identify components of the experimental design in a given experiment: use of a control group, use of a placebo, and blinding

1.2 Variables and Measures of Data

- Identify explanatory and response variables in an experiment
- Define and distinguish between qualitative, quantitative, discrete, and continuous variables
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- Understand the definitions of population, sample, statistic, parameter, and data

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- Understand sampling distributions and the Central Limit Theorem for Proportions
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- Point estimates, margins of error, and confidence intervals
- Calculate a margin of error given a confidence interval
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- Generate a confidence interval using the empirical rule

10.2 Confidence Interval for Mean - Population Standard Deviation Known

- Determine the z-score for a stated confidence level and compute the error bound
- Calculate and interpret the confidence interval for a population mean with a known standard deviation
- Find the sample size required to estimate a population mean with a given confidence level

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- Calculate a point estimate for population proportion
- Find the confidence interval given a population proportion
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Chapter 11: Hypothesis Testing for One Population - V1

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- Identify the null and alternative hypotheses
- Distinguish between one- and two-tailed hypotheses tests and understand possible conclusions
- Differentiate between Type I and Type II errors when performing a hypothesis test

11.2 Hypothesis Test for Mean - Population Standard Deviation Known

- Compute the value of the test statistic (z-value) for a hypothesis test for one population mean with a known standard deviation
- Determine the critical value(s) of a one-mean z-test at a given significance level to define a rejection region
- Make a conclusion and interpret the results of a one-mean hypothesis test using the Critical Value Approach with a known standard deviation

11.3 Hypothesis Test for Mean - Population Standard Deviation Known - P-Value

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11.4 Hypothesis Test for Mean - Population Standard Deviation Unknown - Critical Value Approach

- Understand the assumptions and conditions for using the t-test for hypothesis testing, and compute the value of the test statistic
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- Make a conclusion and interpret the results of a one-mean hypothesis test with an unknown standard deviation
- Conduct and interpret a one-mean hypothesis test using the Critical Approach with an unknown standard deviation

11.5 Hypothesis Test for Mean - Population Standard Deviation Unknown - P-Value Approach

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11.6 Hypothesis Test for Proportion

- One proportion hypothesis testing (test statistic and p-value approaches)

Chapter 11: Hypothesis Testing for One Population - V2

11.1 Hypothesis Test for the Mean - Population Standard Deviation Known

- Distinguish between one- and two-tailed hypothesis tests and understand possible conclusions
- Identify the null and alternative hypotheses
- Differentiate between Type I and Type II errors when performing a hypothesis test
- Compute the value of the test statistic (z-value) for a hypothesis test for one population mean with a known standard deviation

11.2 Conduct a Hypothesis Test for Mean - Population Standard Deviation Known - Critical Value/Rejection Region Approach

- Determine the critical value(s) of a one-mean z-test at a given significance level to define a rejection region
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- Determine the degrees of freedom and critical value(s) for two-mean t-tests (pooled and nonpooled)
- Make a conclusion and interpret a two-mean hypothesis test with assume unequal standard deviations

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- Calculate the test statistic for a nonpooled two-mean hypothesis test
- Calculate the test statistic for a pooled two-mean hypothesis test

12.3 Two Population Hypothesis Test for Proportions (Independent Samples)

- Two population hypothesis testing for proportions

Chapter 12: Hypothesis Testing with Two Populations - V2

12.1 Two-Mean Hypothesis Test with Population Standard Deviations Known

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- Calculate test statistic for testing the difference between two means (z value) - population standard deviations known

12.2 Two-Mean Hypothesis Test - Population Standard Deviations Known - Critical Value/Rejection Region Approach

- Determine the critical value(s) for a hypothesis test for the difference between two means (population standard deviations known) in order to define rejection region(s)
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12.4 Two-Mean Hypothesis Tests with Population Standard Deviations Unknown

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 - Calculate the test statistic (t-value) for a two-mean hypothesis test for population variances assumed unequal (nonpooled estimate of the standard deviation)
 - Determine the degrees of freedom for a two-mean hypothesis test for population variances assumed equal (pooled estimate of the standard deviation)
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- Determine the degrees of freedom for a two-mean hypothesis test for population variances assumed unequal (nonpooled estimate of the standard deviation)

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- Compute the value of the test statistic (z-value) for a hypothesis test to test the difference between two population proportions

12.11 Two population hypothesis test for proportions (Independent Samples)

- Determine the critical value(s) for a hypothesis test to test the difference between two population proportions in order to define rejection region(s)
- Make a conclusion and interpret the results for a hypothesis test to test the difference between two population proportions using the Critical Value/Rejection Region Approach

