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 (5)
   ● Identify and describe the steps in the statistical analysis process (5)

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 (5)

Chapter 2: Z Descriptive Statistics
2.1 Frequency Tables
   ● Constructing and understanding frequency tables for a set of data (5)
   ● Construct and understand relative frequency tables for a set of data (5)
   ● Construct and understand cumulative relative frequency tables for a set of data (5)

2.2 Histograms and Frequencies
   ● Construct and understand frequency tables for a set of business-related data
   ● Create and interpret histograms (5)
   ● Create and interpret stem-and-leaf plots (5)

2.3 Line and Bar Graphs
   ● Create and interpret bar graphs (5)
   ● Create and interpret line graphs of data (5)
   ● Choose appropriate graphs and charts to display data (5)

2.4 Dot plots, Line and Bar graphs with Technology - Calculator
   ● Create and interpret dot plots with technology - Calculator (5)
   ● Create and interpret line and bar graphs of data with technology - Calculator (5)

2.5 Dot plots, Line and Bar graphs with Technology - Excel
   ● Create and interpret dot plots with technology - Excel (5)
   ● Create and interpret line and bar graphs of data with technology - Excel (5)

2.6 Measures of Central Tendency
   ● Find the mean of a set of data (40, 26)
   ● Find the mean from a frequency table (5)
   ● Find the median of a set of data (40, 26)
• Find the mode of a set of data (40, 26)
• Determine whether the mean, median, or mode is the best measure of center for a data set (5)

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
• Compute z-scores and use them to compare values from different data sets (26)
• Determine if a data set is skewed in business examples
• Compute the sample variance and sample standard deviation in business contexts
• Interpret the standard deviation of a set of business-related data
• Compute variance and standard deviation (5)

2.9 Calculate measures of center and spread using Technology – Calculator
• Calculate mean, median and mode for a dataset using Technology – Calculator (5)
• Create and interpret box and whisker plot using Technology - Calculator (5)

2.10 Calculate measures of center and spread using Technology – Excel
• Calculate mean, median and mode for a dataset using Technology – Excel (5)
• Create and interpret box and whisker plot using Technology - Excel (5)

2.11 Calculate Variance and Standard Deviation with Technology - Calculator
• Compute the variance and standard deviation with technology - Calculator (5)
• Compute z-scores and use them to compare values from different data sets with technology - Calculator (5)

2.12 Variance, Standard Deviation and Z-scores with technology - Excel
• Compute the variance and standard deviation with technology - Excel (5)
• Compute z-scores and use them to compare values from different data sets with technology – Excel (5)

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 (5)
• Use conditional probability notation to describe events (5)

3.2 Basic Probability
• Compute basic probability in a situation where there are equally-likely outcomes
• Compute probability involving and, or, and not (40, 40)
• Use the complement rule for probabilities (40)

3.3 Independent and Mutually Exclusive Events
• Understand mutually exclusive events (5)
● Find the conditional probabilities of independent and mutually exclusive events (40)
● Distinguish between independent or mutually exclusive events given conditional probability information (3)

3.4 Addition and Multiplication Rules
● Use the multiplication rule for conditional probabilities (40)
● Use the multiplication rule for independent event probabilities (40)
● Use the addition rule for probabilities (39)
● Use the addition rule for mutually exclusive event probabilities (26)

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 (5)
● Use a venn diagram to compute compound and conditional probabilities (5)

3.6 Counting Principles
● Use factorial notation

3.7 Expected Value
● Applications using expected value (5)
● Compute the expected value of an event (5)

Chapter 4: Discrete Random Variables
4.1 Discrete Probability Density Functions
● Understand the properties of a discrete probability density function (5)
● Find the mean of a discrete random variable from its probability density function (5)
● Find the standard deviation of a discrete random variable from its probability density function (5)

4.2 Binomial Distribution
● Understand the parameters of the binomial distribution (40)
● Use the binomial distribution to compute probability (5)

4.3 Geometric Distribution
● Understand the geometric distribution and use it to compute probability (40)
● Compute the mean of a geometric distribution (40)

4.4 Poisson Distribution
● Understand the parameters of the poisson distribution (40)
● Use the poisson distribution to compute probability (40)

