



Business Statistics

978-1-63545-029-3



To learn more about all our offerings
Visit [Knewton.com](https://www.knewton.com)



| Source | Author(s) (Text or Video) | Title(s) | Link (where applicable) |
|--|--|--|---------------------------------|
| OpenStax | Barbara Illowsky, De Anza College Susan Dean, De Anza College | Introductory Statistics | OpenStax |
| www.onlinestatbook.com | David Lane Developed by Rice University, University of Houston Clear Lake, and Tufts University | Online Statistics Education: An Interactive Multimedia Course of Study | OnlineStatBook |
| JB Statistics | Jeremy Balka, University of Guelph | | YouTube Channel |

Alta Business Statistics was developed to meet the scope and sequence of an introductory business statistics course. To develop the course, Knewton used four main sources of content: OpenStax, Rice University’s Online Stat Book, videos created by a Statistics professor at the University of Guelph, and a team of Subject Matter Experts (SMEs). The SMEs come from diverse backgrounds and are all accomplished academics in the field of Business Statistics. Alta Business Statistics covers the breadth of statistics topics, and also provides the necessary depth to ensure the course is manageable and engaging for instructors and students alike.

Alta Business Statistics has two instructional sequences for every learning objective, giving students multiple opportunities to learn new concepts. Between our text and video content and Knewton SMEs, we were able to solicit ideas from statistics instructors and students at all levels of higher education, from community colleges to Ph.D- granting universities. Alta Business Statistics provides a level of academic rigor, while also promoting relevance and accessibility for students. Knewton has added current and relevant contexts and examples to instruction and assessments.

This course features two versions of the hypothesis testing chapters (chapters 9 and 10). First versions focus on business applications in hypothesis testing, while the second versions focus on a most step by step walkthrough, and break up of critical value and p-value approaches, as well as technology applications.

Business Statistics | Table of Contents

Chapter 1: Sampling and Data

1.1 Sampling and Parameters

- Understand the definitions of population, sampling, statistic, parameter, and data in business applications
- Identify stratified, cluster, systematic, and convenience sampling in business applications
- Identify sampling errors and bias in business applications
- Identify situations in which business statistics can be misleading

1.2 Statistical Study Design

- Determine whether a study is observational or an experiment and appropriate use cases
- Identify and describe the steps in the statistical analysis process

1.3 Variables and Measures of Data

- Identify explanatory and response variables in an experiment using business examples
- Identify levels of measurement of business-related data
- Define and distinguish between qualitative, quantitative, discrete, and continuous variables

Chapter 2: Descriptive Statistics

2.1 Frequency Tables

- Constructing and understanding frequency tables for a set of data
- Construct and understand relative frequency tables for a set of data
- Construct and understand cumulative relative frequency tables for a set of data

2.2 Histograms and Frequencies

- Construct and understand frequency tables for a set of business-related data
- Create and interpret histograms
- Create and interpret stem-and-leaf plots

2.3 Line and Bar Graphs

- Create and interpret bar graphs
- Create and interpret line graphs of data
- Choose appropriate graphs and charts to display data

2.4 Dot plots, Line and Bar graphs with Technology - Calculator

- Create and interpret dot plots with technology - Calculator
- Create and interpret line and bar graphs of data with technology - Calculator

2.5. Dot plots, Line and Bar graphs with Technology - Excel

- Create and interpret dot plots with technology - Excel
- Create and interpret line and bar graphs of data with technology - Excel

2.6 Measures of Central Tendency

- Find the mean of a set of data
 - Find the mean from a frequency table
 - Find the median of a set of data
 - Find the mode of a set of data
 - Determine whether the mean, median, or mode is the best measure of center for a data set
-

2.7 Quartiles and Box Plots

- Find and interpret percentiles and quartiles of a business-related data set
- Find the five-number summary of a business-related data set
- Identify the interquartile range and potential outliers in a set of business-related data
- Construct and understand box-and-whisker plots in business contexts

2.8 Skewness and Standard Deviation

- Determine if a data set is skewed in business examples
- Compute variance and standard deviation
- Compute the sample variance and sample standard deviation in business contexts
- Interpret the standard deviation of a set of business-related data
- Compute z-scores and use them to compare values from different data sets

2.9 Calculate measures of center and spread using Technology - Calculator

- Calculate mean, median and mode for a dataset using Technology - Calculator
- Create and interpret box and whisker plot using Technology - Calculator