12.12 Two population hypothesis test for proportions (Independent Samples)

- Determine the p-value for a hypothesis test to test the difference between two population proportions
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- Make a conclusion and interpret the results for a hypothesis test to test the difference between two population proportions using the P-Value Approach

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Chapter 13: Chi Square

13.1 Chi Square Distributions

- Understand the properties of the chi-square distribution
- Distinguish between use cases of the chi-square tests

13.2 Chi Square goodness-of-fit test

- Compute the value of the test statistic using the expected frequencies for a chi-square goodness-of-fit test
- Conduct and interpret a chi-square goodness-of-fit test

13.3 Chi Square independence test

- Compute the value of the test statistic using the expected frequencies for a chi-square independence test
- Conduct and interpret a test of independence with the chi-square distribution

13.4 Chi Square Homogeneity Test

- Compute the value of the test statistic using the expected frequencies for a chi-square homogeneity test
- Conduct and interpret a test for homogeneity with the chi-square distribution

Chapter 14: Introduction to ANOVA

14.1 ANOVA Basics - Critical Value Approach

- Determine appropriate situations for a one-way ANOVA test and identify the null and alternative hypotheses
- Determine the degrees of freedom for the numerator and denominator for one-way ANOVA test
- Determine the critical value and rejection region for one-way ANOVA test
- Calculate the test statistic for one-way ANOVA test

14.2 Performing an ANOVA test - Critical Value Method - Calculator

- Make a decision for the hypothesis test using critical value/rejection region method and interpret results - Calculator

14.3 Performing an ANOVA test - Critical Value Method - Calculator

- Make a decision for the hypothesis test using critical value/rejection region method and interpret results - Excel

14.4 Performing an ANOVA test Basics - P-Value Approach - Calculator

- Make a decision for the hypothesis test using the p-value method and interpret results - Calculator

14.5 Performing an ANOVA test Basics - P-Value Approach - Excel

- Make a decision for the hypothesis test using the p-value method and interpret results - Excel

Basic Math Appendix

Number Theory

- Understand and identify prime and composite numbers
- Find the GCF and LCM of two or more numbers (40)
- Find the prime factorization of a number

Integers

- Understand integers and find opposites of numbers (40)
- Order and compare integers (40)
- Understand and evaluate absolute value

Integers and Operations

- Understand additive inverse (40)
- Add and subtract integers (40, 40)
- Multiply integers
- Divide integers

Whole Numbers

- Identify the place value of a digit and write a whole number using words or digits
- Identify multiples and apply divisibility tests
- Find the prime factorization of a number

Use the Language of Algebra

- Translate algebraic expressions, equations, and inequalities into English and recognize expressions and equations
- Simplify expressions with integers using order of operations
- Evaluate an expression
- Identify coefficients and identify and combine like terms
- Translate an English phrase to an algebraic expression

Multiply and Divide Integers

- Understand and evaluate absolute value
 - Add integers
 - Subtract integers
 - Multiply integers
-



- Divide integers

Evaluate Expressions

- Evaluate a variable expressions with integers
- Use integers in applications
- Evaluate expressions using summation notation

Visualize Fractions

- Find equivalent fractions (40)
- Simplify complex fractions
- Multiply fractions
- Divide fractions
- Simplify expressions written with a fraction bar
- Translate an English phrase to an expression with fractions

Add and Subtract Fractions

- Add or subtract fractions with a common denominator
- Add or subtract fractions with different denominators
- Use the order of operations to simplify complex fractions and expressions with multiple operations
- Evaluate variable expressions with fractions

Decimals

- Name and write decimals
- Round decimals
- Add and subtract decimals
- Divide decimals
- Multiply decimals
- Convert between percents, decimals, and fractions (40)

Understand Slope

- Use the relationship between rise and run to find the slope of a line from its graph
- Find the slope of horizontal and vertical lines
- Use the slope formula to find the slope of a line between two points
- Graph a line given a point and the slope
- Determine the slope in applications
- Understand the relationship between the slope and y-intercept of a line and its equation
- Identify the slope and y-intercept from an equation of a line and relate a graph to the equation
- Graph a line given its equation using its slope and y-intercept

Exponents

- Understand exponent notation

Simplify and Use Square Roots

- Simplify expressions with square roots
 - Estimate square roots and approximate square roots
 - Simplify variable expressions with square roots
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