4.5 Distribution Types with Technology - Calculator
● Calculate mean and standard deviation for a discrete probability distribution using Technology - Calculator (5)
● Create and interpret a Binomial Distribution with Technology - Calculator (5)
● Create and interpret a Poisson Distribution with Technology - Calculator (5)
● Create and interpret a Geometric Distribution with Technology - Calculator (5)
4.6 Distribution with Technology - Excel

- Calculate mean and standard deviation for a discrete probability distribution using Technology - Excel (5)
- Create and interpret a Binomial Distribution with Technology - Excel (5)
- Create and interpret a Poisson Distribution with Technology - Excel (5)
- Create and interpret a Geometric Distribution with Technology - Excel (5)

Chapter 5: Continuous Random Variables

5.1 Basic Continuous Density Functions

- Use area under the curve to compute probability for continuous probability density functions (5)
- Use the uniform distribution to compute probability (40)
- Use the uniform distribution to compute conditional probability (40)
- Find the mean and standard deviation of the uniform distribution (40)

5.2 Exponential Distribution

- Understand the parameters of the exponential distribution (40)
- Use the exponential distribution to compute probability (40)
- Use the memoryless property of the exponential distribution to compute conditional probability (40)

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 (5)

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 (40)
- Use both forms of the Central Limit Theorem to compute probability (5)

7.2 Central Limit Theorem for Means
- Understand sampling distributions and the Central Limit Theorem for Means (5)

7.3 Using the Central Limit Theorem for Means to Find Probability
- Use the Central Limit Theorem for Means to find probabilities for sampling distributions (5)
- Use the Central Limit Theorem to find a mean given a probability (5)

7.4 Calculator – Central Limit Theorem for Means
- Use the Central Limit Theorem for Means to find probabilities for sampling distributions - Calculator
- Use the Central Limit Theorem for Means to find a mean given a probability - Calculator

7.5 Excel Central Limit Theorem for Means with Technology
- Use the Central Limit Theorem for Means to find probabilities for sampling distributions - Excel
- Use the Central Limit Theorem to find a mean given a probability - Excel

7.6 Understanding effect of sample size for Means
- Understand the effect of sample size on sampling distributions for means (5)

7.7 Central Limit Theorem for Proportions – Understand Sampling Distributions
- Understand sampling distributions and the Central Limit Theorem for Proportions (5)

7.8 Using Central Limit Theorem for Proportions to find Probability
- Use the Central Limit Theorem for Proportions to find probabilities for sampling distributions (5)
- Use the Central Limit Theorem to find a proportion given a probability (5)

7.9 Calculator – Central Limit Theorem for Proportion
- Use the Central Limit Theorem for Proportions to find probabilities for sampling distributions - Calculator
- Use the Central Limit Theorem to find a proportion given a probability - Calculator

7.10 Excel – Central Limit Theorem for Proportion
- Use the Central Limit Theorem for Proportions to find probabilities for sampling distributions - Excel
- Use the Central Limit Theorem to find a proportion given a probability - Excel

7.11 Understand effect of sample size for Proportion
- Understand the effect of sample size on sampling distributions for Proportions (5)
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 (3)
- Compute confidence intervals for the difference in population means (5)

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 (3)
- Distinguish between one- and two-tailed hypotheses tests and understand possible conclusions (5, 5)
- Differentiate between Type I and Type II errors when performing a hypothesis test (5)
- Compute the value of the test statistic (z-value) for a hypothesis test for one population mean with a known standard deviation (5)

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 (5)
- Make a conclusion and interpret the results of a one-mean hypothesis test (population standard deviation known) using the P-Value Approach (5)

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 (5)
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 (5)

9.5 Conduct a Hypothesis Test for Mean – Population Standard Deviation Unknown - Critical Value/Rejection Region Approach
- Determine the critical value(s) for a hypothesis test for the mean (population standard deviation unknown) (5)
- Make a conclusion and interpret the results of a one-mean hypothesis test (population standard deviation unknown) using the Critical Value/Rejection Region Approach (5)

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) (5)
- Make a conclusion and interpret the results of a one-mean hypothesis test (population standard deviation unknown) using the P-Value Approach (5)