2.10 Calculate measures of center and spread using Technology - Excel

- Calculate mean, median and mode for a dataset using Technology - Excel
- Create and interpret box and whisker plot using Technology - Excel

2.11 Calculate Variance and Standard Deviation with Technology - Calculator

- Compute the variance and standard deviation with technology - Calculator
- Compute z-scores and use them to compare values from different data sets with technology - Calculator

2.12 Variance, Standard Deviation and Z-scores with technology - Excel

- Compute the variance and standard deviation with technology - Excel
- Compute z-scores and use them to compare values from different data sets with technology - Calculator-Excel

Chapter 3: Probability Topics

3.1 Probability Terminology and Notation

- Understand definitions of events, outcomes, trials, independent/dependent events, and mutually exclusive events
- Use and, or, and not notation to describe events
- Use conditional probability notation to describe events

3.2 Basic Probability

- Compute basic probability in a situation where there are equally-likely outcomes
- Compute probability involving and, or, and not
- Compute probability using the complement rule

3.3 Independent and Mutually Exclusive Events

- Understand mutually exclusive events
 - Find the conditional probabilities of independent and mutually exclusive events
 - Distinguish between independent or mutually exclusive events given conditional probability information
-

3.4 Counting Principles

- Understand factorial notation
- Calculate and apply combinations
- Calculate and apply permutations

3.4 Addition and Multiplication Rules

- Use the multiplication rule for conditional probabilities
- Use the multiplication rule for independent event probabilities
- Use the addition rule for probabilities
- Use the addition rule for mutually exclusive event probabilities

3.5 Diagrams and Contingency Tables

- Interpret and complete a contingency table
- Use a contingency table to find conditional probabilities
- Use a tree diagram to list outcomes and compute probabilities
- Use a venn diagram to compute compound and conditional probabilities

Chapter 4: Discrete Random Variables

4.1 Discrete Probability Density Functions

- Understand the properties of a discrete probability density function
- Find the mean of a discrete random variable from its probability density function
- Find the standard deviation of a discrete random variable from its probability density function

4.2 Binomial Distribution

- Understand the parameters of the binomial distribution
- Use the binomial distribution to compute probability

4.3 Geometric Distribution

- Understand the geometric distribution and use it to compute probability
- Compute the mean of a geometric distribution

4.4 Poisson Distribution

- Understand the parameters of the poisson distribution
- Use the poisson distribution to compute probability

4.5 Distribution Types with Technology - Calculator

- Calculate mean and standard deviation for a discrete probability distribution using Technology - Calculator
- Create and interpret a Binomial Distribution with Technology - Calculator
- Create and interpret a Poisson Distribution with Technology - Calculator
- Create and interpret a Geometric Distribution with Technology - Calculator

4.6 Distribution with Technology - Excel

- Calculate mean and standard deviation for a discrete probability distribution using Technology - Excel
 - Create and interpret a Binomial Distribution with Technology - Excel
 - Create and interpret a Poisson Distribution with Technology - Excel
 - Create and interpret a Geometric Distribution with Technology - Excel
-

Chapter 5: Continuous Random Variables

5.1 Basic Continuous Density Functions

- Use area under the curve to compute probability for continuous probability density functions
- Use the uniform distribution to compute probability
- Use the uniform distribution to compute conditional probability
- Find the mean and standard deviation of the uniform distribution

5.2 Exponential Distribution

- Understand the parameters of the exponential distribution
- Use the exponential distribution to compute probability
- Use the memoryless property of the exponential distribution to compute conditional probability

Chapter 6: The Normal Distribution

6.1 Parameters of the Normal Distribution

- Understand the notation and interpret the parameters of a normal distribution in business examples
- Standardize a normally distributed random variable in business contexts
- Calculate the mean and standard deviation of a standard normal distribution in business examples

6.2 Probability Using the Normal Distribution

- Use the empirical rule for normal distributions to estimate probability in business contexts
- Use the normal distribution to compute probability in business examples
- Use the normal distribution to approximate the binomial

6.3 Using the Normal Distribution with Technology- Calculator

- Use the normal distribution to compute probability with technology - Calculator
- Use the normal distribution to compute a value for a random variable given probability - Calculator
- Use the normal distribution to approximate the binomial with technology - Calculator

6.4 Using the Normal Distribution with Technology- Excel

- Use the normal distribution to compute probability with technology - Excel
- Use the normal distribution to compute a value for a random variable given probability - Excel
- Use the normal distribution to approximate the binomial with technology - Excel

Chapter 7: The Central Limit Theorem

7.1 The Central Limit Theorem

- Use the Central Limit Theorem for Means to find the sample mean and the sample standard deviation in business examples
- Use the Central Limit Theorem for Sums to find the sample mean and sample standard deviation
- Use both forms of the Central Limit Theorem to compute probability

Chapter 8: Confidence Intervals

8.1 Confidence Intervals for Population Mean

- Find and interpret confidence interval estimates in business examples using the empirical rule
 - Work backwards to calculate the error bound and sample mean given the confidence interval in business contexts
-

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

8.2 Student's T-Distribution

- Determine the degrees of freedom to find and interpret the t-score of a normally distributed random variable in business applications
- Use the Student's t-distribution to calculate the confidence interval for a population mean with an unknown standard deviation in business applications

8.3 Confidence Intervals for Population Proportion

- Find the confidence interval given a population proportion in business examples
- Calculate the sample size required to estimate a population proportion with a given confidence level in business applications

8.4 Confidence Intervals for Two Samples

- Compute confidence interval for difference in population proportions and interpret the interval in context
- Compute confidence intervals for the difference in population means

8.5 Calculating Confidence Intervals with Technology - Calculator

- Calculate a Confidence Interval for the Mean, population standard deviation known - Calculator
- Calculate a Confidence Interval for the Mean, population standard deviation unknown - Calculator
- Calculate a Confidence Interval for a Proportion - Calculator

8.6 Calculating Confidence Intervals with Technology - Excel

- Calculate a Confidence Interval for the Mean, population standard deviation known - Excel
- Calculate a Confidence Interval for the Mean, population standard deviation unknown - Excel
- Calculate a Confidence Interval for a Proportion - Excel

Chapter 9: One-Mean Hypothesis Testing

9.1 Introduction to Hypothesis Testing

- Identify the null and alternative hypotheses for an experiment with one population mean in business applications
- Distinguish between one- and two-tailed hypotheses tests and understand possible conclusions in business examples
- Differentiate between Type I and Type II errors when performing a hypothesis test in business examples

9.2 One-Mean Z-Test

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

9.3 One-Mean Hypothesis Test Using a P-Value

- Use the p-value to make a conclusion and interpret the results of a one-mean hypothesis test with a known standard deviation in business contexts
- Find the p-value using a table given test statistic value (z-score) of a one-mean hypothesis test

9.4 One-Mean T-Test

- Determine the degrees of freedom for a t-test, and use a table to determine the critical values of a hypothesis test with an unknown standard deviation
- Make a conclusion and interpret the results of a one-mean hypothesis test with an unknown standard deviation in business contexts
- Understand the assumptions and conditions for using the t-test for hypothesis testing, and compute the value of the test statistic

9.5 One-Mean Hypothesis Tests

- Conduct and interpret a one-mean hypothesis test with a known standard deviation using the critical approach or the p-value approach in business applications
- Conduct and interpret a one-mean hypothesis test using the Critical Approach with an unknown standard deviation in business contexts

Chapter 9: Hypothesis Testing for One Population - V2

9.1 Hypothesis Test for the Mean - Population Standard Deviation Known

- Identify the null and alternative hypotheses for an experiment with one population mean
- Distinguish between one- and two-tailed hypothesis tests and understand possible conclusions
- 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*

9.2 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*
- Make a conclusion and interpret the results of a one-mean hypothesis test (population standard deviation known) using the Critical Value/Rejection Region Approach

9.3 Conduct a Hypothesis Test for Mean - Population Standard Deviation Known: P-Value Approach

- Find the p-value using a table given test statistic value (z-score) of a one-mean hypothesis test
- Make a conclusion and interpret the results of a one-mean hypothesis test (population standard deviation known) using the P-Value Approach

9.4 Developing Hypothesis and understanding Possible Conclusions

- Compute the value of the test statistic (t-value) and degrees of freedom for a hypothesis test for one population mean with an unknown population standard deviation*

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

- Conduct and interpret a one-mean hypothesis test using the Critical Approach with an unknown standard deviation*
 - Make a conclusion and interpret the results of a one-mean hypothesis test (population standard deviation unknown) using the Critical Value/Rejection Region Approach
-