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 (5)
- Compute the value of the test statistic (z-value) for a hypothesis test for proportion (5)

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) (5)
- Make a conclusion and interpret the results of a hypothesis test for a proportion using the Critical Value/Rejection Region Approach (5)

9.9 Conduct a Hypothesis Test for Proportion - P-Value Approach
- Determine the p-value for a hypothesis test for proportion (5)
- Make a conclusion and interpret the results for a hypothesis test for proportion using the P-Value Approach (5)

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 (5)
- 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 - v2

10.1 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 (5)
- Calculate test statistic for testing the difference between two means (z value) - population standard deviations known (26)

10.2 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) (5)
- 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 (5)

10.3 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) (5)
- Make a conclusion and interpret the results for testing the difference between two means (population standard deviation known) using the P-Value Approach (5)

10.4 Two-Mean Hypothesis Tests with Population Standard Deviations Unknown
- Identify and understand the null and alternative hypotheses for an experiment with two population means (5)
- Calculate the test statistic (t-value) for a two-mean hypothesis test for population variances assumed equal (pooled estimate of the standard deviation) (5)
- Calculate the test statistic (t-value) for a two-mean hypothesis test for population variances assumed unequal (nonpooled estimate of the standard deviation) (5)
- Determine the degrees of freedom for a two-mean hypothesis test for population variances assumed equal (pooled estimate of the standard deviation) (5)
- Determine the degrees of freedom for a two-mean hypothesis test for population variances assumed unequal (nonpooled estimate of the standard deviation) (5)
10.5 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) (5)
- 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 (5)

10.6 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) (5)
- Make a conclusion and interpret the results for testing the difference between two means (population standard deviation unknown) using the P-Value Approach (5)

10.7 Two Mean Hypothesis Tests (Dependent Samples)

- Identify dependent samples versus independent samples (5)
- Identify the null and alternative hypothesis involving the hypothesized mean of the differences for the paired data (5)
- Calculate the test statistic (t-value) and degrees of freedom for a hypothesis test for the differences of paired data (dependent samples) (26)

10.8 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) (5)
- 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 (5)

10.9 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 (5)
- Make a conclusion and interpret the results for testing the difference between means for paired data (dependent samples) using the P-Value Approach (5)

10.10 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 (5)
- Confirm the conditions are satisfied to use a z-test for the hypothesis test to test the difference between two population proportions (5)
- Compute the value of the test statistic (z-value) for a hypothesis test to test the difference between two population proportions (26)

10.11 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) (5)
- 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 (5)
10.12 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 (5)
- Make a conclusion and interpret the results for a hypothesis test to test the difference between two population proportions using the P-Value Approach (5)

10.13 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

10.14 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 Distribution
11.1 Introduction to the Chi-Square Distribution
- Understand the properties of the chi-square distribution (5)
- Distinguish between use cases of the chi-square tests (5)

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 (26)
- Conduct and interpret a chi-square goodness-of-fit test (5, 5, 5, 26)

11.3 Chi-Square Independence Test
- Compute the value of the test statistic using the expected frequencies for a chi-square independence test (5, 5)
- Conduct and interpret a test of independence with the chi-square distribution (5, 5, 5, 5)
- Compute the value of the test statistic using the expected frequencies for a chi-square homogeneity test (5, 5)
- Conduct and interpret a test for homogeneity with the chi-square distribution (5, 5, 5, 5)

11.4 Chi-Square Homogeneity Test
- Compute the value of the test statistic using the expected frequencies for a chi-square homogeneity test (5, 5)
- Conduct and interpret a test for homogeneity with the chi-square distribution (5, 5, 5, 5)

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 (5)
- Define the format for a multiple regression equation (5)
- Make predictions using the multiple regression equation (5)

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
- Determine appropriate situations for a one-way ANOVA test and identify the null and alternative hypotheses (5, 5)
- Determine the degrees of freedom for the numerator and denominator for one-way ANOVA test (5)
- Determine the critical value and rejection region for one-way ANOVA test (5)
- Calculate the test statistic for one-way ANOVA test (5, 5)

13.2 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

13.3 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

13.4 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

13.5 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