9.6 Conduct a Hypothesis Test for Mean - Population Standard Deviation Unknown: P-Value Approach

- Determine the p-value for a hypothesis test for the mean (population standard deviation unknown)
- Make a conclusion and interpret the results of a one-mean hypothesis test (population standard deviation unknown) using the P-Value Approach

9.7 Hypothesis Test for Proportion - Developing Hypothesis and understanding Possible Conclusions

- Identify the null and alternative hypotheses for an experiment with one population proportion
- Compute the value of the test statistic (z-value) for a hypothesis test for proportion

9.8 Conduct a Hypothesis Test for Proportion - Critical Value/Rejection Region Approach

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

9.9 Conduct a Hypothesis Test for Proportion - P-Value Approach

- Determine the p-value for a hypothesis test for proportion
- Make a conclusion and interpret the results for a hypothesis test for proportion using the P-Value Approach

9.10 Hypothesis Testing with Technology

- Perform and interpret a hypothesis test for the mean, population standard deviation known using Technology - Calculator
- Perform and interpret a hypothesis test for the mean, population standard deviation unknown using Technology - Calculator
- Perform and interpret a hypothesis test for a proportion using Technology - Calculator

9.11 Hypothesis Testing with Technology - Excel

- Perform and interpret a hypothesis test for the mean, population standard deviation known using Technology - Excel
- Perform and interpret a hypothesis test for the mean, population standard deviation unknown using Technology - Excel
- Perform and interpret a hypothesis test for a proportion using Technology - Excel

Chapter 10: Two-Mean Hypothesis Testing

10.1 Two-Mean Hypothesis Tests

- Identify and understand the null and alternative hypotheses for an experiment with two population means
 - Calculate the test statistic for a nonpooled two-mean hypothesis test
 - Calculate the test statistic for a pooled two-mean hypothesis test
 - 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
-

Chapter 10: Hypothesis Testing with Two Populations

10.1 Two-Mean Hypothesis Tests - Independent Samples - Population Standard Deviations Known

- Two-Mean Hypothesis Test with Population Standard Deviations Known
 - Identify null and alternative hypothesis for testing the difference between two means - independent samples - population standard deviations known
 - Calculate test statistic for testing the difference between two means (z value) - population standard deviations known
- 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)
 - Make a conclusion and interpret the results for testing the difference between two means (population standard deviations known) using the Critical Value/Rejection Region Approach
- Two-Mean Hypothesis Test - Population Standard Deviation Known - P-Value Approach
 - Determine the p-value for a hypothesis test for the difference between two means (population standard deviations known)
 - Make a conclusion and interpret the results for testing the difference between two means (population standard deviation known) using the P-Value Approach

10.2 Two-Mean Hypothesis Tests - Independent Samples - Population Standard Deviations Unknown

- Two-Mean Hypothesis Tests with Population Standard Deviations Unknown
 - Identify and understand the null and alternative hypotheses for an experiment with two population means
 - Calculate the test statistic (t-value) for a two-mean hypothesis test for population variances assumed equal (pooled estimate of the standard deviation)
 - 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)
 - Determine the degrees of freedom for a two-mean hypothesis test for population variances assumed unequal (nonpooled estimate of the standard deviation)
 - Conducting a Two-Mean Hypothesis Tests - Population Standard Deviation Unknown - Critical Value/Rejection Region Approach
 - Determine the critical value(s) for a hypothesis test for the difference between two means (population standard deviations unknown) in order to define rejection region(s)
 - Make a conclusion and interpret the results for testing the difference between two means (population standard deviations unknown) using the Critical Value/Rejection Region Approach
 - Conducting a Two-Mean Hypothesis Tests - Population Standard Deviation Unknown - P-Value Approach
 - Determine the p-value for a hypothesis test for the difference between two means (population standard deviations unknown)
 - Make a conclusion and interpret the results for testing the difference between two means (population standard deviation unknown) using the P-Value Approach
-

10.3 Two Mean Hypothesis Tests (Dependent Samples)

- Two Mean Hypothesis Tests (Dependent Samples)
 - Identify dependent samples versus independent samples
 - Identify the null and alternative hypothesis involving the hypothesized mean of the differences for the paired data
 - Calculate the test statistic (t-value) and degrees of freedom for a hypothesis test for the differences of paired data (dependent samples)
- Two Mean Hypothesis Tests (Dependent Samples) - Critical Value/Rejection Region Approach
 - Determine the critical value(s) for a hypothesis test for the mean of the differences for the paired data in order to define rejection region(s)
 - Make a conclusion and interpret the results for testing the difference between means for paired data (dependent samples) using the Critical Value/Rejection Region Approach
- Two Mean Hypothesis Tests (Dependent Samples) - P-Value Approach
 - Determine the P-value for a hypothesis test for the mean of the differences for the paired data
 - Make a conclusion and interpret the results for testing the difference between means for paired data (dependent samples) using the P-Value Approach

10.4 Two population hypothesis test for proportions (Independent Samples)

- Two population hypothesis test for proportions (Independent Samples)
 - Identify the null and alternative hypotheses for a hypothesis test to test the difference between two population proportions
 - Confirm the conditions are satisfied to use a z-test for the hypothesis test to test the difference between two population proportions
 - Compute the value of the test statistic (z-value) for a hypothesis test to test the difference between two population proportions
- Two population hypothesis test for proportions (Independent Samples) - Critical Value/Rejection Region Approach
 - 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
- Two population hypothesis test for proportions (Independent Samples) - P-Value Approach
 - Determine the p-value for a hypothesis test to test the difference between two population proportions
 - Make a conclusion and interpret the results for a hypothesis test to test the difference between two population proportions using the P-Value Approach

10.5 Two-Populations Hypothesis Testing with Technology

- Two-Mean Hypothesis Testing with Technology - Calculator
 - Perform and Interpret a Two-Mean Hypothesis Test (population standard deviations known) with Technology - Calculator
 - Perform and Interpret a Two-Mean Hypothesis Test (population standard deviations unknown) with Technology - Calculator
-

- Perform and Interpret a Hypothesis Test for Dependent (paired data) with Technology - Calculator
- Perform and Interpret a Two-Proportion Hypothesis Test with Technology - Calculator
- Two-Mean Hypothesis Testing with Technology - Excel
 - Perform and Interpret a Two-Mean Hypothesis Test (population standard deviations known) with Technology - Excel
 - Perform and Interpret a Two-Mean Hypothesis Test (population standard deviations unknown) with Technology - Excel
 - Perform and Interpret a Hypothesis Test for Dependent (paired data) with Technology - Excel
 - Perform and Interpret a Two-Proportion Hypothesis Test with Technology - Excel

Chapter 11: Chi-Square Distributions

11.1 Introduction to the Chi-Square Distribution

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

11.2 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

11.3 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
- 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 12: Linear Regression

12.1 Linear Regression Equations

- Understand properties of linear equations in business applications
- Understand the relationship between scatter plots and table and determine patterns in business applications
- Find the linear regression equation given a list of data points with business applications

12.2 Uses of Linear Regression

- Find and interpret the correlation coefficient in business contexts
- Make predictions about business scenarios using a line of best fit
- Find outliers in a business-related data set

12.3 Multivariate Relationships

- Identify applications where Multiple Regression can be performed
 - Define the format for a multiple regression equation
 - Make predictions using the multiple regression equation
-

12.4 Performing Linear Regressions with Technology - Calculator

- Calculate the correlation coefficient using Technology - Calculator
- Determine the best fit linear regression equation using Technology - Calculator

12.5 Performing Linear Regressions with Technology - Excel

- Calculate the correlation coefficient using Technology - Excel
- Determine the best fit linear regression equation using Technology - Excel

Chapter 13: Introduction to ANOVA

13.1 ANOVA Basics - Critical Value Approach

- 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

13.2 Performing an ANOVA test with Technology - Critical Value Method

- Performing an ANOVA test with Technology - Critical Value Method - Calculator
 - Make a decision for the hypothesis test using critical value/rejection region method and interpret results - Calculator
- Performing an ANOVA test with Technology - Critical Value Method - Excel
 - Make a decision for the hypothesis test using critical value/rejection region method and interpret results - Excel

13.3 Performing an ANOVA test with Technology - P-Value Approach

- Performing an ANOVA test with Technology - P-Value Approach - Calculator
 - Make a decision for the hypothesis test using the p-value method and interpret results - Calculator
- Performing an ANOVA test with Technology - P-Value Approach - Excel
 - Make a decision for the hypothesis test using the p-value method and interpret results - Excel